

# **Implications of Emergency Remote Teaching During COVID-19 Lockdown : an Exploratory Analysis**

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## **Abstract**

In Spring of 2020, universities and colleges in the USA implemented a number of alternative pedagogical measures in compliance with social distance policies to curb the spread of COVID-19 and persist in academic activities. “Emergency Remote Teaching” ERT, defined as a temporary shift of pedagogy to remote models due to crises, appears to be the most popular among these measures. The transition to ERT has a range of pedagogical implications in many areas including student engagement, technology use and access, emotional stability and student assessment. Data on students and faculty experiences with respect to these areas can offer immediate and strategic insights into the implications of ERT. Current literature focuses on the development of various pedagogical approaches and technologies for remote learning. However, in depth analysis of the implications of ERT is currently lacking. This research seeks to provide insight into the challenges and implications of ERT to pedagogy, specifically we focus on student engagement and academic performance. Hence this research seeks to answer the following research questions: (i) What are the implications of emergency remote teaching on students’ learning experience? (ii) What is the impact of emergency remote teaching instructors’ teaching experience? In order to answer this research question, we designed a questionnaire in “surveyMonkey” and distributed this to students and faculty members at small Universities in Northern Pennsylvania. We received 240 responses. After performing an exploratory analysis on the collected data, we found that although students are engaged with course materials and university staff, peer-to-peer and student-instructor engagement are low in an ERT. Also, ERT appears to have a negative impact on assessment from both students’ and instructors’ perspectives. As instructors continue to search for effective and alternative pedagogical strategies to deliver their courses in the face of COVID-19, we recommend that future efforts towards implementation of ERT should focus on strategies for improving peer-to-peer and student-instructor engagement.

## **Introduction**

COVID-19 Pandemic brought a new paradigm to the operation and execution of activities across the industry and academia. In the industry, the so-called work-from-home or remote work model

became widely adopted. In a similar fashion, universities and colleges all over the world implemented a variety of pedagogical approaches. The overall aim of these pedagogical approaches was to maintain social distancing while persisting academic activities, thereby reducing the spread of COVID-19. Emergency Remote Teaching or *ERT*<sup>1,2</sup> has emerged to be the most popular and widely used approach. In ERT, educational activities such as instruction, advising and assessment, that were originally planned to be delivered in a face-face, are hurriedly and temporarily moved online to avert the crisis<sup>1,2</sup>. This differs from a typical online learning wherein educational activities are originally intended to be delivered online<sup>1,2</sup>.

The sudden transition of educational activities from face-to-face to online came with various challenges. Because both students and instructors had very little time to prepare for the transition, the quality of educational activities delivered in an ERT is difficult to assess<sup>2</sup>. More so, in order to successfully implement ERT, students and faculty had to adopt technologies e.g., Zoom, Virtual Whiteboard, Teams, etc., that are not typically used in the classroom. This introduced another level of stress and uncertainty as they had very little time, usually a week or less, to learn and adopt these technologies.

Although ERT provides a good alternative to teaching and learning in times of crises, another key challenge is to establish an active learning environment, and to engage students into the class session. Our experience shows that it is much easier for the students to be distracted in a typical ERT class because students do not feel like they are in a classroom physically. Many students take the advantage of being off campus during the class since they can easily join the online session from their mobile devices. Students join the class session from their houses, sometimes from outside, or in a public place not very quiet having a lot of elements around that may destroy the focus of the lecture coming through a little computer/mobile device.

Besides misusing the advantage of mobility, there are issues with capability of performing some activities through online meeting sessions. For example, courses that require hands-on practices and practical exercises, such as computer programming, mobile application development, biology-physics-chemistry laboratory works, electrical engineering laboratory works, are still facing this challenge of teaching in a remote setup. Although, some innovative ideas are invented by recent studies to mitigate this lacking by proposing virtual laboratories<sup>3,4</sup>, this shortcoming is still present since the proposed methods are yet not established and available everywhere and needs a proper transition to enrich the ERT pedagogues.

Furthermore, the transition to ERT has a range of pedagogical implications in various aspects of teaching and learning, including student engagement, technology use and access, as well as student engagement. In literature, various studies<sup>5,6,7,8</sup> have been conducted to examine the alternative techniques to persist educational activities during crises. However, the majority of these studies focus on the development of pedagogical approaches, analyzing the relative advantages of alternative pedagogical approaches, etc. Evaluation of the pedagogical implications of alternative pedagogical approaches such as ERT are often neglected in literature. Currently, it is difficult to find studies that have analyzed the impact of ERT on student learning variables such as student engagement, academic performance, use and access to various technologies that support ERT, etc.

