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Comparison of asynchronous and synchronous methods of online teaching for students of medical laboratory technology course: A cross-sectional analysis

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Abstract:

BACKGROUND: In the wake of the novel coronavirus pandemic, the closure of educational institutions has imposed a situation of potential gap in learning. Since training of medical and paramedical students is vital in creation of our army of these frontline health-care workers, this study was aimed at comparing the asynchronous and synchronous methods of online teaching for imparting training to students of medical laboratory technology (MLT).

MATERIALS AND METHODS: This cross-sectional study included 33 students of the 1st-year batch of MLT course at a tertiary level hospital. Ten lectures each from the subject of biomedical statistics were delivered through asynchronous (lecture shared on WhatsApp group) and synchronous (online live lecture) methods followed by a brief examination for each topic. A short survey was designed to assess the students' perception of clarity of concepts, confidence of solving the examination, and their preference for one of these methods. Appropriate statistical tests were applied to the data.

RESULTS: Synchronous method of online teaching was preferred by majority of the students ($P < 0.001$). Students' clarity in understanding of the concepts ($P < 0.001$) and confidence of the ability to solve examination questions ($P < 0.05$) was higher after synchronous teaching. The examination scores after synchronous online teaching were significantly higher ($P = 0.0156$) than those for topics covered through asynchronous method.

CONCLUSION: Online teaching, especially the synchronous method, offers an opportunity of continuum of training during crisis situations such as the ongoing novel coronavirus pandemic. The wide availability of internet services and the ever-changing global situation mandates readiness for this modality of teaching, both for the teachers and the students.

Keywords:

Asynchronous, laboratory technology, online education, synchronous

Introduction

With the increasing usage of computers and the Internet in our everyday lives, teaching and education has been taking strides toward the electronic environment as well.^[1] Online education could serve as an adjunct to the classroom teaching or be

included in the blended model or a pure fully online model with no classroom contact between the teacher and the students.^[2] The fully online model is further subdivided into asynchronous and synchronous modules.^[3] Synchronous teaching refers to an instructional method, wherein the students interact with the teacher through

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internet in real time, thus giving a “classroom-like” feel.^[4] The asynchronous method, on the other hand, involves an interactive learning that is not constrained by limits of time, place, or geography, i.e., the student and the teacher do not have to meet on the web in real time. The asynchronous teaching method offers the learner with a chance of “anytime and anywhere” learning.^[5]

The online teaching (without further classification) has been compared with conventional classroom teaching across many specialties in a number of studies. Majority of these studies have demonstrated a similar efficacy of online teaching methods for various courses.^[6,7] However, the comparison of the synchronous and asynchronous online teaching has been relatively less stressed upon in the literature. The existing studies on this topic have yielded variable and conflicting results that could be related to the acceptability of one or the other modality by the concerned students.^[8,9] A recent systematic review of online education in health sciences included studies in medicine, nursing, postgraduate courses, public health, and dentistry. This review showed that, though online teaching is enabled by the collaboration between teacher and students and the availability of technology, certain barriers do exist and there is a need for better understanding to allow for appropriate and suitable integration of online education into the learning process.^[3] We did not come across any such study in literature which has previously been conducted to assess the effectiveness of online teaching for students of medical laboratory technology (MLT), i.e., future laboratory technicians.

The currently ongoing novel coronavirus pandemic has forced many countries to close their educational institutions in an effort to control the spread of the infection. The potential loss of teaching hours led the authors to design and implement online training modules for their graduate-degree students of MLT course. To optimize the online teaching, this study was undertaken to compare the asynchronous and synchronous methods and assess the students’ perception and acceptability of these methods. This period was perceived as an opportunity to allow the educationists, teachers as well as the students to prepare themselves for the future of teaching and learning in such unprecedented crises. The present study is the first such attempt, to the best of our knowledge, of evaluation of online teaching in laboratory technology students.

