# Written Report: A study on students' satisfaction and commitment towards Online learning during COVID-19

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# Introduction

Due to the COVID-19 pandemic, many students have had to switch to online learning for extended periods of time. We are interested in examining the commitment and satisfaction of students' online learning. This study aims to determine the proportion of STA304 students at the University of Toronto Mississauga who felt satisfied and committed to online learning during the COVID-19 pandemic. Through this report, we analyzed four key hypotheses that may have impacted the students. These hypotheses included: (1) Students who preferred pre-recorded lectures should have a higher concentration of students who watched live virtual lectures. (2) Students who experienced technical difficulties should have lesser concentration over students who had a flawless experience. (3) Difficulties that students experienced during online learning resulted in lesser satisfaction with online learning. (4) There is no significant effect of gender on commitment towards online learning.

In order to conduct this study, students in both sections of STA304 at the University of Toronto Mississauga were surveyed in-person and electronically via Piazza. The questionnaire covered various topics ranging from levels of stress, concentration issues, technical difficulties, and content delivery preference. These responses would then be used to test our hypotheses and conclude our findings.

The importance of this study relates to the increasing use of virtual lecture delivery in schools across the globe. Since online learning is so prevalent nowadays, understanding satisfaction and commitment amongst students is crucial to improving and developing this new method of education.

## Interpretation

We Hypothesized that students who watched pre-recorded lectures would have higher concentration than students who watched live lectures. In order to analyze the data and determine a conclusion, we had to perform a method known as a Z-test. We gathered a P-value from this Z-test which was used to determine our conclusion. We found that the value was greater than 0.05, this indicates that we do not know that pre-recorded lectures would have higher concentration than students who watched live lectures.

## Variables

| **Variable** | **Definition** |
|---|---|
| Satisfaction | Participant's satisfaction with online learning on a scale from 1-5:<br>1 = Strongly dissatisfied<br>2 = Dissatisfied<br>3 = Neutral<br>4 = Satisfied<br>5 = Strongly satisfied |
| LectureFormat | Preferred lecture format during online learning:<br>Live Lecture or Pre-Recorded Lecture |
| AttendGivenRecording | Attendance of live lectures when lectures are recorded:<br>Yes or No |
| TechDifficulties | Frequency of technical difficulties during online lectures or accessing recordings:<br>Sometimes, Often, or Never |
| ConcentrationOnline | How was their concentration during online lectures or watching recordings:<br>Increased or Reduced |
| LevelOfStress | Measured level of stress of online learning versus in-person:<br>More Stressed or Less Stressed |
| UsedExtraResources | Use of academic resources for assistance. E.g office hours, discussion boards, etc:<br>Yes or No |
| TestAsMeasureOfLearning | Did online tests and exams accurately show student's knowledge of course concepts:<br>strongly agree, agree, disagree, or strongly disagree |
| LectureSection | Participants' Lecture section:<br>Thursday Lecture or Wednesday Lecture |

| | |
|---|---|
| Gender | Participants' gender: Male, Female, or Other |

Computations:

Before we ask students to fill our survey, we need to determine how many participants we need to answer to get an answer that is a proper representative of Fall 2022 STA304 students. The number of participants required is called sample size, and is usually denoted as "n" for statistical analyses. We are using stratified random sampling, which involves dividing the class into two groups based on their lecture section (these are called stratum) and then taking a random sample from each group, which is the same as sampling participants using a top hat or random number generator. Please refer to the following formula:

$$n = \frac{\sum_{i=1}^{L} N_i^2 \cdot \frac{p_i \cdot q_i}{a_i}}{N^2 \cdot \frac{B^2}{4} + \sum_{k=1}^{L} N_k \cdot p_k \cdot q_k}$$

The formula suggests that to find an appropriate sample size (n), we need to know the total number of Fall 2022 STA304 students (N), a bound of error on our estimate (B), or how far our estimate could be from the true value. Lowercase p represents the proportion of students that are satisfied and committed towards online learning, while q = 1 - p is the proportion of students who are not satisfied and committed towards online learning. The allocation variable (a) tells us how much of the sample size (n) will be composed of students from each respective lecture section. For example, if we have a sample size of "n = 50", and the allocation for the Thursday lecture section is "a = 0.5", this means that 25 students in the sample are enrolled in the Thursday lecture section. Expressed mathematically we assume that $a_i = N_i / N$.