It is important to note that the aim of this study is not to compare the ERT with face-to-face class,

authors such as Hodges et al have already warned that such comparison will be problematic, see<sup>2</sup>. Moreover, because of the peculiarities of ERT such as lack of preparedness and sudden transitions, it will be difficult to properly compare it with face-to-face delivery. However, our aim in this study is to provide insight into the implications of ERT on variables or factors of student learning and faculty teaching experiences. Specifically we focus on three popular teaching and learning variables that closely align with ERT. As shown in Table 1, these include *student engagement, technology use and access, and student assessment*.

Hence, in this study, we focus on investigating the following research questions that drive our research:

- **RQ 1:** What are the implications of emergency remote teaching on students' learning experience
- **RQ 2:** What is the impact of emergency remote teaching faculty or instructors' teaching experience?

The rest of the paper is organized as: Section discusses the literature review, Section explains the methodology that we use for this study, Section discusses the results obtained from the data, finally Section outlines and thoroughly discusses the future works as a follow up of this study.

## **Literature Review**

### **Distant Education, Online Learning, & Emergency Remote Learning**

The experience of remote teaching is not very new. Traditionally, teachers deliver educational activities (instruction, assessment, advising, etc.) to the learners using two broad models, namely, the classroom and the distant education models. The main differentiating factor between both models is the location of the teacher and learner<sup>9</sup>. In a typical distance education model, the teacher performs educational activities in a separate geographical location from the learner. On the other hand, a classroom education requires both the teacher and the learner to be in the same physical location, usually in a brick and mortar classroom<sup>9</sup>. Moreover, the interaction between the teacher and the learner in a classroom model is face-to-face rather than virtual. Earlier, distant education was carried out through the print media and postal systems i.e., educational materials were produced through the print media and distributed using the post office system<sup>10</sup>. However, nowadays the postal systems are rarely used to distribute educational materials in distance education, this is due to technological innovations and advances. Instead, new technologies such as the internet, learning management systems and other web-based learning systems have emerged and are now being used as an alternative to the postal systems. This led to an improved version of the distant education model known as online learning and its variant e-learning<sup>11</sup>.

Online learning has been defined as the use of (internet, communication and other learning) technologies to exchange educational materials and other learning resources<sup>11,12</sup>. Oncu and Cakir (2011) further added that the exchange of these materials can be in synchronous or asynchronous mode. E-learning is usually used interchangeably with online learning<sup>11</sup>. Authors who made attempts to differentiate between online learning and e-learning conclude that both terms are

variants of the distance education model and are facilitated by use of the internet and other communication technologies<sup>11</sup>. Online learning is very beneficial because it reduces or totally eliminates the effect of geographical distance as a barrier to teaching and learning<sup>11,12</sup>, and makes acquisition of knowledge ubiquitous as well as affordable<sup>13</sup>. One distinct characteristic of online learning is its quality control process. Many authors, e.g.,<sup>2,1</sup>, have noted that the implementation of online learning is preceded by rigorous planning, instructional design and peer-review by instructors and educational experts.

In Spring of 2020, a new variant of online learning emerged, this is known as Emergency Remote Teaching and Learning, popularly known as *ERT*<sup>2,1</sup>. The essence is to enable universities and colleges to continue educational activities and, at the same time, comply with social distance policies and curb the spread of COVID-19. *ERT* is defined as a temporary shift of educational activities to online due to crises. It differs from online learning in many ways<sup>2</sup>. For instance, in a typical online learning, educational activities are intended to be delivered online to meet the needs of a student population and are planned, designed and executed in accordance with this intention<sup>2,1</sup>. This is quite unlike *ERT* where educational activities were originally designed to be delivered using the classroom model but was swiftly moved to online due to crises<sup>2,1</sup>. The main benefit of *ERT* is to prevent total disruption of educational activities during crises e.g., pandemic. Yet, there are concerns about the implications *ERT* has on various dimensions of student learning experience.

