Investigation Effect of Online Learning and Propose an Improved Online Education Process in Bangladesh Perspective

TANIA SULTANA, MD. ASHIKUR RAHMAN KHAN*, FARDOWSI RAHMAN
[1]Department of Information and Communication Engineering,
Noakhali Science and Technology University,
Noakhali 3814, Bangladesh,
BANGLADESH

**Corresponding Author*

Abstract: - Conventional school learning is no longer relevant during the pandemic. Internet and distance learning, generally known as online education, play a vital role in the education system. However, there are many drawbacks to online learning. This study investigates the effects of online learning on Bangladeshi students. Data is collected through surveys and interviews. This study found various serious issues regarding online education, affecting the quality of the Education System. Considering these issues, this work investigates the effect of online learning and proposes an effective online education process to enhance educational institution success. However, one significant and indispensable part of society that innovations and discoveries have also tapped is the concept of online education. By investigating limitations, we hope this study may support teachers and decision-makers in Bangladesh to make well-informed decisions to facilitate the transition to distance learning and develop preparedness plans for future pandemics.

Key-Words: - Online education, pandemic, survey, blended learning, Zoom, Google Meet, Microsoft Teams

Received: July 19, 2022. Revised: August 22, 2023. Accepted: September 23, 2023. Published: October 24, 2023.

1 Introduction

Sudden and unexpected changes to our country may significantly impact critical functions and services, especially education. In the wake of COVID-19, many people worked and studied from home using the Internet, [1]. After overcoming the initial shock, governments decided that, like compulsory education, central functions in society should shift to distance education, [2]. By March 18, 107 countries had decided to close schools, impacting 861,737,696 learners, [3]. After the closing of schools during the pandemic, the requirement of transitions into distance learning has shown that schools observed the new conditions in various ways, indicating that offices need to prepare for transitions and generate guidelines, [4].

The schools were compelled to close due to COVID-19, resulting in uncertainties and disagreements regarding what and how to teach, [5]. Social isolation became a new fact for most people, and the school closure sped up the switch from traditional to distance learning for many teachers and students, [6]. Bangladeshi teachers have yet to gain experience with pandemics and school responses to build on. Education can become transformative when teachers and students synthesize information across subjects and experiences. The goal here is to provide best practices for those planning to develop online courses to make informed decisions in the implementation process.

Over the past years, the internet revolution has made online learning a popular tool for learning as an alternative to face-to-face learning. The Internet has become a medium of delivery for online teaching. Online teaching offers a vast opportunity to expand the learning environment for diverse student populations, [7]. Online learning offers students a variety of teaching tools and communication channels. A broad technology set is engaged with online learning, including learning, web-based learning, virtual classrooms, and digital collaborations. Students can participate in online courses anytime and from anywhere, regardless of their geographic location, [8].

This research is structured as follows: Section 1 represents the background and significance of this research. To analyze the effect of online learning, we studied some recent work discussed in section 2. Section 3 explains the research methodology. This

section is the foundation of this research. The experimental results and discussion are explained in section 4. Finally, Section 5 discusses the conclusion of this paper.

2 Literature Review

Several researchers have been contributing to the areas of online learning during the COVID-19 pandemic.

Online learning is used interchangeably with e-learning. The e-learning process includes instruction via all electronic media, such as the Internet, intranets, extranets, and hypertext documents, [9]. Although there is some debate about an exact definition of e-learning or electronic learning, it is generally accepted that learning content can be electronically distributed via the Internet, a desktop computer, a personal digital assistant (PDA), or a CD-ROM, [10]. E-learning has the following benefits. First, it lowers costs. Second, its content is more time-consuming and dependable. Third, it is a just-in-time learning approach. Fourth, it builds universal communities. Finally, it provides an increasingly valuable learner service, [11]. Some authors claimed that e-learning is less expensive to deliver, is self-placed (e-learning courses can be taken when necessary), faster, works from anywhere and anytime, and is updated swiftly and readily. It can result in excellent retention and a firmer grasp of the subject and can be easily managed for large groups of students, [12]. A paper states that with the advanced technology, using social media with the help of smartphones, tablets, or personal computers, many female students are using social networks to achieve knowledge, [13].

Another paper defined learner attitude as the "learner impression of participating in e-learning activities through computer usage." Students may engage in online learning and control the learning time and procedures themselves, [14]. Some researchers argue that learners' computer attitudes play a significant role in the usability of online learning, [15]. Attitude and self-efficiency are essential factors affecting learners' motivation, interest, and performance in internet-based learning environments, [16]. Also, attitude influences learning interest, [17]. A study stated that when learners are not afraid of complexity in information technology (positive attitude), the learners will become more satisfied and effective in online learning, [18]. Another research indicated that learners have a greater intention to use the updated system if the system is user-friendly. This research also shows that systems that enable the learner to interact effectively and offer access to course content at the time influence students to use the system for their learning, [19]. The willingness of pupils to participate in online learning is also connected to their prior computer skills, [20]. In addition, the learner's attitude toward the Internet is also essential to determine the learner's motivation, interest, and performance in the online learning environment, [21].

The e-mentoring process is "a computer-mediated, mutually worthwhile that provides learning, advising, encouraging, promoting, and modelling, often boundary-less, egalitarian, and qualitatively different from traditional face-to-face mentoring", [22]. According to some authors, e-mentoring is a rapport between a more senior individual and a less-skilled individual, [23]. A paper suggests there are six benefits of telementoring. First, telementoring is available over a vast distance, [24]. Online chats and bulletin boards allow mentors to "talk" to more than one mentee at a time, [25]. Secondly, the mentor has opportunities regardless of time and place. Third, vast guidance and support are available online. Fourth, mentors can contribute and share knowledge among participants in the program. Fifth, it creates collaborative learning between teachers and learners. Sixth, organizations that opt for telementoring can choose the communication methods that are suitable for their use, [24].

Students are generally exposed to various aspects of online learning through mobile, computer, and other internet-based systems, [26]. The worldwide outbreak of the novel coronavirus has given the function of information technology in academia more incredible momentum, [27]. Participants preferred collaborative approaches and encouragement strategies that promoted academic achievement and improved mental health, although genuineness and teamwork also facilitated learning, [28]. In Online classes, learners usually experience isolation in an online learning environment because they are distant. Previous studies showed that the absence of fast or understandable instructor feedback resulted in students reporting uncertainty, worry, and dissatisfaction. E-mentoring can facilitate online learning where learners and teachers can interact through e-mail, chat rooms, bulletin boards, forums, and discussions regardless of location, [29]. In this paper, the experiments are conducted, and the findings demonstrate that the suggested fixes raise the online education standard in Bangladesh.

Previously, researchers described several teaching-related issues and identified the

pedagogical concepts underlying the teaching and learning activities that make up successful e-learning. An accessible procedure for handling online classes or exams is absent. In this study, we will develop a schedule and effective procedure for online classes. The effect of online education during the pandemic in Bangladesh is also shown in this study.

3 Materials and Methods

This section first identifies the related factors of online education in Bangladesh. Then, do the following steps: identify the factors for preparing questions, make a survey form, distribute questions to participants, analyze the response data, formulate the results, make statements, make practical suggestions, and find out the conventional ways of teaching.