Materials and Methods

This was a cross-sectional comparison study conducted at a tertiary care hospital imparting training to paramedical students (MLT). The study was undertaken during the nationwide lockdown in the wake of the novel

coronavirus pandemic. Due to the lockdown, classroom teaching for MLT students had to be suspended and avenues for online teaching were explored. The study was approved by the institutional ethics committee.

The study included 33 students of the 1st year batch of graduate course in MLT at our hospital. Two modules of online teaching, i.e., asynchronous and synchronous, were designed by the teaching faculty for the subject of biomedical statistics. The topics to be covered were stratified on the basis of their difficulty level and then randomized into the two modules by the faculty.

For asynchronous module, the power-point presentations or video lectures (presentations with voice-over explanation of each slide) of the topic were shared with the students in the classroom group on WhatsApp. Students could post their queries in the same app which were promptly answered by the concerned teaching faculty. For each topic, students were given a day to read through the lecture and then appear for a written examination on the same topic. The examination consisted of both multiple choice questions (MCQs) and numerical questions. The students were required to complete the examination in a given time and share the pictures of their answer sheets to the faculty.

The synchronous module comprised live lectures through an online meeting app where on a predecided date and time, the faculty as well as the students connected online through the app. In this method, the students could discuss their queries during or immediately after the lecture. For the topics covered under this module, the examination was also conducted in an online mode at a predecided date and time. The examination pattern was same as that for the synchronous module (MCQs and numerical questions). The evaluation of students’ performance was done by the same teaching faculty who took the lectures.

A short online survey was designed by the teaching faculty to gauge the students’ perception and acceptance of the two teaching methods [Table 1]. The survey included questions regarding the students’ perception of clarity of concepts, confidence in solving the numerical questions in the examination, and their preference for the online teaching module. The survey did not include students’ identifiers to allow them give their honest opinion without having the fear of being recognized. The survey was pretested among the postgraduate students in the department for clarity of questions.

Results

A total of 20 lectures (ten in each module) from the curriculum of biomedical statistics were arranged (either

sent on WhatsApp or delivered through online platform), each followed by an examination. The average attendance for the synchronous module lectures was 92.9% and that for online examinations was 90.6%. Since the asynchronous lectures were shared on WhatsApp, attendance for the lectures was not calculated. However, an average of 91.4% students turned in their examination papers in this module.

Of the 33 students, the survey questionnaire was filled completely by 31 students (93.9%) while two forms were partially filled, hence, were excluded from further analysis.

Understanding and clarity of the concepts

Majority of the students (96.7%) responded that concepts of the topics covered under the synchronous module were fairly or well understood. On the other hand, only about half (56.7%) of the students had fair to clear understanding of the concepts in the topics taught through asynchronous module [Table 2 and Figure 1]. The difference between these two modules for this aspect was statistically significant ($P < 0.001$).

Confidence in problem-solving

Synchronous module made 93.5% students confident in solving some or all of the numerical questions in the subsequent examination. In comparison, 74.2% of students had the same confidence after asynchronous module [Table 3 and Figure 2], and this difference was also statistically significant ($P = 0.039$).

Preference for online teaching module

Most of the students (87.1%) preferred the synchronous module of online teaching, while 12.9% of students preferred the asynchronous module ($P < 0.001$). For the asynchronous module, three-quarters (77.42%) of the students felt satisfied with video lectures while 22.58% preferred the power point presentation.

Subjective comparison of asynchronous and synchronous online modules

Students who preferred synchronous module of online teaching (87.1%) did so for various reasons such as the opportunity to clarify doubts and ask questions, feeling

of being in a classroom with teaching faculty leading to punctuality and enhanced confidence of solving-related problems. However, the students also mentioned that the Internet connectivity issues at times hindered their attendance at the lectures.

Table 1: Survey questions used in the study

Questions
Did the power point presentation sent to you (asynchronous mode) help in understanding the concepts in the topic covered?
After going through the power point presentation, how confident are you of solving numerical questions pertaining to this topic?
Did the online lecture (synchronous mode) help in understanding the concepts in the topic covered?
After the online lecture, how confident are you of solving numerical questions pertaining to this topic?
In the asynchronous mode (sending lecture for offline reading), which format of lecture is preferable?
Which online teaching method would you prefer-asynchronous or synchronous?

