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EFFECTIVENESS OF ONLINE AND FACE-TO-FACE CLASSES: A SURVEY AMONG MALAYSIAN UNIVERSITY STUDENTS FOR ENGINEERING COURSES

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Abstract

Since the Movement Control Order was implemented in early 2020, lectures shifted from face-to-face to online classes. Various initiatives were made to improve the experience of online classes. The use of online tools such as Padlet and Kahoot helped in generating interactive sessions and communication between lecturers and students. Some students adapted well to online classes, and some found it less interesting and difficult to follow. Engineering courses require strong understanding of concepts and mathematical calculations. Since the transition to the endemic phases, universities have gradually begun shifting back from online to face-to-face classes. However, online classes has its own advantages, and may be still be conducted in certain cases. Therefore, the aim of this research is to understand students' perception and comparison on the effectiveness of online and face-to-face classes for engineering courses. A survey was conducted among engineering courses from five universities in Malaysia. A total

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of 255 engineering students participated in the survey. To analyse the data, the methodology used in this paper consists of correlation analysis, the mean correlation coefficient (MCC), multiple regression model and ANOVA. The results show that there are five key factor contributes to the effectiveness and quality in engineering education. In conclusion students satisfied with the effectiveness and quality in engineering education based on five perception questions. The key outcome of this study contributes to the future implementation of online and face-to-face classes for engineering courses in Malaysian universities.
Keywords: Online classes, face-to-face classes, survey

Abstrak

Sejak Perintah Kawalan Pergerakan (PKP) dilaksanakan pada awal tahun 2020, kuliah ditukar dari pelaksanaan secara bersemuka kepada kelas secara dalam talian. Pelbagai inisiatif telah dibuat untuk meningkatkan kualiti pengajaran secara dalam talian dan keberkesanannya. Penggunaan platform seperti Padlet dan Kahoot membantu dalam menjana sesi interaktif dan komunikasi antara pensyarah dan pelajar. Sesetengah pelajar Berjaya menyesuaikan diri dengan baik, dan ada yang mendapati ia kurang menarik dan sukar untuk diikuti. Kursus kejuruteraan memerlukan pemahaman yang kukuh tentang konsep dan pengiraan matematik. Sejak peralihan kepada fasa endemik, universiti secara beransur-ansur mula beralih semula daripada kelas secara dalam talian kepada kuliah secara bersemuka. Walau bagaimanapun, kuliah secara dalam talian mempunyai kelebihan tersendiri, dan masih boleh dijalankan dalam situasi tertentu. Oleh itu, tujuan penyelidikan ini adalah untuk memahami persepsi pelajar terhadap keberkesanan kuliah secara dalam talian dan secara bersemuka bagi kursus-kursus kejuruteraan. Satu soal selidik telah dijalankan dikalangan kursus kejuruteraan dari lima universiti di Malaysia. Seramai 255 pelajar kejuruteraan mengambil bahagian dalam kajian ini. Dalam menganalisis data, metodologi yang digunakan kajian ini terdiri daripada analisis korelasi, pekali korelasi min, model regresi berganda dan ANOVA. Hasil kajian menunjukkan terdapat lima faktor utama yang menyumbang kepada keberkesanan dan kualiti dalam pendidikan kejuruteraan. Kesimpulannya pelajar berpuas hati dengan keberkesanan & kualiti dalam pendidikan kejuruteraan berdasarkan lima soalan persepsi. Hasil kajian ini menyumbang kepada kunci pelaksanaan masa depan kelas dalam talian dan bersemuka untuk kursus kejuruteraan di universiti Malaysia.
Kata kunci: Kuliah secara dalam talian, kuliah secara bersemuka, soal selidik

1.0 INTRODUCTION

The arrival of the COVID-19 pandemic in 2020 caused a huge disruption in our daily lives. All

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around the world, strict measures were adopted to limit the spread of the Covid-19 virus, which has up to date killed over 6 million people (WHO, 2022). In Malaysia, a national lockdown known as the Movement Control Order (MCO) was introduced in early 2020, restricting movement and contact between people. This changed the daily lives of Malaysian citizens, impacting all sectors, from the industry (Esa, et al, 2020), tourism (Karim et al, 2020) , and education sector (Allam et al., 2020).

