

Student Engagement in Online Classes During COVID-19: A Sentiment Analysis

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ABSTRACT

Especially during the COVID-19 outbreak, online classes helped with flexible and remote learning. However, the effectiveness and participation of students in online classes has yet to be determined. The purpose of this study is to see how students interact with online classrooms and how much they help them learn, focusing on the students' engagement in online classes. This study highlights the present condition of students' involvement in online classrooms during the COVID-19 pandemic by using Azure Machine Learning for sentiment analysis from qualitative replies. Sentiment analysis is a sort of text mining that identifies and extracts subjective data from source material, allowing users to better understand social sentiment while monitoring online conversations. This method gives a clearer picture of the student's quantitative data and demonstrates a better knowledge of their feelings. The significant findings of this study are: (a) Students' academic effectiveness is not improving. (b) There is a need to restructure the academia according to online circumstances to maintain the students' engagement. (c) Co-curricular activities have been ignored.

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1. Introduction

Understanding the nature of students' engagement in an online lecture is critical since it impacts the students' future achievements (Nkomo, Daniel & Butson, 2021). Literature on online student engagement reveals that technology is a significant mediator in promoting student engagement in online learning (Nkomo & Daniel, 2021a). Lundberg et al. (2017) also found a link between students' engagement with technologies like lecture recording and improved learning results. Students' access to lecture recordings aids their learning (St. Clair & Jensen, 2020) and helps to balance competing demands (Nkomo & Daniel, 2021b).

A sudden online shift due to the covid 19 pandemic to all academic activities is a big stressor, and quantitative data alone will not be enough to explain why students aren't engaged in class (Jon-ChaoHong et al., 2021). As a result, sentiment analysis is applied in this case to measure the sentiment of students regarding online class in form of qualitative data. It can provide us a useful sentiment score for the qualitative data set, which we can utilize to come to a more appropriate conclusion. Sentiment analysis automates the extraction or categorization of sentiment from sentiment reviews using natural language processing (NLP), text analysis, and computational approaches. The basic purpose of sentiment analysis is to assess the scores of sentiments and analyze the reviews (Hussein, 2018).

Despite the growing usage of online lectures among students, experts have expressed conflicting sentiments about their widespread use (Edwards & Clinton, 2019). Many lecturers question the efficacy of online classes in facilitating learning, claiming that using online classes lowers live lecture interaction and inhibits academics from employing stories and comedy in their teaching (Joseph-Richard et al., 2018). This can affect the engagement of students both directly and indirectly, and extensive use of this can affect the students long term understanding.

However, much engagement research on the student experience focuses on whole groups of students with certain qualities or within specific institutional settings. (Kuh, 2009). This focus on specific groups of students can also be seen in studies that attempt to explain patterns of participation among ethnic minorities and low-income students (Harper, 2009). Nonetheless, the technology adoption theory suggests that student engagement research focuses on whole groups of students with certain characteristics or within specific institutional environments. However, it is evident that these viewpoints only provide a partial explanation for student participation, as "the variance within any group of students is usually always greater than the variance across the groups," as claimed by (Kuh, 2009). It is critical to investigate how individual students determine their engagement to get a more comprehensive picture of student engagement.

2. Literature Review

The phrase "student engagement" has its origins in a corpus of work concerned with student involvement. It is now widely used, particularly in North America and Australasia, where yearly large-scale national surveys have firmly established it.

The most prolific authors in particular, (*What the U.S. (and Rest of the World) Should Know About Higher Education in China: Change: The Magazine of Higher Learning: Vol 51, No 3*, n.d.) have affiliations to the organizations that devised, executed, and supported these nationwide student engagement surveys, which are housed in universities or commercial businesses. (Trowler, n.d.). The creation of a literature highly impacted by cause-effect framing and a focus on effectiveness has been shaped by this context. However, in recent years, a critical literature has evolved that questions some of the student engagement movement's assumptions on the basis of students' rights and freedoms as learners. (Macfarlane & Tomlinson, 2017)