Table 2: Comparison of student's responses regarding understanding of the concept with asynchronous and synchronous modules

Student's response	Asynchronous module (%)	Synchronous module (%)
Concepts not understood	6.67	0.00
Could understand only few concepts	36.67	3.23
Concepts understood fairly	40.00	25.81
Concepts understood clearly	16.67	70.97

Table 3: Comparison of student's responses regarding confidence in problem solving with asynchronous and synchronous module

Student's response	Asynchronous module (%)	Synchronous module (%)
Not at all confident	3.23	0.00
May be able to solve a few questions	22.58	6.45
Confident for some questions but not for all	48.39	29.03
Confident to solve all questions	25.81	64.52

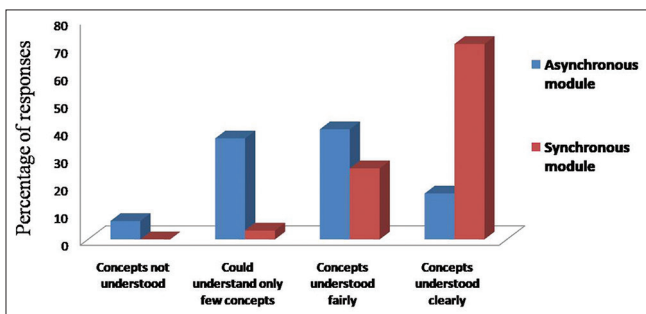


Figure 1: Graphical representation of student's responses regarding understanding of the concept with asynchronous and synchronous modules

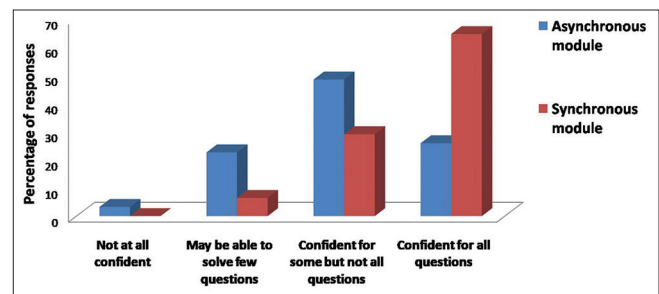


Figure 2: Comparison of student's responses regarding confidence in problem solving with asynchronous and synchronous modules

Although only a minority of students (12.9%) preferred asynchronous module, their reasons included the availability of the power point presentations or video lectures for reading multiple times at their own pace and lesser technical need of continuous connectivity. However, the students did accept that the understanding of concepts was better in the synchronous module due to real-time doubt clarification.

Performance in examinations

The average scores of each examination in both the modules were calculated. For the topics covered through synchronous module, the average score was 25.3 ± 9.8 while that for the topics taught through asynchronous module was 19.4 ± 8.5 . The difference between the two was statistically significant ($P = 0.0156$).

Discussion

A common problem plaguing health care in majority of the developing and some developed countries is the shortage of trained health-care workers including paramedical staff and laboratory technicians.^[10] Although countries attempt to overcome this shortfall through increasing the number of seats in the existing teaching institutions as well as building new colleges, the effort is met with another obstacle of shortage of faculty to teach and train these students. The current ongoing pandemic of novel coronavirus has compounded this problem, since nationwide lockdowns in many countries have included the educational institutions as well.^[11] In such a situation, e-learning or online teaching methods offer the prospect of continuity in the learning process.

The volcanic eruption of information and communication technologies has made the conduct of online education feasible from technologic, economic, and operational perspectives. Online teaching assumes two main forms: asynchronous and synchronous.