Almost all universities around the world faced closure, and teaching and learning activities in universities were forced to be conducted online (UNESCO 2020). Students and lecturers stayed at home and had to join lectures through online platforms such as Google Meet, Microsoft Teams and Webex (Birch & Wolf, 2020). Reacting to this new norm, each platform improved its systems to cater to the requirements of online meetings and classes. For example, in early 2020, Microsoft Teams was capable of displaying 4 participants' videos during video calls. This gradually increased to 9 and eventually 47. Universities and the government also helped by improving internet facilities. In Malaysia, for engineering courses, lecturers conducted online lectures during the movement control order (MCO) (Harun et al., 2022)

Some students adapted well to online classes, while others found it less interesting and difficult to follow (Bahasoan et al., 2020). It was found that more than half respondents indicated that, if given the choice, they do not want to continue with online learning in the future (Chung et. al., 2020). Based on students' perception of online class delivery methods, it was concluded that blended learning should be considered for success in online learning, and communication between lecturers and students also remains a fundamental factor for success (Choi et. al., 2021).

To improve the quality of education and ensure effectives of the courses, various initiatives were made to improve the experience of online classes (Yap et al., 2022). The use of online tools such as Padlet and Kahoot helped in generating interactive sessions and engaging communication between lecturers and students (Martín-Sómer et. al., 2021). Universities conducted training for lecturers to improve their online teaching skills and to imitate the experience of a face-to-face lecture as closely as possible, as well as cater the basic needs for a conducive online learning environment (Harun et al., 2021).

Different fields of studies present different challenges in a successful online learning

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process (Nik-Ahmad-Zuky, et al., 2020). Engineering courses, for example, require strong understanding of concepts and mathematical calculations, as well as a hands-on requirement for lab works and experiments (Winberg et al., 2020) Another big challenge in online learning is the online assessment methods that must be adopted during Movement Control Order, in particular regarding accountability, as it is more difficult to monitor the students during the examinations conducted online (Nguyen et al., 2020).

Since the beginning of the endemic phase in 2022, universities have introduced hybrid sessions combining both face-to-face and online classes. The transition back to face-to-face classes has had various acceptance and feedback, as some students quickly welcomed the return of face-to-face classes with its interactive communication (Mat et al., 2021), while some still preferred being at their rooms and following lectures online from their computer (Sari et al., 2021). Some have suggested the various success of online learning experience during the covid-19 pandemic shows that online learning will stay, in one form or another, especially with continuing improvement of technology (Al-Fodeh et al. 2021) For online teaching and learning to be considered as a viable replacement or a compliment to the traditional method, its effectiveness of online learning needs to be fully analysed (Munir et al.,2022), including aspects of quality of teaching, students' motivation and well-being (Mat et al., 2021), and lecturer-student interaction. Therefore, this present study aims to analyse and compare the effectiveness of online and face-to-face classes from the perspective of engineering students, specifically in Malaysian universities.

2.0 MATERIALS AND METHODS

A blind survey was conducted among engineering students from six Malaysian universities namely the Universiti Kebangsan Malaysia (UKM), Universiti Putra Malaysia (UPM), Universiti Malaysia Pahang (UMP), Universiti Malaysia Perlis (UNIMEP), International Islamic Universiti Malaysia (IIUM) and Universiti Kuala Lumpur - Malaysia France Institute (UniKL MFI). A sample random sampling was then used to choose a sample from each university mention.

