Improved Engagement and Learning in a Blended Learning Environment (Virtual and Face-to-face) during COVID-19 Pandemic for a STEM Related Subject, Discrete Mathematics

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Abstract

It is widely accepted that blended learning can be defined as the form of educational delivery which includes both the face-to-face and online learning environment. Ultimately, the engagement levels of a student within a face-to face learning environment can be controlled to maximize their learning. Learning engagement is not only the interaction between a student and an educator but it is also the peer collaboration as well as students' involvement in active learning. The COVID-19 pandemic had resulted in majority of educational institutions internationally to transition to a blended learning environment to abide to social distancing rules. Despite the situation, our knowledge on whether higher educational institutions have successfully dealt with teaching in a blended learning environment is lacking. This gap in knowledge needs to be addressed so that educational institutions can recognise the necessary procedures needed to protect the education of students in a blended learning environment. This paper attempts to evaluate the learning and engagement levels of Discrete Mathematics students who experienced a blended learning environment during COVID-19 pandemic. Two independent approaches are employed: a questionnaire to gather both qualitative and quantitative information from the students that underwent the blended learning environment during the pandemic, and an analysis of exam results of this module for the Academic Years 2019/2020 and 2020/2021. This study revealed that there were no significant signs of improvement in learning for this STEM subject module whilst students endured a blended learning approach and yet, engagement levels did not show any growth whilst this learning technique was adapted.

Keywords: Blended teaching; Mathematics; Engagement; Learning.

1. Introduction

The Coronavirus pandemic alerted a global emergency whereby the transition to distance learning forced educators to make rapid decisions with respect to the delivery of teaching and learning for their students [Lepp et al., 2021]. This pandemic strained and added more burden to educators of all levels of the sector as they had to consider making students' and their own workload affordable, for the sake of well-being [Lepp et al., 2021]. It provided various challenges for the higher educational institutions, as they had to find a method to maximise 25 and protect the learning practice of students. This also meant considering methods beyond fixed pedagogical frameworks in order to adapt to students' needs and requirements [Peimani and Kamalipour, 2021]. Educators making sure that students' learning was of high standard was difficult, as it was not guaranteed that all students equally benefited from the distance learning environment, due to some having limited access to adequate technical devices and software. Moreover, in a face-to-face learning environment, there is less educational inequality as it provides more opportunities for those with limited access to the Internet and technical conditions [Peimani and Kamalipour, 2021].

The pandemic allowed educational institutions to transition to blended learning environments in order to abide to social distancing rules, with the hope of eventually returning to traditional face-to-face teaching. Educators seeing their students less frequently within the blended learning environment, as well as distance learning, made it difficult for them to maintain student engagement. Students' engagement is viewed as a multi-faceted construct, whereby external influences outside the educators' control can affect the education of a student in those learning environments [Bond et al., 2020]. Procedures of the External Quality Assurance and the Internal Quality Insurance had to be rethought, as to whether their procedures were deemed effective in navigating through the pandemic [Gamage et al., 2020].

Research has proven that the method of Blended Project-Based Learning has enhanced students' learning and encouraged academic achievements [Alamri, 2021]. Research has also identified that governments need to take greater responsibility in protecting the education of students located in rural-based universities - this is due to their lack of access to remote learning [Makgahlela et al., 2021]. Educational stakeholders should ensure that despite students' socioeconomic situation, the right to education of students at rural based universities should be protected [Makgahlela et al., 2021]. Similarly, effectively conceptualising 'disaster education' can provide knowledge for actions to be taken to reduce vulnerability to disasters. Although, there's little work available for this concept, this is a new concern that is being considered within the education sector which is necessary today [Kitagawa, 2021].

The main aim of this project is to evaluate the learning and engagement levels of students undertaking a STEM related subject, Discrete Mathematics, who experienced a blended learning teaching environment during COVID-19 pandemic.