Various studies have compared the traditional classroom teaching and online teaching methods in medical and dental training. A study by Abdollahi *et al.* showed that virtual teaching methods were as effective as conventional method for teaching pathology to medical students.^[6] Moazami *et al.* showed similar results among dental students.^[7] A meta-analysis of massive open online courses and traditional courses in medicine education concluded that though there was no significant difference between the two, investment in online education is necessary to be ready for the future.^[12]

However, the number of studies comparing the two different methods of online teaching has been fewer with variable and somewhat conflicting results. A study among postgraduate dental residents showed that asynchronous

and synchronous formats were rated equally for the student–teacher and student–student interaction. For the ability to learn, the asynchronous format was rated higher than the synchronous format ($P < 0.001$) with higher level of comfort in the former than the latter.^[8] The authors concluded that the preference for asynchronous format may be attributed to the unfamiliarity with the technology required for synchronous format. In contrast, a study among students pursuing dental hygiene course showed that synchronous method led to higher cognitive presence than the asynchronous technique. The higher levels of cognitive presence are thought to foster critical thinking leading to better skills.^[9] Knopf-Amelung *et al.* evaluated asynchronous and interactive online methods in nursing students to impart training for screening, brief intervention, and referral to treatment for substance abuse. The authors reported that the online interactive method was better in changing the students' attitude regarding their role in control of substance abuse. However, motivational interviewing style was significantly higher in the asynchronous teaching group.^[13] A recent meta-analysis showed that synchronous online webinars were more effective in promoting student knowledge than asynchronous methods.^[14] A recent systematic review of online education in health sciences demonstrated that facilitation and effectiveness of learning and integration of theory and practice were the main drivers behind adoption of e-learning. However, factors such as poor student engagement, lack of self-discipline, investment in course development, nonfamiliarity with the technology, and unsuitability for some courses acted as the main barriers.^[3]

The present study was a first-of-its-kind attempt of evaluation of the two methods of online teaching among MLT students. Our study clearly demonstrated the higher efficiency of synchronous method in making the students understand the concepts of topic being taught leading to their confidence while appearing for an examination for the same topic ($P < 0.05$) compared to the asynchronous method. Majority of the students in the present study expressed their comfort during the synchronous online classes. The main advantage of synchronous module reported by our students was the ability to interact with the teacher and clarify doubts in real time, leading to better understanding. However, a few students preferred asynchronous method since that gave them the chance to read the lecture at their own pace with repeated reading wherever required. These results are similar to those reported by Kunin *et al.*^[8] The limitations of both these methods in our study were also similar to the earlier reports, i.e., network and connectivity issues during the synchronous online classes and the lack of interaction with teacher in asynchronous method.

The subjective assessment and preference of the students for the online teaching methods was supported by the performance in the examinations after each module. Our study showed that the average scores in examinations (comprising of both MCQs and numerical questions) were significantly higher after the synchronous method compared to the asynchronous method ($P < 0.05$). None of the previous studies comparing these two online teaching methods in medical science have included this objective evaluation of the efficacy of learning.

Strengths and limitations

The main strength of our study was the readiness of the students in accepting the online teaching modules. Having a single teacher prepare the modules for asynchronous classes as well as the lectures for synchronous teaching followed by similar pattern of examination for all the topics was another strong point offering consistency in the teaching and assessment formats. Another unique strength of our study was the evaluation of teaching outcome apart from the subjective assessment by the students.

However, certain limitations also deserve mention. Due to the sudden lockdown in the wake of ongoing pandemic, evaluation of teaching involving skill acquisition could not be undertaken for these students. In view of limited resources available, only biomedical statistics could be taught during this period. Another potential limitation could be the chances of the students taking help from their books during examination, though this would apply similarly to both the groups of online teaching and hence would have had no effect on the results of comparison between the two.

Conclusion

The present study provides subjective as well as objective evidence of the efficacy of both modes of online teaching for students of MLT, with synchronous module scoring over the asynchronous method. In wake of the unprecedented crisis and unsure times ahead, acceptance of online teaching methods by the students and appropriate preparation and modifications in the teaching modules by the teachers is the need of the hour to be ready for the future. There is a need of examining the utility of these methods of online teaching in laboratory skill acquisition by such students as well and this may require innovative methods to be employed during online training. Similar studies also need to be conducted among other medical professional students to provide further credence to the results of the present study.

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Conflicts of interest

There are no conflicts of interest.

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