Note that we have 200 students (N = 200) and since we don't know the proportion, we assume that p = 0.5 for now. As we could only gather responses from 54 participants, we shall choose a bound of B = 0.15, or 15%. To create suitable stratums ($N_k$), we referred to the University timetable builder (https://ttb.utoronto.ca/). We know that in reality, 239 students are enrolled in STA304H5 Fall 2022, with 123 in LEC0101 (Wednesday section) and 116 in LEC0102 (Thursday section) as of November 23th, 2022. We found it reasonable to assume that the proportion of students enrolled in each section out of 200 will be the same as the true proportions given by the timetable builder. Expressed mathematically, we suggest the following:

If we know that $N_1 + N_2 = N = 200$, then we make the following assumptions: $N_1 / 200 \approx 123 / 239$ and $N_2 / 200 \approx 116 / 239$. So we find that $N_1 \approx 103$, $N_2 \approx 97$. Hence, we compute the following to find the sample size (n):

$$n = \frac{\sum_{i=1}^{L} N_i^2 \cdot \frac{p_i \cdot q_i}{a_i}}{N^2 \cdot \frac{B^2}{4} + \sum_{k=1}^{L} N_k \cdot p_k \cdot q_k} \quad \frac{103^2 \cdot \frac{0.5^2}{\frac{103}{200}} + 97^2 \cdot \frac{0.5^2}{\frac{97}{200}}}{200^2 \cdot \frac{0.15^2}{4} + 103 \cdot 0.5^2 + 97 \cdot 0.5^2} = 36.36363 \cong 37$$

After collecting our responses, we first computed the point estimate of the population proportion of students satisfied with online learning during the COVID-19 pandemic. This estimate is given by the following equation:

$$\hat{p}_{st} = \frac{1}{N}\sum_{i=1}^{L} N_i \cdot \hat{p}_i = \sum_{i=1}^{L} \frac{N_i}{N} \cdot \hat{p}_i$$

The computation of this estimate was achieved using the R programming language, which yielded a value of

$$\hat{P}_{st} = 0.432406 \approx 0.43$$

Hence, we have that the proportion of sampled students who were satisfied with online learning during COVID-19 was 0.43, which is less than 0.5.

The next task was to determine the proportion of sampled students who were satisfied and committed towards online learning

We use a technique known as the one-sided Z-test to test the significance of each of our variables (survey questions). The test asks a simple question, is the observed proportion of students who find this question favorable significantly greater than 0.5 (50%). The table below shows the results, of relevance is the test conclusion.

| ITEM | P-value | Test conclusion |
|---|---|---|
| Rate your satisfaction with online learning on a scale of 1-5 | 0.6524579 | Insignificant |
| Did you prefer a pre-recorded lecture or attending a live lecture? | 0.05502036 | Insignificant |
| Would you still attend live virtual lectures if the lecture was recorded? | 0.0005643273 | Significant |
| Did you experience technical difficulties during a lecture or accessing recordings? | 0.9996335 | Insignificant |
| How was your concentration during online lectures or while watching recordings? | 0.9996335 | Insignificant |

| | | |
|---|---|---|
| Did you feel more or less stressed during online learning? | 0.03861554 | Significant |
| Did you use extra resources for assistance? i.e office hours, piazza, emails | 4.433929e-05 | Significant |
| During online learning, having online tests and exams accurately shows your knowledge of course concepts | 0.6524579 | Insignificant |

Based on the results, we concluded that STA304 Fall 2022 students who were likely to attend a live lecture given a recording were more committed than those who said no. Likewise, we concluded that STA304 Fall 2022 students who utilized extra resources and were less stressed were more committed towards online learning during the COVID-19 pandemic.