A variety of factors can influence students' engagement with online classes. There are four interwoven parts of student engagement that must be examined (Christenson et al., 2012). Those are behavioral, cognitive, emotional, and agentic. Behavioral engagement refers to how active students are in learning activities in terms of attention, involvement, effort, intensity, or perseverance. Cognitive engagement refers to how much mental effort students put into completing learning activities while using complicated rather than superficial learning strategies. Emotional engagement refers to students' feelings towards professors, peers, learning activities, and the school experience, as well as their sense of belonging. Agentic engagement is defined as the act of taking actions that support learning and teaching. (Christenson et al., 2012; Reeve, 2013). For example, Visser et al. (2014) found that students are more likely to attend lectures in courses offered in a short period of time, courses that are primarily lecture-driven, and feature contents of which are not available in other media. Edwards and Clinton (2019) investigated students' interaction in online classes and their effects on learning outcomes in a recent study. Despite the decades spent creating software visualization (SV), there are still concerns about its efficacy. Furthermore, because it is linked to a variety of beneficial academic outcomes, student engagement is vital in enhancing SV effectiveness. The existing SV has been proved to be ineffective in engaging students. (Al-Sakkaf, Omar & Ahmad, 2019).

When lecture recordings were made public, they discovered that attendance on online lectures had plummeted dramatically. They did find that students engage with online lectures differently. Ebbert and Dutke (2020) backed this up by stating that students who employ deep learning use lecture recordings as supplemental learning tools and are highly engaged in their studies. However, the curriculum developed with online lectures in mind can have a greater engagement rate than conventional methods that are just online. This provides an excellent outline of how the low engagement score and somewhat negative sentiment can be mitigated. However, teachers can help students be more motivated in online/distance learning by supporting student autonomy, ensuring learning, and being involved interpersonally. Supporting student autonomy entails promoting and assisting the pursuit of personal goals, as well as encouraging student endorsement of learning activities (Assor, Kaplan & Roth, 2002). Autonomy-supportive teachers examine student viewpoints in online learning, allow for learning options, provide an

explanation when choices are limited, minimize dominating language, and decrease unneeded stress and demands on students.

A more complete picture would necessitate a thorough examination of the above-mentioned areas that are potentially related to student engagement (including, but not limited to, student feedback, student representation, student approaches to learning, institutional organization, learning spaces, architectural design, and learning development). This, on the other hand, was outside the scope of this project and would be a huge undertaking. As a result, our evaluation focuses on publications that are based on the authors' student participation rather than any publication that substantively tackles issues that fall within our description.

3. Methodology

This study is based on primary data. A survey research approach guided the investigation, including an online structured questionnaire with closed and open-ended questions. The quantitative data was utilized to explain the qualitative measures and provide context for the interpretation of the results ($n = 263$). Following ethical approval, academic staff responsible for different courses were asked to email students to participate in an online survey on the importance of online classes. A total of 263 students spontaneously took part in the survey.

The azure machine learning (AML) has been used as excel add-ins to analyze the qualitative data provided by the respondents. With sentiment analysis, we can acquire a better grasp of respondents' opinions using AML and grasp prevalent subjects and trends, identify important terms and things such as persons, places, and organizations, and use domain-specific, pre-trained models to classify medical terms, examine text in a variety of languages. This study uses AML because it collects vast and reliable data compared to any other similar lexicons. AML presents its results into percentage scores. The cumulative scores calculated from each response indicate the sentiment of the given dataset. The description of the AML percentile method is shown below. The sentiment analysis tool assigns sentiment labels (such as "negative," "neutral," and "positive") to sentences and documents based on the service's highest confidence score. This function also offers confidence values ranging from 0 to 1 for positive, neutral, and negative emotion for each document and sentence inside it.

- A score between 0% and 49% is treated as unfavorable, while 0% being the most negative sentiment and 49% being the least.
- A score of 50% represents a neutral sentiment.
- A score between 51% and 100% represents positive while 51% being the least favorable and 100% being the most positive.

Measures

For the purpose of collecting data for the research, a questionnaire was created based on previous literature. Again, for purpose of collecting responses, the questionnaire was delivered to students by e-mail and through their course

professors. This survey included students from a variety of disciplines and academic levels, and their demographic data is displayed subsequently. We collected data from many different institutions and academic disciplines to get a proper understanding about the topic.