3.1 Process of Learning in Pandemic Time

The COVID-19 pandemic has impacted educational systems worldwide, forcing almost complete closures of schools, childcare centres, colleges, and universities. Most governments temporarily closed educational institutions to reduce the spread of COVID-19. The burden of education has been transferred from schools to families and individuals by the newly developed online services. Consequently, people everywhere who rely on schools rather than computers and home life have needed help accessing their education. Early childhood education, care, and school closures impact students, teachers, and families and have far-reaching economic and societal consequences. For conducting online theoretical and practical classes, most universities have their own platforms.

3.1.1 Process of Online Theoretical Classes

An online course is delivered through the Internet. They are generally conducted through a learning management system, where students can view their course syllabus and academic progress and communicate with students and their course instructors. Online classes offer an uninterrupted educational process and flexibility, and it is cost-effective. Teachers and students communicate through a virtual learning platform using Zoom, Google Meet, and Microsoft Teams. Using those, teachers can conduct online courses by sharing slides or verbal speeches. The general process of online classes is shown in Figure 1.

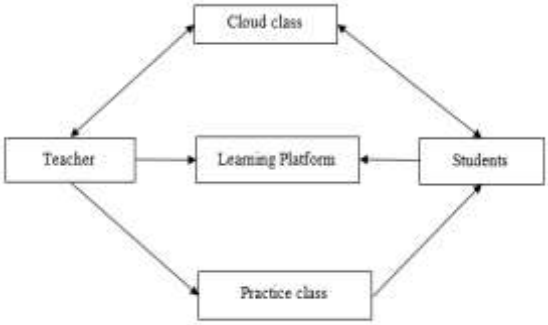

Fig. 1: Process of online class.

Online classes are conducted through many learning management systems during a pandemic, strike, or unwanted situation. The procedures are followed.

A. Zoom

First, open the Zoom mobile app and sign in to the account to start a Zoom meeting. Click the orange new meeting icon that appears on the screen. Then, edit meeting settings according to preferences. When it is done, tap the blue start a meeting button. After that, to add participants, once the meeting starts, tap the participant icon in the toolbar at the bottom of the screen to add and manage participants. Then, tap on the invite option at the bottom left in the participants' window that opens up. A teacher can provide links to students. Zoom will now give us the option to share meeting details via a variety of communication platforms. These include various text, e-mail, and messaging apps on smartphones. The teacher can share the screen to show the presentation. The limitation of Zoom is that there are 100 participants, with a maximum of 99 attendees and a host. The process of online classes in Zoom is shown in Figure 2.

Fig. 2: Online class in Zoom.

B. Google Meet

The following procedures are involved in using Google Meet. Go to meet.google.com. Enter the meeting code or click Start a new meeting. Choose the Google account. Click join the meeting. The Teachers can add others to the meeting, connect video and audio, and deliver lectures, monitoring students' activity. The limitation of Google Meet is screen sharing restrictions, blank presentation problems, limited features, interoperability service users are prohibited from joining, display of a limited number of participants, users from outside the domain are disallowed, and browser freezing problems.

C. Microsoft Teams

The following steps are involved in operating Microsoft Teams. Firstly, open the Microsoft Teams app. Then tap on the Teams icon at the bottom of the screen, an icon of two people, and a plus sign in the top right. To create a new team, give the team a name and description and set the privacy preferences. One thousand participants can be added to Microsoft Teams simultaneously. The working process of the Microsoft team is shown in Figure 3.

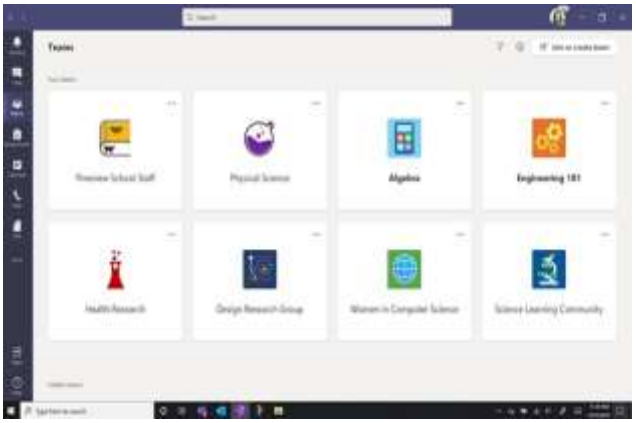

Fig. 3: Microsoft Teams

3.1.2 Online Class of Practical Courses

The practical courses cannot be appropriately explained for online classes through Zoom, Google Meet, and Microsoft Teams. Students must have questions about a critical topic. A student can easily ask during offline classes; the teacher should explain it on the board.

3.2 Student Evaluation

Evaluation serves various purposes and success in education. First, it is used to rank the quality of students' performance. Secondly, it provides evidence or certification. The first and second purposes have a summative function and are often referred to as the assessment of learning properly. Regular assessment can be taken by dividing the courses through class tests, quizzes, and assignments.

A. Class Test

To conduct an online exam, a candidate has to complete registration; the authority stores the candidate's details and generates the exam link details. Then, the teachers schedule the test time and verify candidate details in the exam room software. They set up and maintain a fair examination and get feedback from the candidate.

B. Quiz Test

The students have their exams through live tests and quizzes. Teachers create a new assessment, add a question, and periodically set general question options. They choose the number of correct multiple-choice responses or add the multiple-choice answers here. Select whether or not to rely on randomization for multiple-choice answers. For quiz tests crowedsignal, Google Classroom is used most.

C. Assignment Test

An assignment is a piece of academic work. It ensures opportunities for students to learn, practice, and demonstrate that their learning objectives have been achieved. It provides proof for the teacher that the students have succeeded in achieving their objectives. Assignments can be created and stored by the following procedure. The manual online assignment submission process must be more suitable for justifying students' quality. The current process is to write the assignment on paper, click a picture, and send it to a teacher. Here, students' handwriting needs to be appropriately checked. Student can complete their assignment with another person. They can also copy them. A teacher must take assignments on the spot to recover the drawbacks by monitoring students' activity. The teacher must have the student's handwriting format. The teacher must check students' laptops through TeamViewer software. TeamViewer is a type of software by which a teacher can access students' laptops remotely. Through this, teachers can improve the evaluation process.

D. Final Assessment

Students can identify their areas of weakness via assessment, and instructors can learn where they have succeeded and where improvement is needed when teaching. A final assessment is a task that evaluates students' progress in a course. Zoom, Google Meet, and Microsoft Teams are mainly used

for the final assessment. Also, Camscanner helps to make a clear PDF and document.

3.3 Survey Method and Data Collection

The survey method measures the effect of online learning. It refers to the process of acquiring data by posing questions to those who are believed to possess the needed data. It can be summarized as "learning things about many people by talking to a few." It can be modified by stating that collecting information with other data collection alternatives available to the survey researcher in addition to interviewing, i.e., questionnaire, personal observation, etc. In the case of descriptive research, surveys are conducted with the help of questionnaire techniques is the most appropriate approach.