2. Methodolgy

Considering the case of the pandemic, educational institutions have had to assess the effectiveness of the learning environment the students have been put in, as well as, how it affected their engagement levels [Peimani and Kamalipour, 2021, Toto and Limone, 2021, Calder et al., 2021, Poláková and Klímová, 2021]. Blended learning is defined as the combination of virtual and face-to-face learning methods [Heijstra and Rafnsdottir, 2010]. In 2012, it was recognised that both the face-to-face and online learning environments had advantages and disadvantages [Caner, 2012]. To maximise the benefits of both learning environments, some educational institutions merged both elements to create a blended learning environment. Due to the closure of educational institutions, by April 1st, 2020, a total of 1.598 billion students from 194 countries were affected by April 1st, 2020 [Lossec et al. 2020]. COVID-19 had a significant impact on students' academic, social, and emotional lives, as well as their habit changes. Since lectures were moved online, examinations also had to adjust as a result and hence this period was undoubtedly stressful for all involved [Aristovnik et al., 2020].

To assess whether there was improved engagement and learning in a blended learning environment for the Discrete Mathematics module during this period, students were presented with questionnaires to complete. The questionnaire consisted of scale style questions, yes and no style questions, multiple choice questions and other styles of questions. The questionnaire was given to the students of Discrete Mathematics of the academic year of 2020/2021 using the Google Forum tool [UMA, 2013]. A total of 41 responses were received from the questionnaires, whereby the results were primarily in the form of quantitative data. The findings of the questionnaires were presented in different data presentation methods, in order to identify trends and draw conclusions accordingly. In addition, the findings allowed reliable judgements to be made about the Discrete Mathematics students.

Data from exam results of the Discrete Mathematics module was collated for comparison purposes from two consecutive academic years: Analysis Group-Academic Year 2020/2021 (AY20/21) and the Control Group-Academic Year 2019/2020 (AY19/20). Specifically, the students of the AY2021 of Discrete Mathematics completed the exam online; and students of the AY19/20 of Discrete Mathematics completed the exam face-to-face. All exam result data were collated, and statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) software [Alchemer, 2018]. This form of methodology enabled comparisons to be made and portray trends or patterns to be drawn between the two different academic years.

Furthermore, in order to draw reliable and accurate conclusions, the Cohen's Index indicator [Cohen, 1988] was used to interpret the effect size and measure the standardized difference between two groups, consequently to conclude the effect size of the variables used [Becker, 2000].

3. Results and discussion

Figure 1 presents the summarised statistics for both the AY20/21 exam results and the AY19/20 exam results. Students for the Discrete Mathematics Module undertake exams at the end of the semester.

Statistics

Exam Results of February 2021

N	Valid	139
	Missing	0
Mean		63.26
Median		65.00
Mode		40[a]
Std. Deviation		19.198
Variance		368.556
Skewness		-.381
Std. Error of Skewness		.206
Range		90
Minimum		10
Maximum		100
Percentiles	25	50.00
	50	65.00
	75	77.00

(a) AY20/21 Statistical Data

Statistics

Exam Results of January 2020

N	Valid	108
	Missing	0
Mean		58.52
Median		61.00
Mode		40
Std. Deviation		24.494
Variance		599.934
Skewness		-.315
Std. Error of Skewness		.233
Range		92
Minimum		7
Maximum		99
Percentiles	25	40.00
	50	61.00
	75	79.50

(b) AY19/20 Statistical Data

FIGURE 1. Statistical summary of exam results of the AY20/21 and the AY19/20.

The mean score in Figure 1(a) is 63.26 which is slightly greater than the mean score of Figure 1(b), of the value 58.52, supporting the conclusion that students' performance in the AY20/21 improved academically, since their mean value was slightly larger compared to the year prior.

Using the Cohen's index and the relevant information from Figure 1 the effect size was calculated to be d = 0.215397, thus, the effect size is small, echoing the deduction that blended learning did not significantly improve students' achievements compared to sole face to face delivery. Additionally, a Hypothesis Test was conducted using the necessary information provided by Figure 1, to calculate the difference of means between the AY19/20 and the AY20/21. Using the values which represent the respective mean, standard deviation and population size of the AY19/20 and the AY20/21 allow for Z= -1.65 and upon comparison with the Z-score using a 95% confidence level, since 1.96 > -1.65, this results in an acceptance of the null hypothesis. This proves that the difference mean did not significantly differ between the two academic years, again, supporting that blended learning did not significantly improve students' achievements.

Performing the statistical measurement of Confidence Interval's to identify the interval of the difference of the two means between the AY19/20 and the AY20/21 it was calculated that at 99% confidence level this is (-12.6, 2.6) and at a 95% confidence level the true mean lies within this interval (-10.4, 0.9). The small interval implies the possible small change of exam results.