Demographic information was gathered from students and their opinions on the value of online classes in their learning. The questionnaire included questions that are graded on a 5-point Likert scale.

Because the questionnaire was sent to students from various academic disciplines and levels across various academic institutions, the experiences of those who replied varied, as did their personal views about online classes; thus, the data analysis is mainly focused on self-reported experiences.

Table 1: Demographic statistics of respondents (Age, gender, academic stage, discipline, and level)

Gender	Frequency (%)	Academic Discipline	Frequency (%)
Male	202 (76.8%)	Science	105 (39.93%)
Female	61 (23.2%)	Business	124 (47.15%)
Age group		Humanities	27 (10.27%)
17-18	19 (7.2%)	Social Science	3 (1.14%)
19-20	49 (18.6%)	Bachelor of Fine Arts	2 (0.8%)
21-22	110 (41.9%)	Engineering	1 (0.38%)
23-24	76 (28.9%)	LLB	1 (0.38%)
25+	9 (3.4%)	Academic Level	Frequency (%)
Academic Stage	Frequency (%)	Under graduation (BBA, BSc or equivalent)	205(77.9%)
Under-Graduation		Post-Graduation (MBA, MSC or equivalent)	54(20.5%)
1 st year	46	PhD	4(1.5%)
2 nd year	106		
3 rd year	80		
4 th year	25		
Post-Graduation			
MBA	3		
MSS	1		
PhD	2		

4. Results and Analysis

The demographic differences among the respondents in terms of gender, age group, academic disciplines and level demonstrate a wide variety in response (Table 1) and, thus, advocates for a robust outcome. The majority of the respondents opined that online lecturing could be a supplementary tool for education during this

intermediate period of COVID-19 but not the replacement. They stated different scenarios explaining the limitations of online lectures at this stage. One respondent reported, “Online classes don't offer the same immediate and regular access to instructors and classmates as traditional face-to-face classes.” Despite the above direct oppositions by the respondents, this study found mixed sentiments from the respondents, which are explained in the later sections.

Q1. Do you think that online classes have made you less likely to attend the class? And to what extent?

Online classes have dramatically overtaken conventional physical classes as the COVID-19 pandemic has forced people to stay apart and practice social distances. This has a long-tail impact on daily activities for people of all walks. Students have been facing difficulties due to this change. Sudden change in the way of participating in classes has both positive and negative impacts. Carefully analyzing curated feedback of the 140 participants, the overall impact of this online class situation paints a negative picture. Table 2 presents the summary of the responses.

Table 2: Sentiment analysis summary for Q1

Sentiment	Count of Response	Average of Score
negative	72	22%
neutral	21	53%
positive	47	67%
Grand Total	140	42%

The sudden shift from physical to online classes with the same curriculum presented the students with various hiccups. The online classes come with a couple of flexibilities that enable students to gain knowledge from the comfort of their choosing. According to one of our respondents pursuing his undergrad in business background stated:

The environment of peer-group, obligation to the teacher's presence and mystery of the new 'going to be discussed' topic, teacher's certain body language and tone for certain description, the thrive to end the class soon and go out for an air-this essential classroom environment is more or less absent during online classes in addition to internet and device issues disrupting the smooth flow of conversation and understanding. Staying at home makes it even harder.

Figure 1 shows the quantitative representation of the respondents on a 5-point Likert Scale. From the Likert scale presentation, it is evident that very few respondents believe that online classes have made respondents less likely to attend

class. However, most of the respondents believe that online classes have made them less likely to attend classes either to some extent or a great extent. It must be mentioned here that many respondents believe that there is no effect on their presence whether the class is being held physically or digitally. It indicates a considerable group of respondents have a studentship nature in their psychology and will attend classes in any circumstances.