3.3.1 Data Collection

The creation of online surveys and questionnaires is a well-known tool. Data is collected by using an online Google form. The Google form is used in this paper because its interface visualizes the outcomes in a simplified manner. Data is captured from people who know about the Internet, are active on social networking sites, and need more knowledge of online learning. Most of the samples are collected from university students. The sample size is determined as 138 respondents' opinions from the students and nine respondents' opinions from teachers who presently have online classes.

3.3.2 Questionnaire

The questionnaire has a list of questions to be asked and spaces in which the respondents record their answers. Each question is worded as it is to be asked; also, the questions are listed in an established sequence. The questionnaire incorporated questions about students' preference for online marketing and other traditional mediums to increase awareness of various brands and make purchase decisions.

A. Category: Students

1. How would you describe the impact of COVID-19-led disruption on the examination schedule of your institution?
   - Both Semester and Entrance Examinations were disrupted.
   - Disruption has yet to be faced, as my institution had already conducted the exams online during the lockdown.
2. What is your strategy in dealing with COVID-19-led disruption of the examination schedule?
   - Postpone the examinations until the situation is under control.
   - Cancel the examinations and promote the students based on the performance of the previous exams.
   - Scout for online-based solutions to conduct examinations.
   - Wait for the guidelines from the UGC (University Grants Commission) and other relevant authorities to decide on the next steps.
3. How would you describe the existing mode of conducting all major semester examinations in your institution?
   - Exams are computer-based and administered at an invigilated examination hall.
   - Exams are Paper/OMR-based and administered at an invigilated centre/examination hall.
   - Exams are administered online and can be attempted by students online remotely with remote invigilation or proctoring.
4. What are your significant challenges in exploring an online examination solution?
   - Preventing students from indulging in cheating.
   - Create and schedule the exams.
   - Assure a seamless user experience for examiners and students alike.
   - To ensure access and connectivity, even in remote areas.
   - Need for more human factors.
   - Capabilities of students and faculty.
   - To take legal implications and data protection.
5. When are you planning to implement online examinations in your institution?
   - The system is already implemented.
   - In the next 5-6 months.
   - Have a plan to implement in the next academic year.
   - They still need to be planned.
6. Choose the most important features when evaluating the anti-cheating for an online exam.
   - The ability to remotely proctor the candidate manually
   - The ability to view and record candidates' screens
   - Robust candidate authentication system to avoid impersonation.
   - Describe the challenge faced by students in taking an online exam.
   - Accessibility to computers.

- Internet/broadband connectivity.

7. What is the biggest argument against shifting the exams online?
   - Maintaining academic integrity and preventing cheating
   - The ease of use for students, particularly complex question types and courses.
   - Accessibility to laptops/computers.
   - Internet/broadband connectivity.
8. Students believe learning activities will be fine with online learning.
   - Agree
   - Disagree
9. Can you wait a few hours or maybe even a few days between asking the teachers a question and getting a response?
   - Yes
   - No
10. Can you stick to a study schedule at home?
    - Yes
    - No
11. Do you need more quiet space, technical issues, and load-shedding problems during online classes?
    - Agree
    - Disagree
12. How was the teacher's feedback?
    - Good
    - Average
    - Bad
13. Which do you use most for an online class?
14. Give your opinions on cheating-free online exams and labs.

B. Category: Teachers

1. Are you satisfied with the technology and software you use for online teaching?
   - Yes
   - No
2. Are students stressed while learning remotely during the COVID-19 pandemic?
   - Agree
   - Disagree
3. What kind of response have you got so far from your students?
   - Good
   - Average
   - Poor
4. Has the online class and exam changed accreditors within the last two years?
   - Yes
   - No
5. What are your significant challenges in exploring an online examination solution?
   - Preventing students from indulging in unfear means
   - Creating and scheduling exams
   - Assuring seamless user experience for examiners and students alike
   - Accessibility and connectivity, even in remote areas
   - Missing the human factor
   - Capabilities of students and faculty
   - Legal implications and data protection
6. How do the outcomes for students?
   - Good
   - Average
   - Poor
7. Have the teachers received training on how to conduct cheating-free online exams?
   - Yes
   - No
8. Which software do you prefer most for an online class, quiz, exam, and lab?
9. How can you proctor the behaviour issues of students for the class?
   - By using Artificial Intelligence software
   - Monitoring the activities
   - By checking attendance
10. Give your opinion on a sustainable system for cheating-free online exams and labs.

3.4 Proposed Method

This work proposed a Blended system and a Hybrid system to enhance the quality of the online education process.

A. Blended System

During strikes or unwanted situations, a teacher can take a course by combining online and offline classes. To reduce session complexity, teachers can take make-up classes online during holidays. Self-paced learning, teacher-led online modules, and in-person instruction are frequently used in blended learning approaches. The process of blended learning is shown in Figure 4.

The teacher's most important role is keeping the students digitally safe. The blended learning technology used in classroom teaching and learning processes is innovative. It combines the quality of both online learning and classroom methods. It not only creates interest in learning through audio-visual

aids but also develops better understanding and group feeling among students.

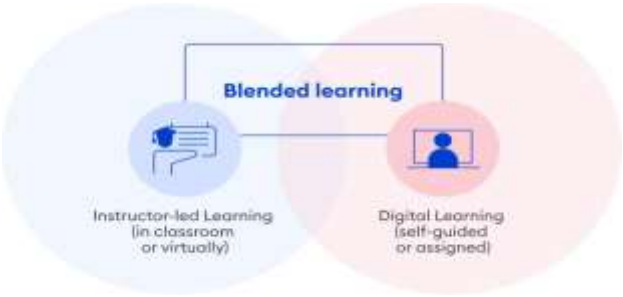

Fig. 4: Process of Blended Learning

The following characteristics are necessary to develop a blended system.

1. Keep traditional teaching methods.
2. Switch to digital assessments for instant feedback.
3. Set digital revision tasks and use the results to inform class schedules.
4. Explore group projects that utilize multimedia tools.
5. Incorporate technology for reinforcement.
6. Try new teaching techniques.
7. Mix up Group work styles.

The traditional class can be taken online, but the assessment would be done offline. Assessment should be done on holidays by using Zoom to reduce session crises. The importance of blended learning can be pointed out as follows:

- Helps students to develop project and time management skills.
- Integrate appropriate technology and manage it effectively throughout courses.
- Cost benefits increased access to educational opportunities, the flexibility of workforce deployment, and so on.
- Opportunities to design engaging, relevant, and personalized learning experiences.
- Support the distribution of knowledge and tools to students
- Encourage interaction and teamwork among pupils to engage and inspire them.
- Synchronous technologies allow students to communicate and collaborate outside of the classroom.

Online classes must be taken by using blended learning. Blended learning has two procedures: synchronous online class and asynchronous online class.

Synchronous learning allows the students to engage with the course content simultaneously but from different locations. The teacher interacts with students in real-time using tools such as Microsoft Team to live stream audio, video, and presentations to hold live lectures or meetings, a chat feature to engage in live conversations, Google Docs to simultaneously edit documents, add documents, and more.