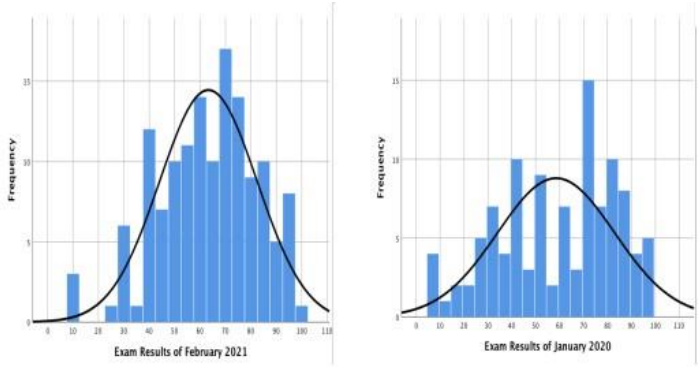

FIGURE 2. Histograms presenting exam results of the AY20/21 and the AY19/20

From general analysis of Figure 2, it is apparent that Figure 2(a) demonstrates a more varied type distribution whereas Figure 2(b) demonstrates a more random distribution. Using the information from Figure 1 alongside the histograms in Figure 2, it's evident that the median >mean > mode.

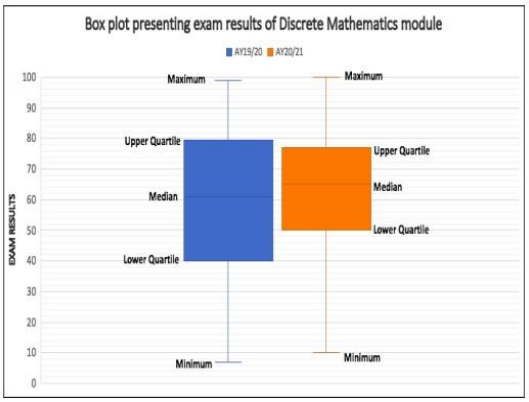

FIGURE 3. Vertical box plot illustrating exam results for the AY19/20 compared to the AY20/21.

The Interquartile range is significantly smaller for the AY20/21 compared to AY19/20 and the boxplot presented as Figure 3, for both these years, illustrates that there are no outliers present in the exam results.

Primary data was gathered via the method of questionnaires with results being predominantly in quantitative form. The questionnaires were appointed to all students of the Discrete Mathematics Module for the AY20/21, of which a total of 41 responses were received. The responses and tabulation for Question 16-25 are shown below as a paradigm of the findings:

16. Students engage in class matters or common interests outside the class setting

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	13	31.7	31.7	31.7
	2	18	43.9	43.9	75.6
	3	10	24.4	24.4	100.0
	Total	41	100.0	100.0	

17. Students work in collaboration during class

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	11	26.8	26.8	26.8
	2	14	34.1	34.1	61.0
	3	16	39.0	39.0	100.0
	Total	41	100.0	100.0	

18. Students are comfortable with their peers in class

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	7	17.1	17.1	17.1
	2	17	41.5	41.5	58.5
	3	17	41.5	41.5	100.0
	Total	41	100.0	100.0	

19. Students have moderate discussions in class

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	13	31.7	31.7	31.7
	2	16	39.0	39.0	70.7
	3	12	29.3	29.3	100.0
	Total	41	100.0	100.0	

20. Students prepare for exams together using online communication tools i.e. Whatsapp

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	13	31.7	31.7	31.7
	2	10	24.4	24.4	56.1
	3	18	43.9	43.9	100.0
	Total	41	100.0	100.0	

21. Lecturer allows time for questions and answers during the class

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	3	7.3	7.3	7.3
	2	12	29.3	29.3	36.6
	3	26	63.4	63.4	100.0
	Total	41	100.0	100.0	

22. Lecturer posts regular announcements or email reminders

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	8	19.5	19.5	19.5
	3	33	80.5	80.5	100.0
	Total	41	100.0	100.0	

23. Lecturer interacts with the students

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	13	31.7	31.7	31.7
	3	28	68.3	68.3	100.0
	Total	41	100.0	100.0	

24. Lecturer gives the students a chance to give feedback

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	3	7.3	7.3	7.3
	2	14	34.1	34.1	41.5
	3	24	58.5	58.5	100.0
	Total	41	100.0	100.0	

25. Lecturer refers to the students by name in discussion forums and/or during class

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	1	2.4	2.4	2.4
	2	8	19.5	19.5	22.0
	3	32	78.0	78.0	100.0
	Total	41	100.0	100.0	

FIGURE 4. Frequency table to illustrate responses for Q16-Q25.