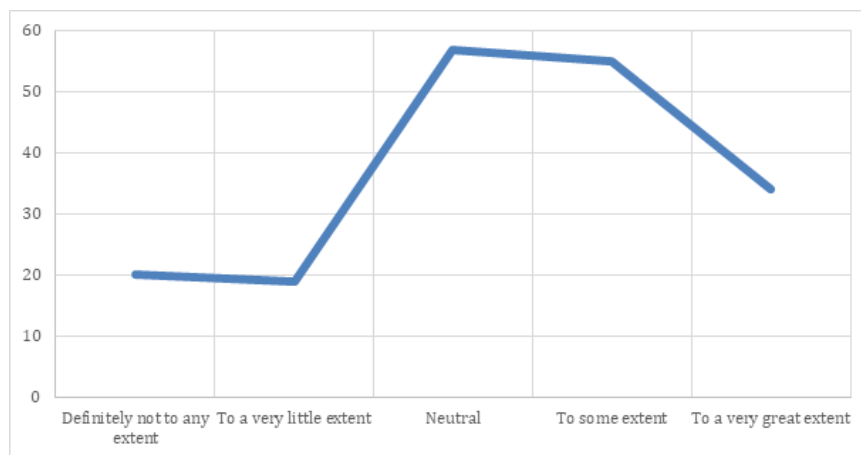


Figure 1: Respondents' feedback in 5-point Likert Scale on Q1

Q2. Do you think the use of online lectures has improved your engagement with the content of the course?

Colleges and universities are spending much time and effort to provide their students with the best educational experiences. It is believed that more learner-centered and collaborative activities will surely enhance a student's learning experience. Though a positive learning experience could be defined by several factors, student engagement and expected outcome are two of the most dictating constituents to a student's positive learning experience (Floyd et al., n.d.). A careful analysis of 157 feedbacks from the respondents indicates overall negative feedback from the students. The lack of engagement with the course content is summarized in figure 2.

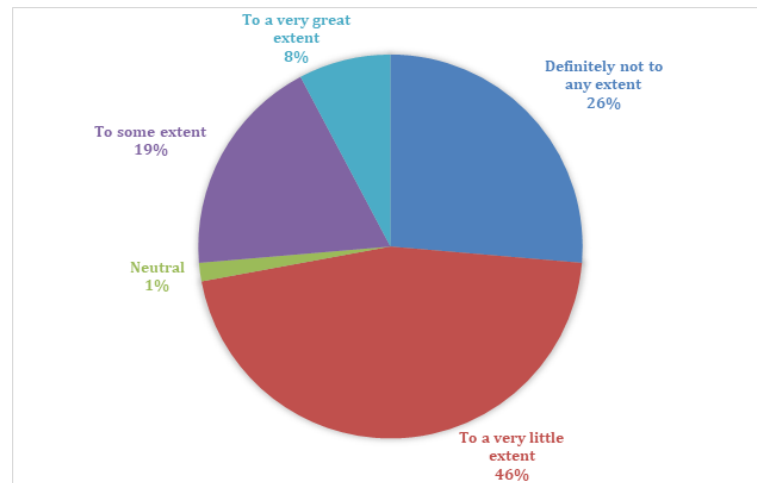


Figure 2: Respondents' feedback in 5-point Likert Scale from Q2

Figure 2 describes the engagement level of the content of the course (whether the course content structure is engaging or not). It is found that 46% of the respondents stated that their engagement with the course content has been improved to a very little extent. In addition, 26% of the respondents showed that online classes did not improve their course engagement. On the contrary, only 19% of the respondents reported that their engagement increased to some extent, and 8% of the respondents think that online classes increased their engagement with the course content to a very great extent. Overall, it is evident that most of the respondents feel that online classes lag behind expectations in terms of student engagement. Besides the negative feelings, there are evidences of mixed feelings too. As one undergrad student of business discipline stated:

I can't focus much on the class too much. While the answer tends to be a negative one, the response also stretches out to the positive end with the aid of class recording and also browsing up many resources on the topic for somewhat in-depth knowledge.

A total of 132 respondents have given their written statements for this question. The sentiment analysis has a contrary result that advocates for respondents' neutral feedback (Table 3). The average sentiment score for this question is found neutral with 49%. Nevertheless, student engagement is found either negative or neutral indicating a gap in student engagement in online classes during COVID-19.