Asynchronous learning ensures that the students in the course all engage with the course content at different times and locations. The teacher provides students with a sequence of units that the students move through as their schedules permit. Each unit might use assigned readings or uploaded media, online quizzes, discussion boards, and more. A teacher may record a whole class and then show it to the audience. The teacher guides the students, provides them with feedback, gives instruction, and assesses them as needed.

B. Hybrid System

Hybrid learning can be defined as instructors delivering online and traditional instruction to their students simultaneously. While some students attend via the Internet, others attend classes in person. It was seen that the effect size of hybrid learning on the students' academic achievement was at a high level. In line with the results obtained, it was deemed appropriate to make the following suggestions:

As a result of the analysis, it was understood that hybrid learning significantly affected the student's academic achievement. For this reason, the use of hybrid learning in educational environments should be encouraged, and the necessary infrastructure and facilities should be provided.

It was understood that the discipline was a distinctive variable in the academic achievement of hybrid learning. It was found that studies applied to the disciplines of biology and science had larger effect sizes. For this reason, the application of the hybrid model in biology and science classes should be encouraged.

4 Results and Discussion

After getting the questionnaire results, a proper study is discussed here. The effect of online learning in Bangladesh is discussed here.

4.1 Effect of Online Learning

The effect of online learning is discussed in two sections. The first section shows the effect of online

learning according to students. The second section shows the effect of online learning according to teachers.

A. According to Students

The effect of online learning, according to students, is measured by taking the answers to some questions from students. The results of each section are discussed below.

1. Classify Audience

Audience classification based on the questionnaire is shown in Figure 5. In Figure 5, it is seen that most of the students are university students, whose responses are 94.2%. The response of class i-v is very minimal. Moreover, the response of class vi-x and higher secondary are very narrow.

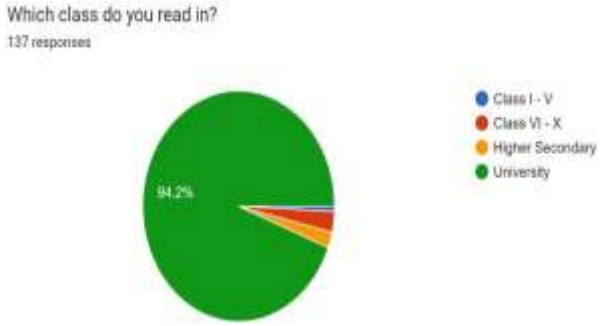

Fig. 5: Audience Classification

2. Impact of Disruption

The impact of COVID-led disruption on the examination schedule of the institution is shown in Figure 6.

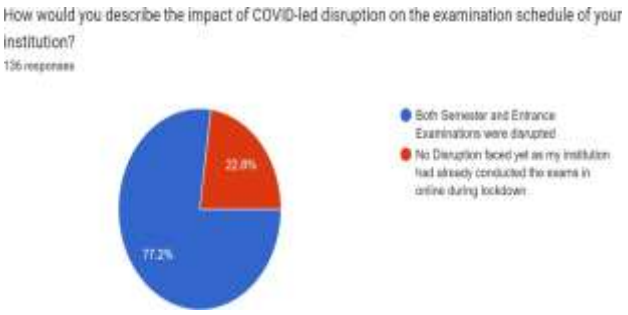

Fig. 6: Impact of COVID-led disruption

There are large numbers of activities that can be done using the Internet. Figure 6 shows that 77.2% of students say semester and entrance examinations are disrupted. 22.8% of students faced no disruption.

3. Strategy

The strategy for dealing with COVID-19-led disruption of the examination schedule is shown in Figure 7. After analysis, it is seen that 40% of the students want to scout for online-based solutions. The lowest response is for the cancellation of the exam. 23% of students want to postpone the exam. 33.3% of students want the guidelines from UGC.

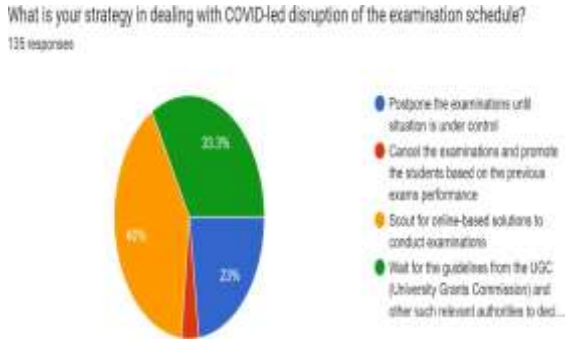

Fig. 7: Strategy for dealing with COVID-led disruption

4. Existing Mode

Figure 8 describes the existing mode of conducting all major semester examinations in the institution.

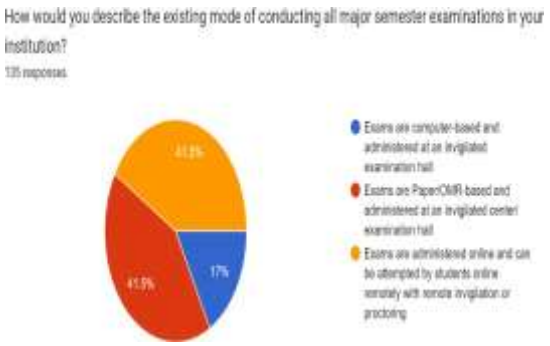

Fig. 8: Existing Mode

Figure 8 shows that 41.5% of students want paper-based administered at an invigilated centre. 41.5% of students who want examinations are administrated online. 17% of students need computer-based exams at an invigilation examination hall.

5. Challenges

The significant challenges in exploring an online examination are shown in Figure 9. From Figure 9, it is seen that 39.6% of students face problems with accessibility and connectivity. 23.9% of students think indulging in cheating may hinder student quality. 9.7% of students need help creating and scheduling exams. 9% of students think missing the human factor is also a challenge for online exams. A Narrow response is for legal implications, data protection, and creating and scheduling exams.

Tania Sultana, MD. Ashikur Rahman Khan,
Fardowsi Rahman

Fig. 9: Challenges

6. Planning

Figure 10 shows that 69.1% of students have already implemented plans for online exams. 24.3% of students still need to implement planning. The low response is for the next academic class and the next 5-6 months.

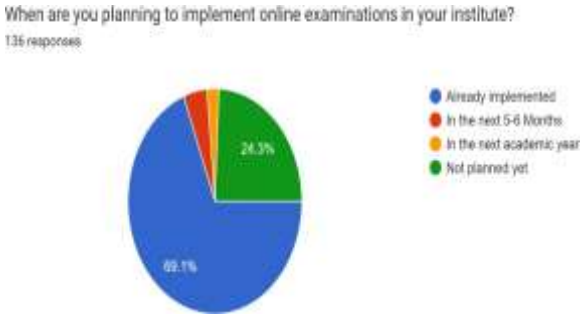

Fig. 10: Planning

7. Solution

Figure 11 shows that 43.4% of students need the ability to record and view screens by their teachers. 23.5% of students need a robust authentication system. 11% of students want the ability to proctor their activity by teachers remotely. 8.8% of students need internet connectivity to the Internet to have special proctoring software.