2.1 Survey Establishment and Collection

The survey was conducted among engineering students with the sampling based on their study experience from foundation, Year 1-4 and to Master by coursework from the six universities. The circulation was done on voluntary act and does not bind to any assessment by the lecturers. The online survey was established on a google Form platform and distributed online in one single stage between 21st of August to 31st of August 2022.

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The survey consists of 3 parts to measure the different aspects of teaching and learning; Effectiveness & quality (6 questions), Student motivation (9 questions) and finally the Engagement & interaction (5 Questions). Each element is measured in Likert Scale from 1-5 to translate the tendencies with 5 being highly agree and 1 highly disagree. The sources of the questions are from Kwan et al. (2022).

The students were also asked a final question, whether they preferred online or physical classes to summarize their perspective. Additionally, the survey is complemented with respondents' background data; University, Course and year of study. The list of questions can be referred to in Table 1-4.

Table 1: *Survey Respondents Group by University, Years and Courses*

Questions	Answers
University	UKM, UPM, UIA, UMP, UNIMAP, UNIKL-MFI, others
Year	Foundation studies, Year 1-4, Masters (Coursework), others
Course	Engineering foundation studies, Mechanical, Electrical and electronics, Chemical, Civil engineering, others

Table 2: *Effectiveness & quality (understanding of topics)*

Code	Question	Response
Q1*	The quality of Face-to-face (F2F) lectures is better than Online lectures (OL)	1 – 2 – 3 – 4 – 5**
Q2	OL are taught as comprehensively and in detail as face-to-face (F2F) lectures	1 – 2 – 3 – 4 – 5
Q3	It is much easier to understand engineering concepts taught in OL compared to F2F lectures	1 – 2 – 3 – 4 – 5
Q4	F2F lecture contents are more organised compared to OL	1 – 2 – 3 – 4 – 5
Q5	I like OL lectures because when recorded, I can replay the lecture video to strengthen my understanding.	1 – 2 – 3 – 4 – 5
Q6	I find F2F lectures and OL equally effective in understanding engineering concepts.	1 – 2 – 3 – 4 – 5

*The code Q denotes 'Effectiveness and Quality'.
**refer to Likert scale where 1: Highly disagree, 2: Disagree, 3: neutral, 4: Agree, 5: Highly Agree.

Table 3: Student motivation (fun, enjoyment of lectures)

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Code	Question	Response
M1*	I tend to do other things and browse the internet during online lectures (OL).	1 – 2 – 3 – 4 – 5**
M2	I prefer Face-to-face (F2F) lectures compared to OL because it is more exciting and I feel more motivated to study.	1 – 2 – 3 – 4 – 5
M3	I find it easier to focus for a longer period of time in F2F lectures compared to OL.	1 – 2 – 3 – 4 – 5
M4	I find F2F lectures more fun compared to OL.	1 – 2 – 3 – 4 – 5
M5	Lecturers tell more jokes during F2F lectures compared to OL	1 – 2 – 3 – 4 – 5
M6	I quickly get distracted in OL	1 – 2 – 3 – 4 – 5
M7	I am more prone to be absent from F2F lectures compared to OL because I have to commute to the lecture hall	1 – 2 – 3 – 4 – 5
M8	OL is practical because it offers more flexibility since I can join the lecture from anywhere	1 – 2 – 3 – 4 – 5
M9	One of the important advantage of F2F lectures compared to OL is the experience of student life at the faculty.	1 – 2 – 3 – 4 – 5

*The code M denotes 'Student Motivation'.
**refer to Likert scale where 1: Highly disagree, 2: Disagree, 3: neutral, 4: Agree, 5: Highly Agree.