Table 3: Sentiment analysis summary for Q2

Sentiment	Count of Response	Average of Score
negative	53	23%
neutral	18	53%
positive	61	70%
Grand Total	132	49%

Q3. Do you think the use of online lectures has improved your engagement with the lecturer?

It is widely believed that a better learning experience comes from an engaging and collaborative classroom. Although online lectures have been on the rise for quite a while now, due to this COVID-19 pandemic, the growth of online courses continues to rise dramatically. Alongside the increasing online classes, a need for a better engaging class scenario has been growing at the same pace. Several studies have found that students in online classes often outperformed those of in-person classrooms (Dixson, 2012).

Curating the answers of 187 respondents, it is found that the majority of the answers are leaning towards the negative part of the 5-point Likert scale that has been used to analyze the results. 45% of the total 187 respondents think that it has not helped increase engagement with the lecturer. 27.28% of respondents think that it has minimal impact on their engagement. 29.95% of respondents are unsure about the fact. Only 34% of respondents are leaning towards the positive side of the given scale.

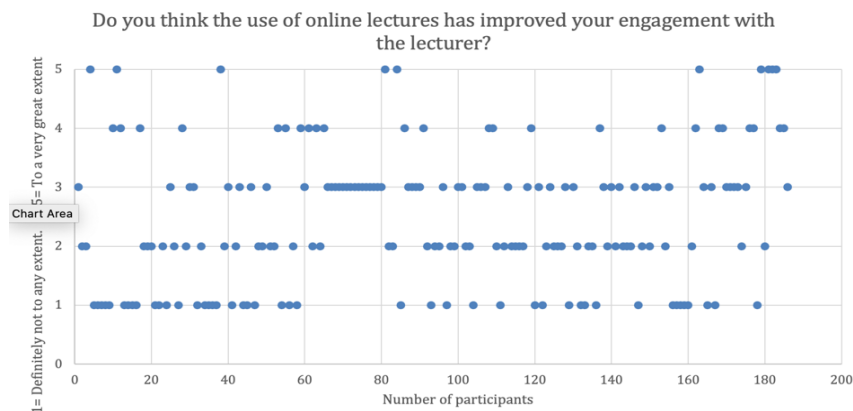


Figure 3: Respondents feedback on a 5-point Likert scale from Q3

Analyzing the sentiment of 128 statements, the total sentiment score is 52%. This number depicts that the genuine sentiment is neutral. There are 66 positive

statements, and their average sentiment score is 69%. As one of the undergrad students of business discipline responded, “Yes, I can raise any questions turning my video off which is tough for introverts to do in the classroom in front of classmates.” 42 of the responses are negative with an average score of 25%. According to a 23 years old undergrad student in science discipline, “Technological issues and psychological profoundly unexplored barriers cause a much lesser performance in the interaction between teachers and students.” This advocates that the negative sentiments are more robust than positive ones. There are 20 neutral words found where the average sentiment score is 53%. Overall, the results are somewhat neutral, but interestingly this differs from the respondent's response on the prior 5-point Likert Scale.

Table 4: Sentiment analysis of the answers of Q3

Row Labels	Count of Response	Average of Score
negative	42	25%
neutral	20	53%
positive	66	69%
Grand Total	128	52%

Q4. Do you think the use of online lectures has improved your engagement with peers?

Online classes are different from conventional physical classes at their core. Distant learning is the opposite of being on the campus and having an independent learning and practice environment. The data that has been collected in the form of the Likert scale has shown that the majority of the students have mentioned that their engagement with peers has declined significantly. Amongst 172 respondents of these specific questions, 46 (26.14%) students think that their engagement with peers has not improved to any extent at all. 53 (30.82%) participants think that it has improved to a very little extent. 44 (25.59%) students are neutral about that fact, and 17 (9.89%) respondents think that their engagement with peers has improved to some degree. 12 (6.98%) think that the online class scenario has improved their engagement with peers to a very great extent.