## **Evaluating the Implications of ERT**

The nature of emergency remote teaching and learning *ERT* i.e., the sudden and unplanned transition from classroom teaching to remote teaching, suggests that it has implications on the quality of teaching and learning<sup>2</sup>. Authors such as<sup>2,1,14</sup> have expressed concerns over the quality teaching and learning in *ERT*, especially as educational activities delivered under *ERT* lack the rigorous design and preparations found in a typical online or e-learning. Currently, the implications of *ERT* on students' teaching and instructors' learning experiences are largely unknown. There are few publications<sup>2,1,14</sup> that made attempt to explain the concept of *ERT*, differentiate it from online learning, and outline its merits and demerits. These authors discussed the importance of evaluating the implications of *ERT* on students learning experience and often times stop at identifying the factors that may be used for such evaluations. However, they made very little to no attempts in performing the actual evaluations of *ERT* on students' and instructors' pedagogical experiences.

Evaluating the implications of *ERT* on students' learning experience as well as instructors' teaching experience can provide insight that are critical to the quality and improvement of educational activities. Moreover, such evaluation may help determine the viability of *ERT* as an alternative instructional approach, especially in times of crises. Our aim in this study is to provide insight on how *ERT* impacts on educational activities from both student and instructor (faculty) perspectives. Already, some studies have proposed various factors that may be used to evaluate the implications of online learning from both student and faculty perspectives, see<sup>15,2,16,17,18,15,19,20</sup>. Based on these studies, we identified factors and sub-factors and used these to perform our evaluation. The factors and sub-factors used are listed in Table 1 and Table 2.

Table 1: Factors for Evaluating Students Learning Experience in ERT

<b>Factors</b>	<b>Sub-Factors</b>
<b>Student Engagement</b>	<ul style="list-style-type: none"> <li>• Interaction and engagement with peers</li> <li>• Interaction with Instructors</li> <li>• Access to staff and support services</li> </ul>
<b>Technology Use and Access</b>	<ul style="list-style-type: none"> <li>• Join classes without interruptions</li> <li>• Student interest in remote learning</li> <li>• Overall experience on technology use and access</li> </ul>
<b>Student Assessment</b>	<ul style="list-style-type: none"> <li>• Feedback from instructors about performance</li> <li>• Feedback to instructors about learning experience</li> <li>• Academic performance</li> </ul>

Table 2: Factors for Evaluating Instructor’s Teaching Experience in ERT

<b>Factors</b>	<b>Sub-Factors</b>
<b>Student Engagement</b>	<ul style="list-style-type: none"> <li>• Interaction and engagement with students</li> <li>• Rapport with Students</li> <li>• Access to staff and support services</li> </ul>
<b>Technology Use and Access</b>	<ul style="list-style-type: none"> <li>• Seamless delivery of course materials</li> <li>• Impact on the quality of instruction</li> <li>• Overall experience on technology use and access</li> </ul>
<b>Student Assessment</b>	<ul style="list-style-type: none"> <li>• Provide timely and effective feedback to students</li> <li>• Gather feedback about student learning experience</li> <li>• Impact on instructor’s assessment approach</li> </ul>

## Methods

To collect data for our study, we used the factors and sub-factors identified from literature, see Table 1 and Table 2, to design questionnaires using the Survey Monkey Software. After we obtained IRB (Institutional Review Board) approval, we distributed the questionnaire to students and faculty members in a small-size University in Northern Pennsylvania, USA. Data collected over Spring of 2020 (March to May) to coincide with the first wave coronavirus when most institutions transitioned to remote learning.

## Data Collection

In order to comprehensively collect data about students’ learning experience of emergency remote teaching, the qualitative survey is designed to ask open-ended questions based on the factors listed in Table 1. The questionnaire is designed with the use of survey monkey software and Likert Scale was used to rate student learning experience for each factor as follows:

- **Student Engagement:**

- I am able to interact and engage with my peers in a seamless way

- I feel I have good interaction with my instructors
- I have seamless access to course materials and other university resources

- **Technology Use & Access:**

- I am able to seamlessly join my classes without any interruption
- My remote learning and use of technology for my courses meet my expectations
- My instructors' use of technology in my classes has increased my interest in remote learning

- **Student Assessment:**

- I receive timely and helpful feedback from my instructors
- I have opportunity to provide feedback to my instructors on my learning experience
- Remote learning does not affect my expected grades in assignments and examinations