Table 4: Engagement & interaction (lecturer-student interaction, QnA)

Code	Question	Response
E1	Online lectures (OL) provides less opportunity for interaction between students and students compared to F2F lectures.	1 – 2 – 3 – 4 – 5
E2	OL provides less opportunity for interaction between students and the lecturer compared to F2F lectures.	1 – 2 – 3 – 4 – 5
E3	Online courses provide a better opportunity for students to ask questions compared to F2F teaching	1 – 2 – 3 – 4 – 5
E4	Classes in OL largely consist of one-way communication from the lecturer.	1 – 2 – 3 – 4 – 5
E5	I am more confident and brave to ask questions in F2F lectures compared to OL.	1 – 2 – 3 – 4 – 5

*The code E denotes 'Engagement and Interaction'.
**refer to Likert scale where 1: Highly disagree, 2: Disagree, 3: neutral, 4: Agree, 5: Highly Agree.

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2.3 Survey Analysis

The analysis of survey was performed using SPSS version 22. SPSS is a statistic tool for advanced analytics and multivariate analysis. The first analysis performed is the average Likert Scale Score. The second analysis is on the correlation matrix between each question in each of the three parts, multiple regression analysis, and analysis of variance (ANOVA).

3.0 RESULTS AND DISCUSSION

From the online survey among the targeted population, a total of 233 responses were obtained, as shown in Figure where 27% are from year one undergraduate student, 22.3% are from year 4th undergraduate student, 19.7% are from year 2nd undergraduate student, 16.3% are from postgraduate student (Master coursework), 13.7% are from year 3rd undergraduate student and other refer to small percentage from fresh graduate students.

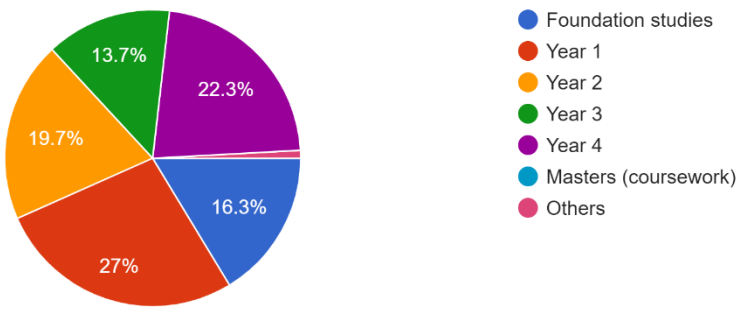

Figure 1: Survey response group by years of study

Based on the survey analysis, first a descriptive statistics analysis was performed. The mean, the standard deviation, the median and the mode are tabulated in Table 5, Table 6 and Table 7. The parameters of mean, median and mod are used to measure the distribution central tendency (Paul et al., 2022). Based on the scores from Table 5 till Table 7 it did not perfectly fit to normal distribution.

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Table 5: Students' perception questions in the online questionnaire - Effectiveness & quality (understanding of topics)

Question	Mean (Stev)	Median	Mode
Q1	3.9 (1.04)	4	5
Q2	3.6 (0.99)	4	3
Q3	3.1 (1.21)	3	3
Q4	3.7 (1.08)	4	5
Q5	4.4(0.91)	5	5
Q6	3.4 (1.08)	3	3

Table 6: Students' perception questions in the online questionnaire - Student motivation (fun, enjoyment of lectures)

Question	Mean (Stev)	Median	Mode
M1	3.5 (1.15)	4	4
M2	3.8 (1.11)	4	5
M3	3.9(1.18)	4	5
M4	3.8(1.1)	4	5
M5	3.7 (1.1)	4	5
M6	3.8 (1.1)	4	5
M7	3(1.3)	3	3
M8	1.9 (1.0)	4	5
M9	4.3 (0.8)	5	5

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Table 7: Students' perception questions in the online questionnaire - Engagement & interaction (lecturer-student interaction, QnA)

Question	Mean (Stev)	Median	Mode
E1	3.8 (1.07)	4	5
E2	3.7 (1.12)	4	5
E3	3.54 (1.09)	3	3
E4	3.7 (0.97)	4	4
E5	3.2 (1.21)	3	3

The second analysis performed is on the correlation matrix analysis between each question in each of the three parts. The correlation matrix computed comprises correlation coefficients that indicate the consistency of students' responses to the questions. Value -1 implies that students have opposite satisfaction levels for the given two perception questions, whereas a value of +1 implies that students had same satisfaction levels. Based on Figure 2, the lowest correlation coefficient is -0.302 (between Q4-Q5) and the highest is 0.628 (between Q1-Q4).