(Other questions and their statistics can be seen in the *Appendix*). Two of the most significant difficulties endured by the students during the blended learning approach: "Personal concerns (emotional, sickness, financial)" and "Technical issues", show that these issues would have perhaps existed due to external influences and thus, could have impacted students' experience on blended learning.

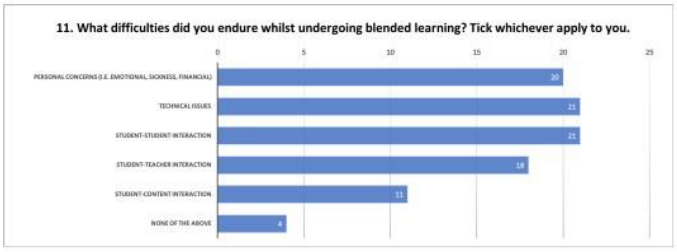

FIGURE 5. Horizontal bar graphs presenting responses for Q11.

Student-student interaction which occurs both within the classroom as well as outside the classroom setting also appeared as a heavy contributor to the challenges of blended learning.

4. Conclusion

The purpose of this paper was to determine whether there were signs of improved engagement and learning in a blended learning environment for the University level module, Discrete Mathematics. The results of this study revealed that the blended learning approach for the Discrete Mathematics students have improved within the learning environment as supported by the quantitative analysis nonetheless not substantially.

Additionally, in terms of the engagement factor, qualitative analysis from the findings of the questionnaire, showed that this did not improve within the blended learning environment during the pandemic. As a matter of fact, it can be as far said to have been reduced within the blended learning environment for these students.

12. Do you believe that the blended learning environment has enhanced your learning in Mathematics for Computing (Discrete Mathematics)?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	21	51.2	51.2	51.2
	Yes	20	48.8	48.8	100.0
	Total	41	100.0	100.0	

FIGURE 6. Frequency table to illustrate responses for Q12.

Moreover, there was a split of opinions for the students undertaking the questionnaire on whether they felt blended learning enhanced their learning (Figure 6). Outcomes from the questionnaire also enforced that external influences could have been a form of an obstacle in student learning compared to previous year, such as those impacts of COVID-19 or the differing types of households between the students. Several reports have shown that if all students were privileged with the same resources for their learning, then they would all benefit equally from the distance learning environment [Poláková and Klímová, 2021, Jasobson, 2020].

Empirical findings within this paper demonstrate that the students of the Discrete Mathematics module of the Analysis Group AY20/21 felt highly engaged when it came to student-to-content interaction, showing that they felt satisfied with the access to the resources provided for them in the blended learning environment. Nevertheless, this engagement isn't as significant when it comes to interacting with their peers or their own efforts with regards to engaging with their lecturer. The most striking concern to emerge from this study is the matter of mental health amongst the students. Considering that it was possible for external influences to affect the learning of students, 34% of the students reported that the blended learning environment did impact their mental health. Majority of those students voiced that the lack of social interaction impacted their mental health, with expressions such as 'levels of anxiety and depression increasing by not being able to go outside and meet students from university or taking part in activities' and "online learning made me feel lonely" prevailing as part of the student comments.

Taking into account the calculated small effect size from the Cohen's Index, this indicator furthermore perhaps validates the conclusion that it was not necessarily the blended learning environment that impacted the exam results of the Discrete Mathematics students in the AY20/21. The Hypothesis Test that was conducted in relation to the significance level of the difference of means between the AY19/20 and the AY20/21 showed that at a 95% Confidence Level, the null hypothesis can be rejected, supporting that the exam results of the Analysis group was not significantly greater than the Control group. This validates that although the exam result mean did improve slightly, it was not a significant change. It could potentially have been external influences such as the exams being completed online as opposed to face-toface, like it was completed in the AY19/20.