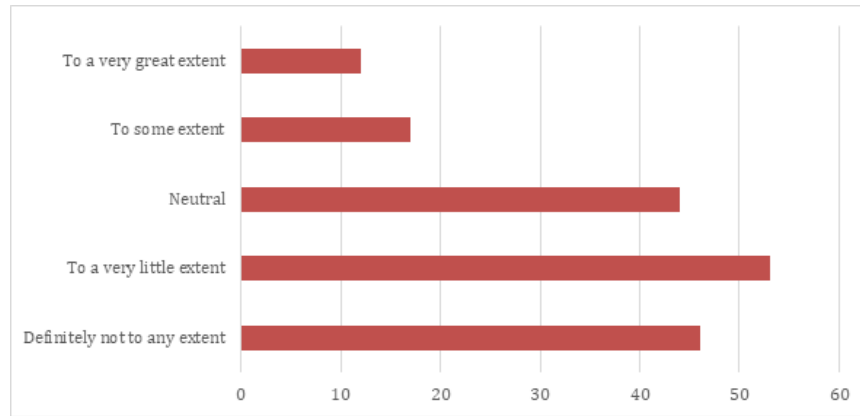


Figure 4: Respondents' feedback in 5-point Likert Scale from Q4

The sentiments of the respondents (126) show that their sentiments are somewhat neutral. According to some undergrad students (22 years old, business and science discipline respectively):

The use of online lectures has improved my engagement with the relevant peers regarding the betterment of the classes.

It helps sometimes. When it is interesting then we listen it very curiously but when it is boring then we don't listen so far.

Total 43 (34.13%) responses that are received demonstrate negative sentiment with an average score of 29%. The average score of neutral statements is 52%. 24(19%) of the responses are neutral. 59(46.8%) responses are positive sentiments. Considering all these, 49.667% is the overall sentiment score, which is a neutral number.

Table 5: Sentiment analysis summary for Q4

Sentiment	Count of Response	Average of Score
negative	43	29%
neutral	24	52%
positive	59	68%
Grand Total	126	49.66%

Q5. To what extent has access to online lectures improved your learning?

Among 152 respondents, 30 (19.7%) think that online classes have not improved their overall learning experience to any extent. This may be the effect of a sudden shift from conventional to online classes without much time to update and accommodate the curriculum for online learning. 45 (29.6%) respondents think that this has not improved their learning experience, even to a very small extent. 49 (32.24%) responses were neutral. 25 (16.45%) participants think that online classes have somewhat improved their learning experience. 3 (1.98%) respondents think that the shift from physical to online classes has improved their learning experience greatly.

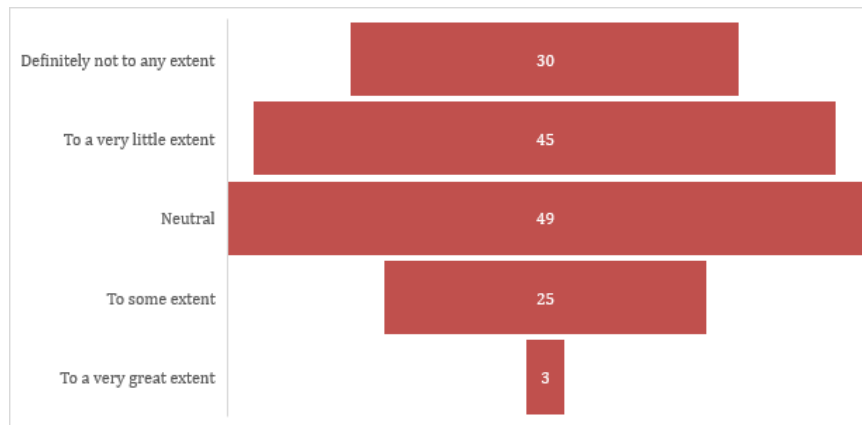


Figure 5: Respondents' feedback in 5-point Likert Scale from Q5

Analyzing the sentiment of the responses, this is observed that the sentiment of the overall learning experience with online classes has a great score of 43%. This sentiment score of 43% depicts that the respondents have a negative sentiment towards online lectures in Bangladesh. 126 respondents briefly described the reasoning behind their answer to the Likert Scale. 63 (50%) responses had negative sentiment in them with an average score of 23%. 22 (17.46%) of the responses were neutral, having an average sentiment score of 53%. 41 (32.54%) responses have positive sentiment in their description. The sentiment score for these positive statements is 68%.