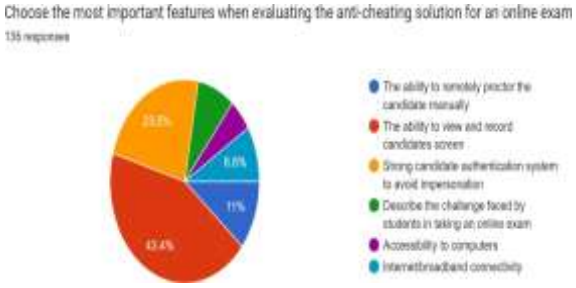

Fig. 11: Features of the anti-cheating solution

8. Arguments

Figure 12 shows that 49.6% of students need to maintain academic integrity. 23% of students have a broadband issue. 15.6% of students have accessibility issues.

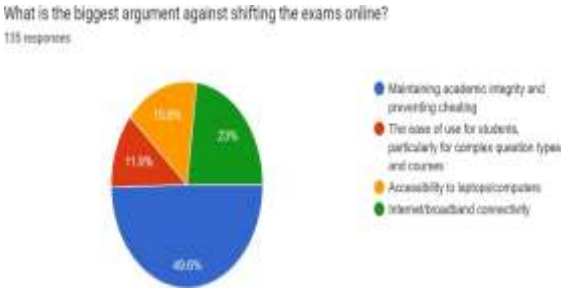

Fig. 12: Arguments

9. Disruption

Figure 13 shows that 52% of students think online will not be disrupted learning activities. 47% of students think online learning will disrupt learning activities.

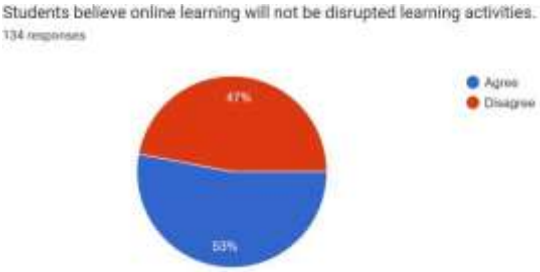

Fig. 13: Disruption

10. Response

Figure 14 shows that most students can wait a few hours or days to ask a question and get a response.

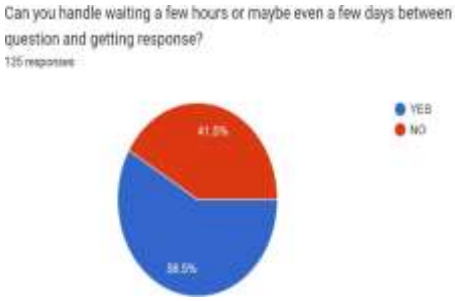

Fig. 14: Response

11. Issues

Figure 15 shows that most students have technical issues, space, load-shedding, etc.

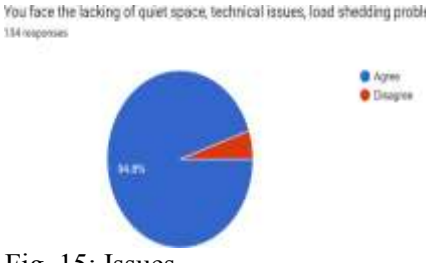

Fig. 15: Issues

12. Feedback

Figure 16 shows that most students get average teacher feedback during an online class. The lower response is for lousy feedback.

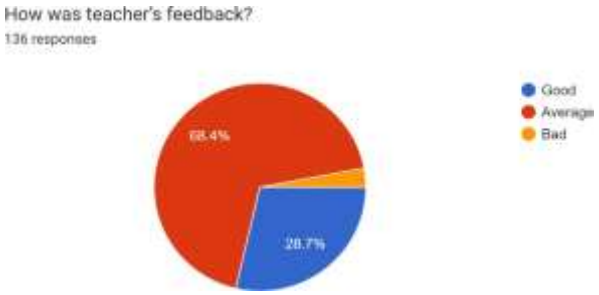

Fig. 16: Feedback

13. Opinion

Figure 17 shows that most students use Zoom for an online class.

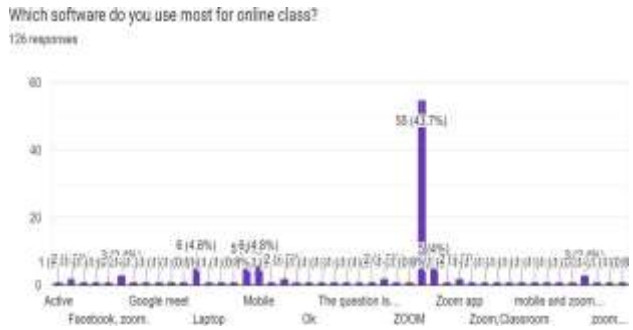

Fig. 17: Software for online class

B. Impacts of Online Learning According to Teacher

According to teachers, the effect of online learning is measured by taking the answers to some questions from teachers. The results of each section are discussed below.

1. Satisfaction

Based on the analysis, Figure 18 shows that most teachers are satisfied with the technology used for online teaching.

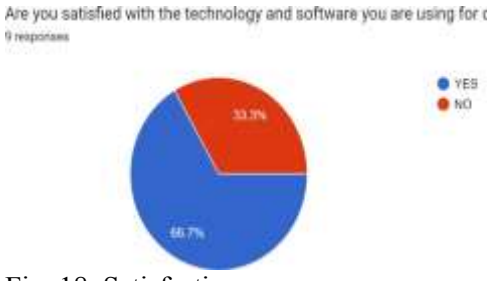

Fig. 18: Satisfaction.

2. Student condition

From Figure 19, it is seen that most of the students are stressed while learning remotely.

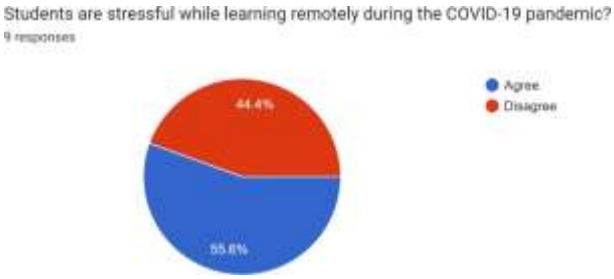

Fig. 19: Condition

3. Response

Figure 20 shows that most students give an average response based on the analysis. 22.2% of students provide poor responses during online learning.

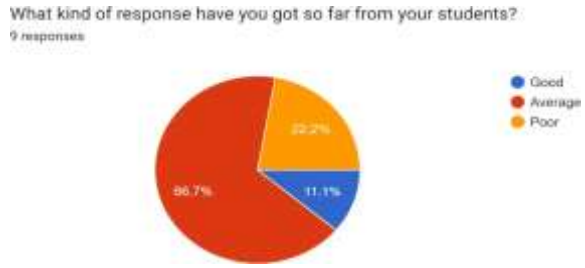

Fig. 20: Response.

4. Accreditors

Figure 21 shows that 55.6% of teachers think online classes and exams changed accreditors within the last two years. 44.4% of teachers think that the accreditors did not change.