With the perspective of instructors, we designed the following open-ended questions based on the same three aspects:

- **Student Engagement:**

- I am able to interact and engage with my students in a seamless way
- I have good rapport with my students via the learning management system I use
- I have timely access to staff and support services when needed

- **Technology Use & Access:**

- I am able to seamlessly deliver my course materials without any interruption
- My experience with use of technology for my courses meet my expectations
- Use of technology has enhanced my quality of instructional delivery through remote learning

- **Student Assessment:**

- I am able to provide timely and helpful feedback to my students
- I have opportunity to gather feedback on student learning experience
- Remote learning does not have any effect on the way I grade student assignments and examinations

In total, we received responses from 338 participants, which involved 240 students and 98 instructors. Figure 2 describes the distribution of students according to majors. Figure 1 shows the statistics of our student participants. In Figure 1a, we evenly involved the students with all levels including freshman, junior, sophomore, senior undergraduate students, and graduate students. As shown in Figure 1b, 66.3% of student participants are female. Our survey results tend to reflect the opposition of STEM female students. In Figure 1c, we can see that 41.7% of

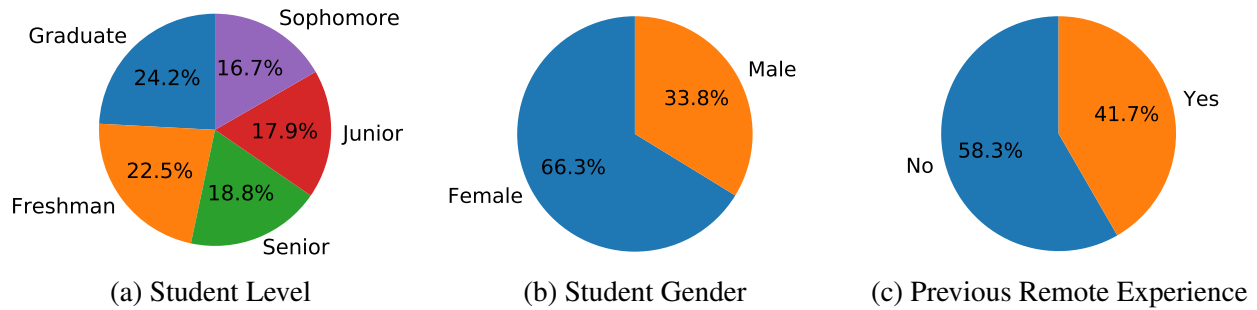


Figure 1: Statistics of Students' Background

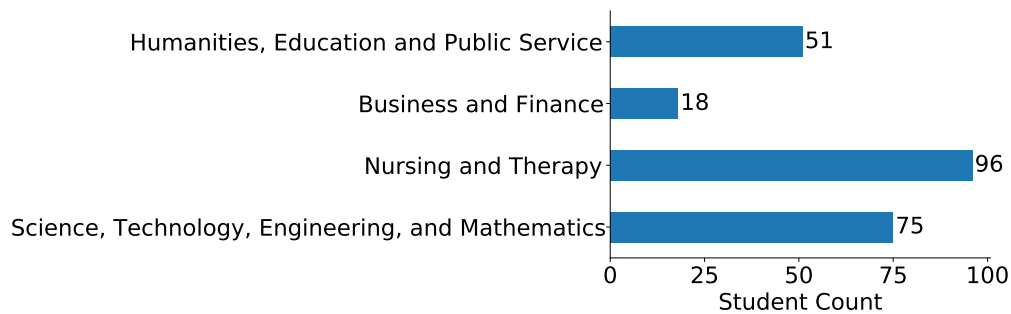


Figure 2: Distribution of students according to their majors.

student respondents say they have previous exposure to remote learning while the rest says otherwise.

In addition, the statistics of our instructor respondents are shown in Figure 3. In Figure 3a, we can see that 83.8% of our respondents are experienced instructors who have more than 6 years of teaching experience. The gender ratio of instructor respondents is balanced as shown in Figure 3b. Similar to the student respondents, in Figure 3c, 44% of instructor respondents have the experience of remote teaching.

To analyze and visualize our survey responses, we use Python (version 3.6) with Pandas Data Analysis Library(version 1.4) in order to plot the percentages of options in every designed question. The detailed results and analysis are presented in the following section.