Table 6: Sentiment analysis summary for Q5

Row Labels	Count of Response	Average of Score
negative	63	23%
neutral	22	53%
positive	41	68%
Grand Total	126	43%

Q6. Do you think online classes have affected your co-curricular activities?

Being physically absent from the campus has affected the co-curricular activities of many students. The chart below shows that 136 (52%) respondents opine that this sudden transition has affected their co-curricular activities. 92 (35%) respondents think that they are unaffected by this. This may be because their co-curricular activities (such as graphic designing and so on) do not require them to be on the campus. 35 (13%) of the respondents are unsure about the answer.

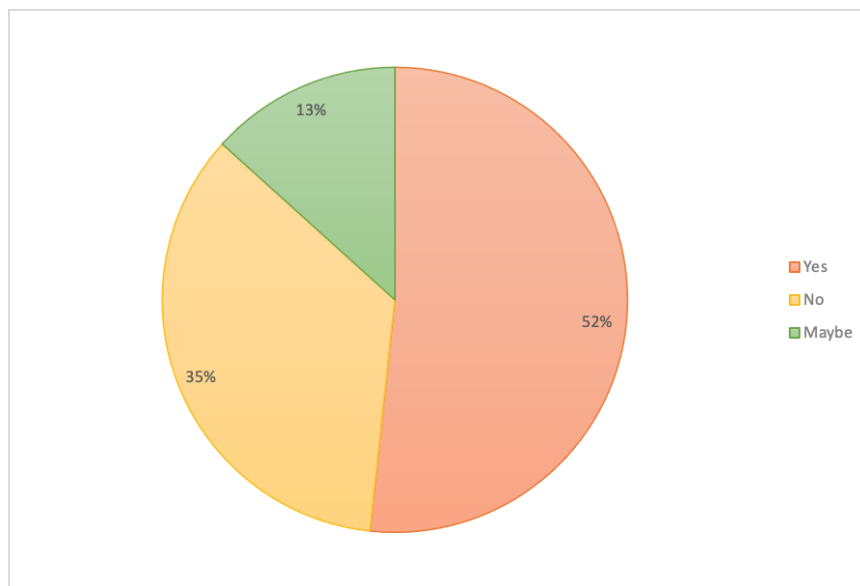


Figure 6: Respondents' feedback in 5-point Likert Scale from Q6

Q7. In which situation do you attend your online classes?

The figure below shows different states in which the students participate in online classes. There has been an exciting variation in the participants' answers. Almost 52% of the participants attend their classes with multiple distractions that are very concerning. The students with more significant numbers of online courses also reported less exposure to effective teaching practices and lower quality of interactions.

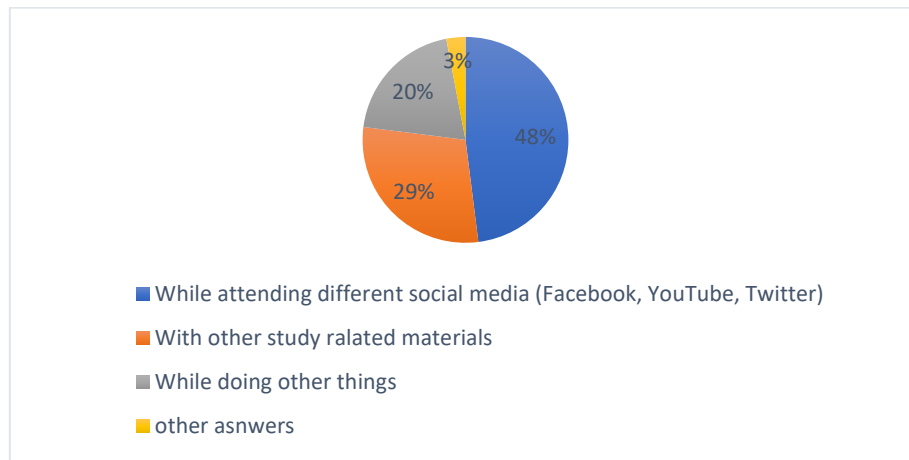


Figure 7: Respondents' feedback in 5-point Likert Scale from Q7

Analyzing the results, it is observed that 48% of the participants join their classes in conjunction with study-related materials. Though this number is good, this can be a lot better. The figure shows that 78 (29%) of the respondents participate in class while doing other things. In contrast, 52 (20%) of them join classes while attending different social media. 3% of the respondents stated other different scenarios.