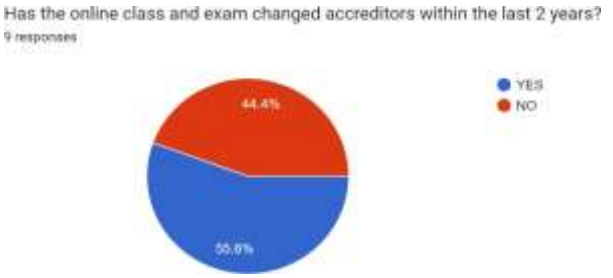

Fig. 21: Accreditors.

5. Challenges

Based on the analysis, Figure 22 shows that 44.4% of teachers need accessibility and connectivity, even in remote areas. 22.2% of teachers think preventing students from indulging in unfair means is also challenging. 11.1% of teachers think the challenge is the capability of students and faculty. 11.1% of teachers think that student human factors need to be included. 11.1% of teachers want user experience for examiners and students.

Fig. 22: Challenges.

6. Outcome

The outcome measurement of students is shown in Figure 23. It is seen that most of the outcomes of the students are average. 33.3% of students have poor outcomes, and 22.2% have a good outcome.

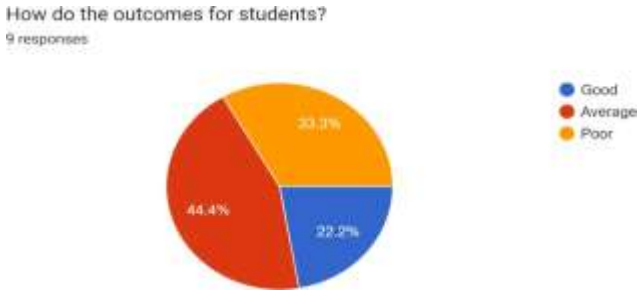

Fig. 23: Outcomes.

7. Training

Figure 24 shows that most teachers need to have training to conduct unfear means free exams.

Fig. 24: Training.

8. Opinion

Based on the analysis, Figure 25 shows that most teachers use Zoom for online classes, quizzes, and labs.

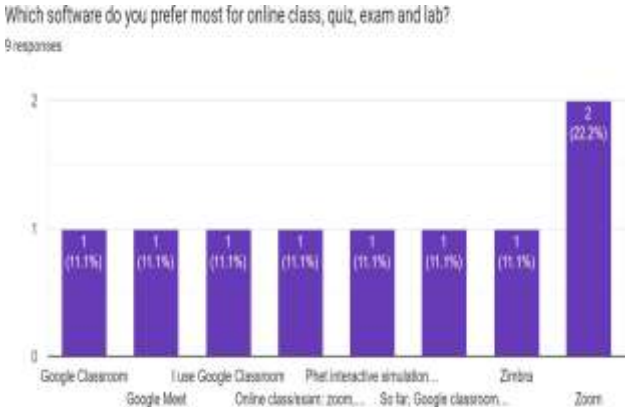

Fig. 25: Opinion.

9. Proctoring Behavior Issue

Figure 26 shows that most teacher monitors student activities to identify behaviour issues.

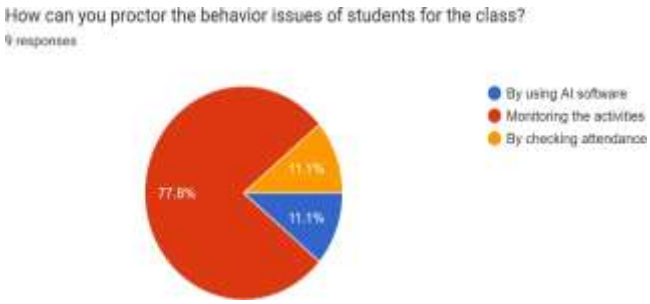

Fig. 26: Behavior issue.

After completing the survey, this work proposed a blended system for online education.

4.2 Proposed System

This work proposed a Blended system to improve online class performance and student evaluation. This section includes term- online theoretical class, online course evaluation, online practical/lab class, and online practical course evaluation.

Blended System

The concept of "blended learning" denotes the educational strategy of integrating digital learning resources with more conventional face-to-face instruction in the classroom. The process of the blended system is shown in Figure 27.

These three steps are described below:

(i) Face-To-Face Learning

The face-to-face blended learning methodology uses Internet resources to teach and train individuals needing more help with a particular subject. The teacher simultaneously conducts the significant component of the instruction by presenting the entire class.

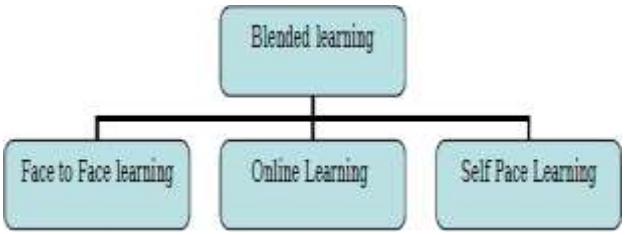

Fig. 27: Blended system.

(ii) Online Learning

A formal education program comprises in-person classroom time and individual study online using e-learning software. This multichannel method incorporates tutor-led activities, images, video, digital tasks, and face-to-face discussion.

(iii) Self -Pace Learning

With self-paced learning, students can set their schedule and speed for learning. They are not required to do their homework or start their classes at the same time as others. They can go quickly from one subject or section to the next.

The role of teachers and students in Blended Learning is significant. The teacher should have in-depth knowledge about content to teach various subjects. They should also be able to differentiate between various instructions based on students' needs. Students should also be able to demonstrate through various aids as and when required. The teacher continues to boost students' confidence, inspire, encourage, evaluate their development, provide comments, and keep them motivated. Teacher and student roles are very interconnected. With the use of technology in the teaching and learning process, student participation has increased. Students in blended learning work as a partner of teachers. Now, the new role of the teacher is facilitator and guide. The essential requirement of students is to understand the unit of the subject, so their participation is necessary; the teacher motivates students to increase their confidence to develop critical thinking and analysis. The teacher's most important role is keeping the students digitally safe. Using blended learning technology in classroom teaching and learning processes is innovative. It combines the quality of both online learning and classroom methods. It creates interest in learning through audio-visual aids and develops better understanding and group feeling among students.

a. Online Theoretical Class Based on Blended Learning

Online classes must be taken by using blended learning. Blended learning has two procedures: synchronous online classes and asynchronous online classes. Teachers can take classes using Microsoft Teams, Google Meet, Facebook, and Zoom.

A teacher may detect student attentiveness by identifying students' attendance charts and facial expressions. Using the expression Artificial Intelligence(AI) app, a teacher can understand whether a student is neutral, guilty, confused, or happy. The finding of emotion using the expression AI is shown in Figure 28.

a) Happy

b) Neutral

Fig. 28: The Finding of emotion by using Expression AI.

Also, in blended learning, Pen Digitizer is a valuable tool (Figure 29). Pen Digitizer gives the flexibility to write, draw, design, interact with the Graphical User Interface, and perform other input-related tasks in a very user-friendly manner. With the help of a pen digitizer, a teacher can explain lab exam topics through specific drawings. By using virtual lab simulation software, students can find it easily. By doing this, we can overcome the limitations and challenges and improve the effectiveness of current processes.