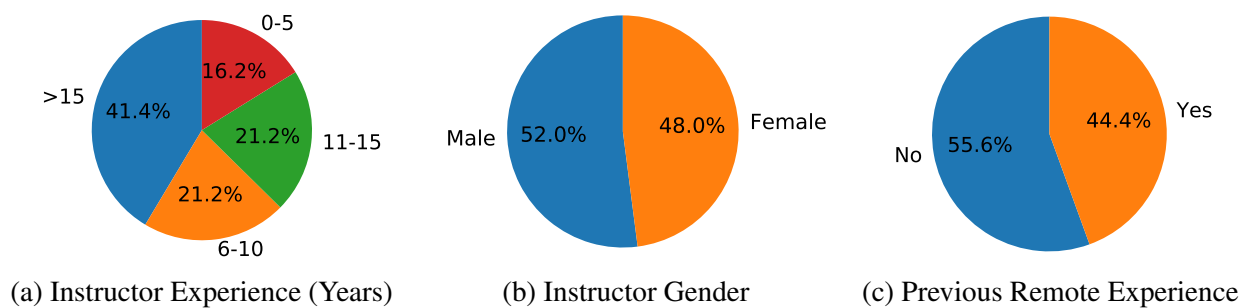


Figure 3: Statistics of Instructors' Background



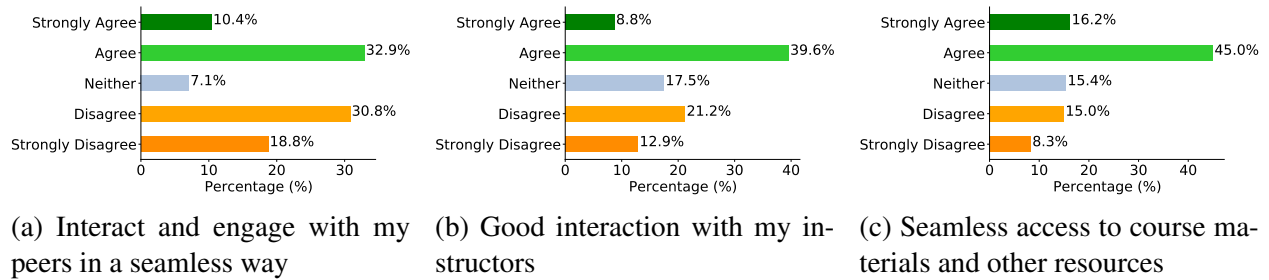


Figure 4: Responses from Students Regarding Student Engagement

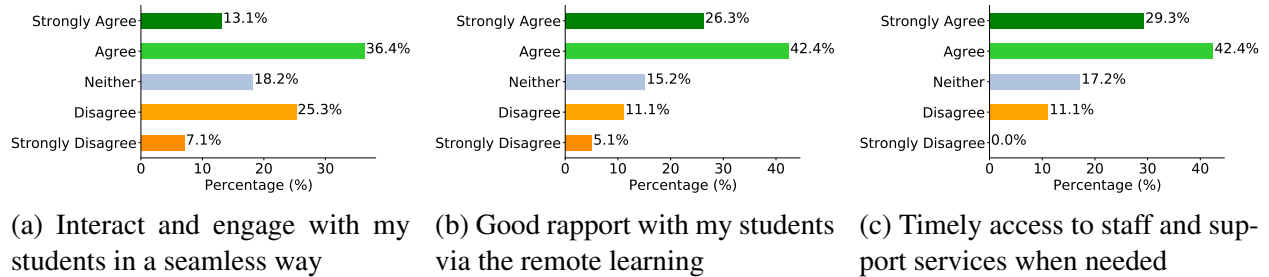


Figure 5: Responses from Instructors Regarding Student Engagement

## Results and Discussion

According to the data we collected, we illustrate and discuss the survey data from students and instructors, respectively.

### Results Regarding Student Engagement

We asked student participants the following questions to collect the data regarding student engagement: (1) I am able to interact and engage with my peers in a seamless way, (2) I feel I have good interaction with my instructors, (3) I have seamless access to course materials and other university resources. Figure 4 shows the responses of these questions. It is challenging to keep the students engaged to the class context during Covid-19, especially to keep peer-to-peer interaction and engagement. As shown in Figure 4a, our exploratory analysis shows that 49.6% of students are not able to interact and engage with peers in a seamless way. However, as illustrated in Figure 4b and Figure 4c, remote learning seems not bring more negative impact for interaction with instructors and access to course materials, where 48.4% of students say that they good interaction with instructors and 61.2% of students say that they seamless access to course materials. That may be because most students may have been used to interacting with instructors and getting materials online before Covid-19.