4.1 Limitations and future work

The generalisation of these results is subject to certain limitations. For instance, the concern of academic dishonesty of the AY20/21 students in Discrete Mathematics. The exams in the AY19/20 were completed in controlled exam conditions, whereas, in the AY20/21, the students completed the exams in a distance-learning environment which admittedly was a lesscontrolled environment. An additional uncontrolled factor is the possibility of external influences impacting the learning of the AY20/21 students of Discrete Mathematics. The differing households of the students affected their learning in the Discrete Mathematics module resulting in their learning experience being subjective amongst each other. Recent research has proven that the COVID-19 pandemic had further worsened learning inequalities and had disadvantaged learning for those who rely on assistance in their academics. Similarly, for the educators, teaching during the COVID-19 pandemic, meant that educators had to consider interacting more regularly than usual via email communication or learning platforms, because of the lack of face-to-face contact leaving them highly fatigued from interacting continuously [Chirinda et al., 2021].

This study has offered an understanding into how COVID-19 has affected students' education within a blended learning environment for the STEM module Discrete Mathematics. Concurrently, it has also identified where there is further work needed in understanding the impact a blended learning environment can have on the learning and engagement of a student.

Further research should be undertaken to investigate the mental health of students in a blended learning environment. Evidently, extraneous variables alongside the blended learning environment contributed to the improvement in exam results, as opposed to solely the blended learning environment. The findings of the Cohen's Index and the Hypothesis Test provided greater understanding of the exam results of the AY19/20 and the AY20/21. As this supports the idea that external influences contributed more significantly on the exam results of the AY20/21, rather than the blended learning environment itself. Despite the slight improvement of the exam results, questions remain. Such as, whether students would have received such results easier if it was in a face-to-face learning environment, without the disruption of their mental health that the distance learning environment brought. This raises concerns about student safety and well-being, and whether health guidelines should be added to the quality assurance (QA) process in pandemic situations [Gamage et al., 2020]. To develop a full picture of how the blended learning environment affected engagement and learning, additional studies will need to be conducted in relation to assessments in a blended learning environment.

The Discrete Mathematics students of the AY20/21 completed the exam in a distance learning environment, which meant that their exams were not in a controlled assessment environment like the AY19/20. In the future, higher educational institutions should take into consideration that there is a potential risk of academic dishonesty for assessments within a distance learning environment. Therefore, should consider an alternative assessment to avoid

the risk of plagiarism, in order to ensure students are being assessed fairly. Although, it's difficult to control unavoidable external influences that could impact the learning of students, educational institutions need to take greater care in implementing guidelines to minimise the effects of those influences.

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Competing interests

Author declares that no competing interests exist.

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APPENDIX

1. In Mathematics for Computing (Discrete Mathematics), do you prefer the virtual learning environment or the face-to-face learning environment?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Both	17	41.5	41.5	41.5
	Face-to-face Learning Environment	14	34.1	34.1	75.6
	Virtual Learning Environment	10	24.4	24.4	100.0
	Total	41	100.0	100.0	

2. Would you prefer the approach of blended learning for the remaining of your degree?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	For specific modules only	1	2.4	2.4	2.4
	No	20	48.8	48.8	51.2
	Yes	20	48.8	48.8	100.0
	Total	41	100.0	100.0	

4. Do you feel that the communication between you and the lecturer worsened in blended learning compared to pre-COVID?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	19	46.3	46.3	46.3
	Yes	22	53.7	53.7	100.0
	Total	41	100.0	100.0	

5. Do you feel that the communication between you and your peers worsened in blended learning compared to pre-COVID?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	13	31.7	31.7	31.7
	Yes	28	68.3	68.3	100.0
	Total	41	100.0	100.0	

6. Are you satisfied with the learning resources provided for you in a blended learning environment?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	12	29.3	29.3	29.3
	Yes	29	70.7	70.7	100.0
	Total	41	100.0	100.0	

7. Do you believe that the assessment method in Mathematics for Computing (Discrete Mathematics) is fair?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	9	22.0	22.0	22.0
	Yes	32	78.0	78.0	100.0
	Total	41	100.0	100.0	