"It depends on the situation. If I find the class interesting and motivating, I will concentrate fully."

"I attend while I am sleeping."

"It basically depends on the class lecture. I used to participate in the interesting one and ignore the boring one."

"I find myself watching recordings of previous classes because the recordings can be paused, and I seem to need breaks far more frequently due to the nature of the lectures as mentioned above."

5. Conclusion, Policy Implications and Future Research

The main goal of the current study was to investigate students' engagement in online classes. The results of this investigation show that students' academic performance failed to meet expectations. Considering students' engagement, there is a need to restructure the academia in accordance with online learning situations. Moreover, co-curricular activities ignored in online education should be included in the academic curriculum.

Because of the feasibility of online course offerings, some schools and universities may be under pressure to develop online education curriculum. Some students believe traditional college degrees are less relevant to the technical skills sought by businesses, and some employers are beginning to accept alternative educational credentials. The Internet can be a useful tool for expanding educational opportunities and improving educational quality. It is, nevertheless, critical to track and enhance online education to guarantee that its promises of increased educational accessibility are realized for all students. Online classes have been heavily used during this COVID-19 pandemic to avoid academic delays and keep the students in the loop. Nevertheless, this sudden change without restructuring the curriculum in favor of the class delivery method affects students' engagement in various forms. An immediate and scientific approach to mitigate the engagement problem is very much needed to have a significant improvement over the current position.

This study is not out of limitations. This study did not collect data from the financially disadvantaged student groups for the sake of convenience. Respondents from the rural areas were not taken into account. As a result, the findings of this study may not be equally applicable to students from rural areas. Two limitations of questionnaires employed as self-reported measures are the inability to track response rates and the potential of missing data. As a result, specific questions had missing data or had fewer respondents. Nevertheless, sentiment analysis restricts the ability to pre-train any dataset and relies on a pre-trained classifier, so the findings do not reliably score the sentiments. In addition, most sentiment analysis algorithms ignore the meaning of the document. Shorter sentences are more reliable than large blocks of text for the classifier used in this analysis. However, AML outperforms other resources like the Stanford NLP Sentiment Analysis engine (Chatterjee & Perrizo, 2016). Furthermore, since the questionnaire was distributed to students from various academic divisions and levels across the university, the analysis did not capture the design of the videos or their length, which may have differed.

The findings of this study advocate for several policy implications at a national level. There is a need for policy formulation regarding online teaching highlighting the need for student engagement to make the classes more effective. This can benefit the students in the long run.

The results from this study shed light on the acute need for several future research. There is a clear need for rigorous study on technology adoption among the students for online classes. Our sentiment analysis illustrates how qualitative data can be triangulated to confirm or contest research findings with different data types available to researchers. It would also be crucial to look into the reactions of undergraduate students and postgraduate students to online classes. We assumed that various students look at online classes in different ways. Understanding how individuals and groups use these tools will help educators tailor learning support to their specific needs.

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Appendix I

Questionnaire

- 1a. Do you think that online classes have made you less likely to attend the class? And to what extent?
- 1b. Briefly state the reasons in favor of your answer.
- 2a. Do you think the use of online lectures has improved your engagement with the content of the course?
- 2b. Briefly state the reasons for your choice in the question above.
- 3a. Do you think the use of online lectures has improved your engagement with the lecturer?
- 3b. Briefly state the reasons in favor of your answer.
- 4a. Do you think the use of online lectures has improved your engagement with peers?
- 4b. Briefly state the reasons for your answer in the question above.
5. Overall, to what extent has access to online lectures improved your learning?
- 6a. Do you think online classes have affected your co-curricular activities?
- 6b. Briefly discuss the reasons why and how your co-curricular activities have/haven't been affected.
7. In which state do you attend your online classes?