From the perspective of instructors, in Figure 5a, 49.5% of instructors feel great to interact and engage with their students in a seamless way and while 32.4% of them do not think so, which is similar to the responses of students. 68.7% of instructors in Figure 5b have rapport with students, which also meet the same result as students' responses. We can see that both most students and instructors do not have the problem of integration and engagement.

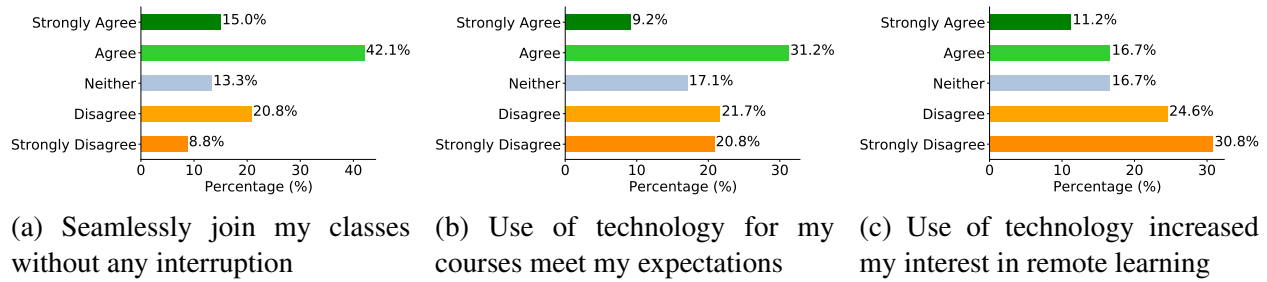


Figure 6: Responses from Students Regarding Technology Use & Access

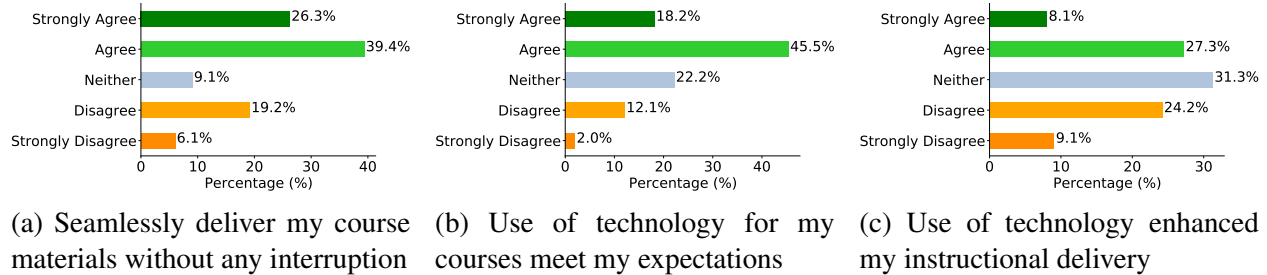


Figure 7: Responses from Instructors Regarding Technology Use & Access

## Results Regarding Technology Use & Access

From the aspect of Technology Use & Access, we designed the following questions to learn about the students' attitudes to the remote learning: (1) I am able to seamlessly join my classes without any interruption, (2) My remote learning and use of technology for my courses meet my expectations, (3) My instructors' use of technology in my classes has increased my interest in remote learning. As the rapid development of communications technology (e.g., 5G/6G and fiber fiber-optic communications), it can provide us robust access to the online classes. As shown in Figure 6a, the majority of students (i.e., 57.1%) are able to seamlessly join my classes without any interruption. Even though the communications technology could ensure the stable access to classes, in Figure 6b, many students (i.e., 42.5%) still do not consider that the use of technology for the courses via a remote way meet their expectations. More negatively, as shown in Figure 6c, only 27.9% of students say that instructors' use of technology in classes has increased interest in remote learning. Hence, we can see that the technologies used in in-person and online classes are distinct and it is hard to use those technologies to attract students' interest via a remote way. It is desired to explore new technologies used in remote classes.