Fig. 29: Pen digitizer

b. **Online Course Evaluation through Blended Learning**

For course, evaluation quiz tests must be taken by using Poll everywhere (Figure 30). For the theoretical exam, the students have to join a live stream with pen and paper. The whole interface should be recorded or shown by another camera. To avoid unfair means during an exam, the students must give a mock viva about their answer script that they wrote immediately.

Poll Everywhere

Assessment tool Poll Everywhere offers hybrid power work. Engage audiences across hybrid workspaces through live online polling, surveys, Q&As, quizzes, word clouds, and more. Let us create a feedback poll or ask questions and see real-time results. It enables students to respond in various ways. Open-ended questions can capture data and spin up tag clouds to aggregate responses.

The following procedures are included to have a quiz exam. The students join their presence with a Google account. The teachers prepare a question and distribute them. They can see the response over time. The benefits of the crowedsignal are many. It provides actionable team insights, visualizes employee feedback in real-time with various activities, then measures engagement, follows up on feedback, and uncovers the next steps. In polls everywhere, candidates must and during a short period.

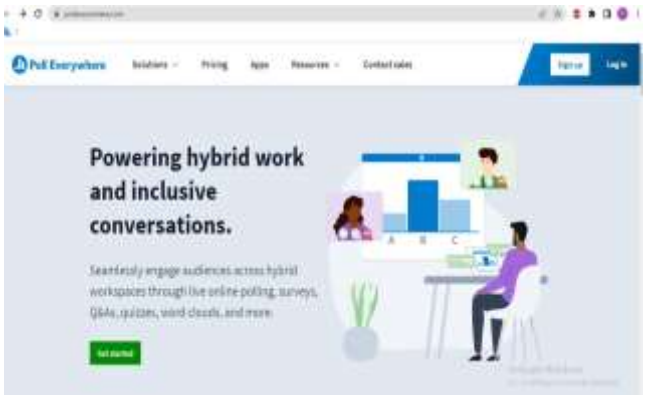

Fig. 30: Poll everywhere for an online quiz.

c. **Online Practical/Lab Class through Blended Learning**

Programming-based labs can be taken quickly online. For other labs, the following software can be used.

LABINAPP

It provides a multi-platform for a lab. It also has a multi-curriculum and 550+ simulations. More than 5,000 schools use the startup's solution, LABINAPP, which enables the virtual modelling of lab apparatus and experiments without necessitating a costly laboratory setup. The app also ensures learning content through 3D/2D interactive simulations, which helps students grasp challenging concepts better.

The underlying technology that drives these virtual lab scientific activities is a computer graphic engine utilized to create games for desktops and mobile devices. These simulations cover concepts across physics, chemistry, biology, and mathematics and are supported across Windows, Android, and web platforms. The process is shown in Figure 31(a).

a) Virtual Lab Experiment view in LABINAPP.

b) Lab Simulations for Physics Lab.

Fig. 31: Online Lab Experiment process.

PHYSICS LAB

Virtual lab simulations allow students to complete online laboratory experiments, abstract concepts, and complex theories without entering a physical science lab. Then, engage students in science through interactive learning scenarios. Figure 31(b) shows an example of a Physics Lab. Simulate experiments, train lab techniques and unique models, and teach theory through visual experiences that enhance long-term learning outcomes. The advantages of Physics Lab software are-

1. About 250+ Web-based simulations can be played on laptops without installing any software.
2. Teachers show a dashboard to automate grading and track student progress.
3. Embedded quizzes help the students master science content.
4. There is a Library of learning resources, lab reports, videos, theory pages, graphics, and more.

PHET Interactive Simulation

Virtual lab platform PHET simulations provide funny, interactive, research-based simulations. The teacher can show video clips of PHET simulations in the online classroom lectures. Students' activity can be measured through lab quiz tests. The process of PHET interactive simulation is shown in Figure 32.

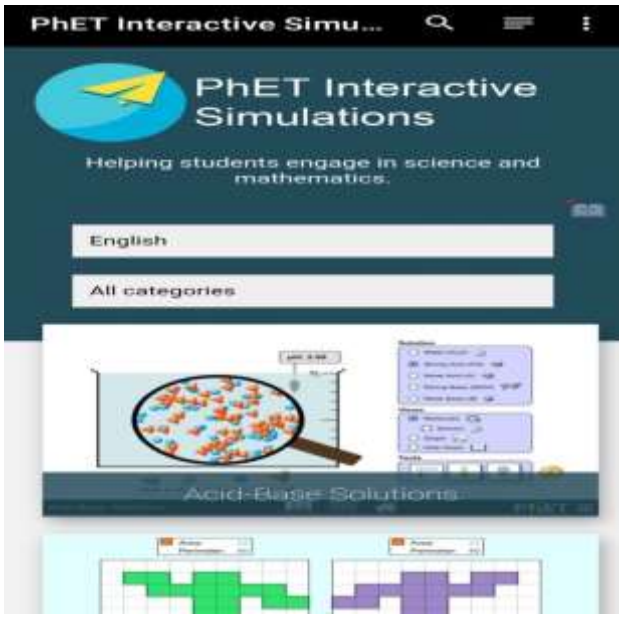

Fig. 32: Lab Simulations in PHET Interactive Simulations.

d. Online Lab Course Evaluation

Online lab courses can be divided into different sections, such as quizzes, mock tests, and assignments.

4.3 Test Result

A good software platform is found by measuring student performance through a test. Test results are the measurable and objective findings obtained from the evaluations. Four major components should be included when writing a test report.

(i) Test objective: The test objective is what type of testing the team and its testers executed. Here, a good platform is built by gaining opinions from students.

(ii) Test cases (test coverage and execution details): Several types of software are used to identify the best solution.

(iii) Defect counts: Defect counts can be used as indicators of process quality.

(iv) Platform and test environment configuration details are shown in Table 1**.**

From the above test, we can use Microsoft Teams for taking classes, as it can join more participants, about 300. The premium version of MICROSOFT-TEAMS can add 1,000 participants. For the quiz, POLL EVERYWHERE is used because the teacher can set a time for one question; after completing one question, the other is given. For assignments, THINGLINK is used for multi-purpose.

Table 1. Students opinion

Student Name	Class	Quiz	Assignment
MIFTA	MICROSOFT TEAM	POLL EVERYWHERE	THINKLINK
TITHY	MICROSOFT TEAM		THINKLINK
NISHAT	MICROSOFT TEAM		CROWEDSIGNAL
SADIA	ZOOM	GOOGLE FORM	THINKLINK
MIM	MICROSOFT TEAM	POLL EVERYWHERE	CROWEDSIGNAL
SIYAM	MICROSOFT TEAM		CROWEDSIGNAL
FARJANA	ZOOM	GOOGLE FORM	THINKLINK
RIMA	ZOOM		THINKLINK
LAMIA	MICROSOFT TEAM	POLL EVERYWHERE	CROWEDSIGNAL
TAMANNA	MICROSOFT TEAM		THINKLINK

5 Conclusion

The purpose of this study is to visualize the current status, effects, limitations, ways, and probable improvements of online education during the pandemic in Bangladesh. It tries to identify different aspects of online classes and suggest a long-term, robust, and effective workaround to overcome the limitations of continuing online classes during the pandemic. The statistical result from this study will help improve the performance and effectiveness of online education during the pandemic situation.