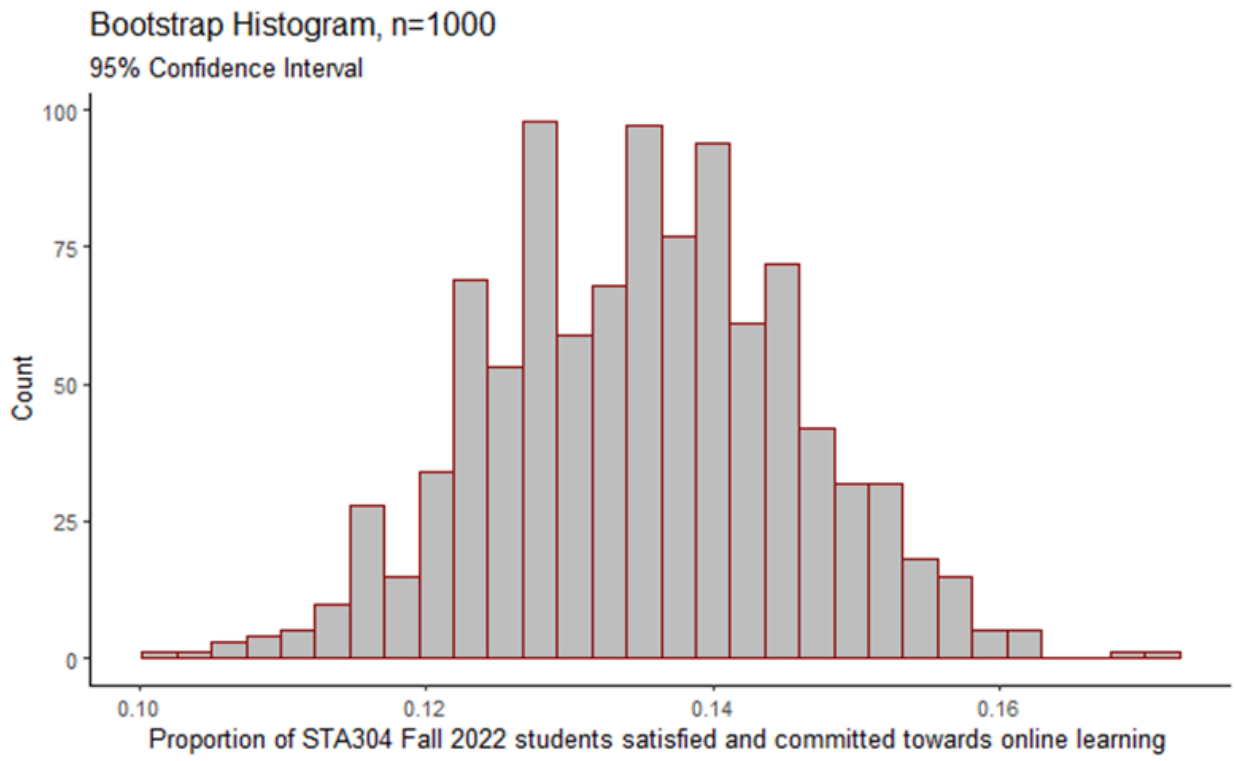
Hence, the proportion of STA304 Fall 2022 students who were satisfied and committed towards online learning during COVID-19 are all cases where participants said they were satisfied, and those same students said they would attend a live lecture given a recording, utilized extra resources, and felt less stressed online.

Again, we utilized the R programming language to find the estimated proportion as:

$$\hat{P}_{\text{st}} = 0.1349434 \approx 0.135$$

# Advanced Methodologies

Given the limited sample size, we conducted a bootstrap analysis. Bootstrapping is “a resampling method used to stimulate samples out of a data set using the replacement technique. The process of bootstrapping allows one to infer data about the population, derive standard errors, and ensure that data is tested efficiently.” (Rawat, 2021). With this technique, we are 95% confident that the true proportion of STA304 Fall 2022 students who were satisfied and committed towards online learning is between 11.5% and 15.6%.




# **Limitations and Conclusion

This study involved us sampling STA304 Fall 2022 students to determine the proportion of STA304 Fall 2022 students who were satisfied and committed to online learning during the COVID-19 pandemic. It would be beneficial for future studies to be conducted on a department wide basis. As we had computed our sample before stratifying, we were limited to 54 students in our analysis. Future studies should conduct a stratified random sample before delivering our survey to participants. The study had us find the proportion of students who were both satisfied and committed to online learning, but the study did not establish a causal relationship between either factor. Future studies should investigate the relationship between satisfaction and commitment to online learning.

The study found that 43% of STA302 Fall 2022 students were satisfied with online learning during the COVID-19 pandemic, and that 13.5% were satisfied and committed towards online learning.

To support this conclusion, we conducted several hypothesis tests**.

**For the test “There is no significant effect of gender on commitment towards online learning.”, we failed to reject the null hypothesis and concluded that there is no significant effect of gender on commitment towards online learning. For the test “Difficulties that students experienced during online learning resulted in lesser satisfaction with online learning”, we rejected the null hypothesis and concluded that difficulties students faced resulted in lesser satisfaction with online learning.

Given the low proportion of STA304 students who were satisfied and committed, we can conclude that an ideal online learning experience should take into consideration the environment of STA304 Fall 2022 students outside of the classroom, where there are more distractions and sources of stress, as well as considered ways to stimulate and improve digital communication between students and course staff.

# Appendix

STA304H5 Fall 2022 students' satisfaction and commitment towards Online learning during COVID-19.

1. Rate your satisfaction with online learning on a scale of 1-5 below
2. Did you prefer a pre-recorded lecture or attending a live lecture?
3. Would you still attend live virtual lectures if the lecture was recorded?
4. Did you experience technical difficulties during a lecture or accessing recordings?
5. How was your concentration during online lectures or while watching recordings?
6. Did you feel more or less stressed during online learning?
7. Did you use extra resources for assistance? i.e. office hours, piazza, emails?
8. During online learning, have online tests and exams accurately shown your knowledge of course concepts?
9. Which Lecture section are you enrolled in?
10. What is your gender?