Different from students' responses, instructors have more positive feedback regarding technology use & access via remote teaching. In Figure 6b, only 14.1% of instructors consider that the use of technology for courses does not meet their expectations, which contrasts sharply with the 42.5% in students' responses. This sharp contrast indicates that we need to enhance the interaction between students and instructors to meet consensus of courses during the remote classes. In addition, as shown in Figure 6b, 35.4% of instructors say that use of technology has enhanced my quality of instructional delivery through remote learning.

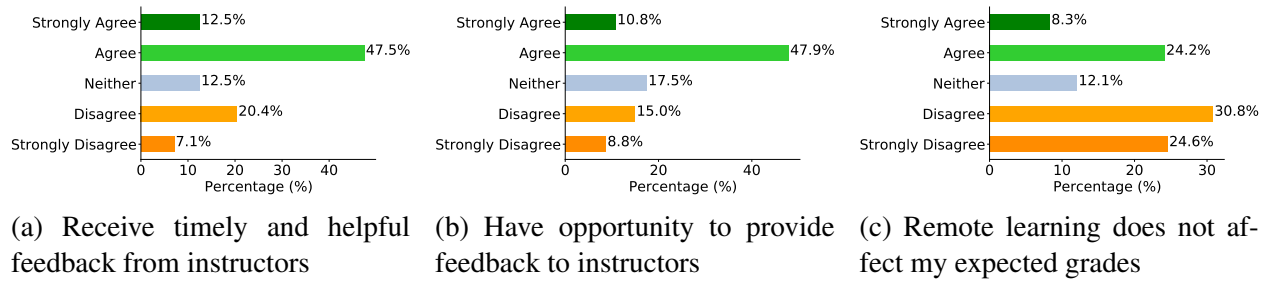


Figure 8: Responses from Students Regarding Student Assessment

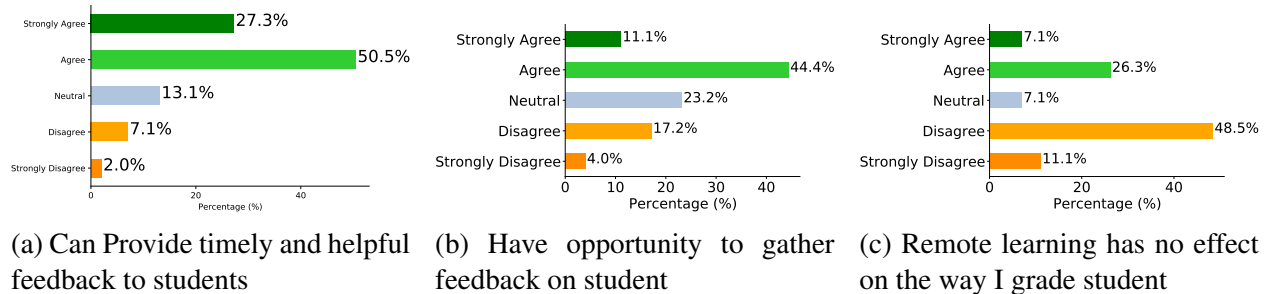


Figure 9: Responses from Instructors Regarding Student Assessment

## Results Regarding Student Assessment

As we can see in Figure 8a and Figure 8b, most students hold a positive attitude on receiving feedback from instructors. 60.0% of students can timely receive feedback from instructors and 58.7% of them think they have the opportunity to provide feedback to instructors. However, many students indicate that remote learning did have an impact on their grades. As shown in Figure 8c, 24.4% of students strongly disagree and 30.8% of them disagree that remote learning does not affect their expected grades.

From the side of instructors, we got similar results where most instructors (i.e., 77.8%) think that they can provide timely and helpful feedback to students. Besides, most instructors (i.e., 59.6%) conclude that remote learning has an effect on the way they grade students on assignments and exams. Hence, we can see that remote learning/teaching has a significant influence on the grades of students.

## Future Work

We will extend our work further investigating using various other metrics and more advanced methods (e.g. predictive analytics using regression). Specifically, we will add more factors to student engagement and technology use & access and investigate the correlation between those factors using statistical methods. In addition, we will explore the impact of remote learning in terms of emotional stress to investigate the issues of mental health of students and instructors. Also, we will conduct an exploratory factor analysis to observe if there is any particular tool, electronic media, or mechanism that plays a significant impact on improving students' engagement and learning effectiveness.

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