8. Have personal circumstances due to the pandemic affected your learning in Mathematics for Computing (Discrete Mathematics)?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	20	48.8	48.8	48.8
	Yes	21	51.2	51.2	100.0
	Total	41	100.0	100.0	

10. Have you suffered from internet failure during distance learning?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	14	34.1	34.1	34.1
	Yes	27	65.9	65.9	100.0
	Total	41	100.0	100.0	

9. How engaging do you feel face-to-face learning is as opposed to virtual learning?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	6	14.6	14.6	14.6
	2	7	17.1	17.1	31.7
	3	14	34.1	34.1	65.9
	4	14	34.1	34.1	100.0
	Total	41	100.0	100.0	

12. Do you believe that the blended learning environment has enhanced your learning in Mathematics for Computing (Discrete Mathematics)?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	21	51.2	51.2	51.2
	Yes	20	48.8	48.8	100.0
	Total	41	100.0	100.0	

13. Do you partake in extra-curricular activities (whether online or on campus) around the university?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	30	73.2	73.2	73.2
	Yes	11	26.8	26.8	100.0
	Total	41	100.0	100.0	

15. Have your initial concerns about blended learning reduced or increased after going through blended learning?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Increased	10	24.4	24.4	24.4
	Reduced	13	31.7	31.7	56.1
	Stayed the same	18	43.9	43.9	100.0
	Total	41	100.0	100.0	

16. Students engage in class matters or common interests outside the class setting

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	13	31.7	31.7	31.7
	2	18	43.9	43.9	75.6
	3	10	24.4	24.4	100.0
	Total	41	100.0	100.0	

17. Students work in collaboration during class

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	11	26.8	26.8	26.8
	2	14	34.1	34.1	61.0
	3	16	39.0	39.0	100.0
	Total	41	100.0	100.0	

18. Students are comfortable with their peers in class

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	7	17.1	17.1	17.1
	2	17	41.5	41.5	58.5
	3	17	41.5	41.5	100.0
	Total	41	100.0	100.0	

19. Students have moderate discussions in class

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	13	31.7	31.7	31.7
	2	16	39.0	39.0	70.7
	3	12	29.3	29.3	100.0
	Total	41	100.0	100.0	

20. Students prepare for exams together using online communication tools i.e. Whatsapp

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	13	31.7	31.7	31.7
	2	10	24.4	24.4	56.1
	3	18	43.9	43.9	100.0
	Total	41	100.0	100.0	

21. Lecturer allows time for questions and answers during the class

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	3	7.3	7.3	7.3
	2	12	29.3	29.3	36.6
	3	26	63.4	63.4	100.0
	Total	41	100.0	100.0	

22. Lecturer posts regular announcements or email reminders

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	8	19.5	19.5	19.5
	3	33	80.5	80.5	100.0
	Total	41	100.0	100.0	

23. Lecturer interacts with the students

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	13	31.7	31.7	31.7
	3	28	68.3	68.3	100.0
	Total	41	100.0	100.0	

24. Lecturer gives the students a chance to give feedback

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	3	7.3	7.3	7.3
	2	14	34.1	34.1	41.5
	3	24	58.5	58.5	100.0
	Total	41	100.0	100.0	

25. Lecturer refers to the students by name in discussion forums and/or during class

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	1	2.4	2.4	2.4
	2	8	19.5	19.5	22.0
	3	32	78.0	78.0	100.0
	Total	41	100.0	100.0	

26. LECTURER ANSWERS QUERIES THROUGH CONTACT INFORMATION (I.E. EMAIL, TELEPHONE, FAX)

27. LECTURER SHOWS FACE DURING VIRTUAL LEARNING

28. LECTURER SHARES SCREEN DURING VIRTUAL LEARNING

29. Summaries are provided at the end of each virtual class

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	8	19.5	19.5	19.5
	2	18	43.9	43.9	63.4
	3	15	36.6	36.6	100.0
	Total	41	100.0	100.0	

30. The content is presented in several multimedia formats (i.e. Powerpoints, Recording, Documents, Blackboard)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	9	22.0	22.0	22.0
	3	32	78.0	78.0	100.0
	Total	41	100.0	100.0	

31. Lecturer provides practice questions based on class content

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	1	2.4	2.4	2.4
	2	8	19.5	19.5	22.0
	3	32	78.0	78.0	100.0
	Total	41	100.0	100.0	