For future studies, further research can be conducted in several developing countries to generalize the findings of this research. The institute should develop its private platform to conduct online exams. Moreover, a qualitative study of students and teachers can be done to make the results more detailed and clarified.

Acknowledgement:
We thank the Research Cell, Noakhali Science and Technology University, for financial support.

References:

[1] MacKenzie, D., Covid-19 goes global, New Scientist. 2020, 245, pp. 7. https://doi.org/10.1016/s0262-4079(20)30424-3.

[2] Zhang, W., Wang, Y., & Yang, L., Suspending classes without stopping learning: China's education emergency management policy in the COVID-19 outbreak. Journal of Risk and Financial Management, 2020, 13, pp.1–6.

[3] UNESCO, 2020. COVID-19 Educational Disruption and Response. Retrieved March 18, 2020, https://en.unesco.org/themes/education-emergencies/coronavirus-school-closures (Accessed Date: 30/9/2023)

[4] Klaiman, T., Kraemer, J. D., & Stoto, M. A., Variability in school closure decisions in response to 2009 H1N1: A qualitative systems improvement analysis. BMC Public Health, 2011, 11, pp.1-10. https://doi.org/10.1186/1471-2458-11-73.

[5] Wang, G., Zhang, Y., Zhao, J., Zhang, J., & Jiang, F., Mitigate the effects of home confinement on children during the COVID-19 outbreak. Lancet (London, England), 2020, 395, pp.945-947. https://doi.org/10.1016/S0140-6736(20)30547-X

[6] Bergdahl, N. and Nouri, J., Covid-19 and crisis-prompted distance education in Sweden. Technology, Knowledge and Learning, 2021, 26, pp.443-459.

[7] Douglas, D.E and Van Der Vyver, G., Effectiveness of E-Learning Course Materials for Learning Database Management Systems: An Experimental Investigation. Journal of Computer Information Systems, 2004, 44, pp.41-48.

[8] Richardson. J.C., and Swan, K., Examining social presence in online courses about students' perceived learning and satisfaction. Journal of Asynchronous Learning Network, 2023, 7(1).

[9] Govindasamy, T., Successful implementation of e-learning: Pedagogical considerations. The Internet and Higher Education, 2002, 4, pp.287-299.

[10] Sandars and Langlois, E-learning and the educator in primary care: responding to the challenge. Education for Primary Care, 2005, 16, pp.129-13.

[11] Liaw, S.S., Huang, H.M. and Chen, G.D., An activity-theoretical approach to investigate learners' factors toward e-learning systems. Computers in Human Behavior, 2007, 23, pp.1906-1920.

[12] Cantoni, V., Cellario,M., and Porta, M.,

Perspectives and challenges in e-learning: Towards Natural Interaction Paradigms. Journal of Visual Languages and Computing, 2004, 15, pp.333- 345.

[13] Nawshin, F., Khan, M.A.R., Akter, J., Modelling the effect of social media on female student using Artificial Neural Network. International Journal of Education and Learning Systems, 2023, 8, pp.27- 31.

[14] Sun, P. C., Tsai, R. J., Finger, G., Chen, Y. Y., & Yeh, D., What drives a successful e-Learning? An empirical investigation of the critical factors influencing learner satisfaction. Computers & Education, 2008, 50, pp.1183–1202.

[15] Ho, L.A. and Kuo, T.H., How can one amplify the effect of e-learning? An examination of high-tech employees' computer attitude and flow experience. Computers in Human Behavior, 2010, 26, pp.23-31.

[16] Peng, H., Tsai, C.C. and Wu, Y.T., University students' self-efficacy and their attitudes toward the Internet: the role of students' perceptions of the Internet. Educational studies, 2006, 32, pp.73-86.

[17] Hannafin, J. J. and Cole, D. D., An analysis of why students select introductory high school computer coursework. Educational Technology, 1983, 23, pp.26–29.

[18] Piccoli, G., Ahmad, R., and Ives, B., Web-based virtual learning environments: a research framework and a preliminary assessment of effectiveness in basic IT skill training. MIS Quarterly, 2001, 25, pp.401–426.

[19] Pituch, K.A. and Lee, Y.K., The influence of system characteristics on e-learning use. Computers & Education, 2006, 47, pp.222-244.

[20] Selim, H.M., Critical success factors for e-learning acceptance: Confirmatory factor models. Computers & Education, 2007, 49, pp.396-413.

[21] Yang, Y. and Lin, N.C., Internet perceptions, online participation and language learning in Moodle forums: A case study on nursing students in Taiwan. Procedia-Social and Behavioral Sciences, 2010, 2, pp.2647-2651.

[22] Bierema, L. L., and Merriam, S., E-mentoring: Using computer-mediated communication to enhance the mentoring process. Innovative Higher Education, 2000, 26, pp.211-227.

[23] Single, P.B. and Muller, C.B., When E-mail and Mentoring Unite: The Implementation of a Nationwide Electronic Mentoring Program--MentorNet, the National Electronic Industrial Mentoring Network for Women in Engineering and Science, 2001.

[24] Price, M.A. and Chen, H.H., Promises and challenges: Exploring a collaborative telementoring program in a preservice teacher education program. Mentoring and Tutoring, 2003, 11, pp.105-117.

[25] Adams, G. and Crews, T.B., Telementoring: A viable tool. Journal of Applied Research for Business Instruction, 2004, 2, pp.1-5.

[26] Heng, K. and Sol, K., Online learning during COVID-19: Key challenges and suggestions to enhance effectiveness. Cambodian Journal of Educational Research, *1*(1), 2021, pp.3-16.

[27] Akuratiya, D. A., and D. N. Meddage. "Students' perception of online learning during COVID-19 pandemic: A survey study of IT students." Tablet 57, no. 48, 2020, 23.

[28] Yates, Anne, Louise Starkey, Ben Egerton, and Florian Flueggen. "High school students' experience of online learning during Covid-19: the influence of technology and pedagogy." Technology, Pedagogy and Education 30, no. 1, 2021, pp.59-73.

[29] Hara, N. and Kling, R., 2001. Student distress in web-based distance education, http://www.slis.indiana.edu/CSI/wp00-01.html (Accessed Date: 6/1/2021)

Contribution of Individual Authors to the Creation of a Scientific Article (Ghostwriting Policy)

- Tania Sultana has contributed to the work simulation, optimization, and paper writing.
- Md. Ashikur Rahman Khan has given the idea and supervised this research work. Moreover, he has contributed to the model development, accomplishing paper revision and paper submission.
- Fardowsi Rahman has played a significant role in writing the paper, revising it, and preparing it for the journal article.

Sources of Funding for Research Presented in a Scientific Article or Scientific Article Itself

This work is fully funded by Research Cell, Noakhali Science and Technology University.

Conflict of Interest

The authors have no conflicts of interest to declare.