Based on Figure 2 till Figure 4 the correlation matrix shows consistency of correlation values across different perception questions. This indicates the validity of the questions and their responses.

Q2	0.103				
Q3	0.402	0.446			
Q4	0.628	-0.139	-0.241		
Q5	-0.239	0.369	0.364	-0.302	
Q6	0.13	0.247	0.2	0.08	0.332
	Q1	Q2	Q3	Q4	Q5

Figure 2: Correlation Matrix for students' perception on Quality (Q1-Q6)

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	M1	M2	M3	M4	M5	M6	M7	M8
M2	0.461							
M3	0.42	0.791						
M4	0.416	0.791	0.695					
M5	0.301	0.647	0.588	0.756				
M6	0.545	0.72	0.631	0.677	0.517			
M7	-0.074	-0.305	-0.329	-0.306	-0.238	-0.127		
M8	-0.281	0.354	0.303	0.357	0.272	-0.285	0.421	
M9	0.271	0.575	0.573	0.626	0.53	0.511	-0.138	-0.123

Figure 3: Correlation Matrix for students' perception on Motivation (M1-M9)

	E1	E2	E3	E4
E2	0.774			
E3	-0.255	-0.322		
E4	0.418	0.479	-0.06	
E5	0.461	0.536	-0.331	0.267

Figure 4: Correlation Matrix for students' perception on Engagement (E1-M5)

Table 8 till Table 10 shows the mean correlation coefficient (MCC) of students' responses for each perception question. Based on Table 8 till Table 10, higher MCC value indicated the question has the highest pair-wise correlation with every other question. The highest MCC score also implies that the satisfaction score across other perception questions is also high, and lower MCC score implies lower satisfaction.

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Table 8: Mean correlation coefficient (MCC) of perception questions on Quality. Q1 and Q2 have the highest mean correlation coefficient

Question Code	MCMC
Q1	0.21
Q2	0.21
Q3	0.23
Q4	0.00
Q5	0.10
Q6	0.20

Table 9. Mean correlation coefficient (MCC) of perception questions on Motivation. M2 and M4 have the highest mean correlation coefficient

Question Code	MCMC
M1	0.45
M2	0.50
M3	0.46
M4	0.50
M5	0.42
M6	0.40
M7	-0.14
M8	0.13
M9	0.35

Table 10: Mean correlation coefficient (MCC) of perception questions on Engagement. E2 has the highest mean correlation coefficient

Question Code	MCMC
E1	0.35
E2	0.37
E3	-0.24
E4	0.28
E5	0.23

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Finally, the multiple regression analysis for three model (Effectiveness & Quality, Motivation, and Engagement) are compute. For effectiveness & quality model, Table 11 shows the model summary and Table 12 shows the analysis of variance (ANOVA) whereas Table 13 show coefficient analysis for predictors. For multiple regression, only the effectiveness & quality model is presented since its produces similar output for the models regarding student motivation and engagement. Table 12 shows the model capture 94.6% variance in the data in which these predictors are statistically significant (Table 13). Based on these results, the predictors (Q1, Q2, Q3, Q4 and Q5) can be viewed as key factors, as shown in Figure 5 and 6. 94 % of the respondents highly agree that the quality of face-to-face lectures are better than online lectures. The students also agreed that face-to-face lectures are more organised than online lectures. With the improvement made using these key factors, it will help to improve the overall effectiveness and quality of education.

Table 11: Model summary for overall quality

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.946[a]	.896	.893	.16617

a. Predictors: (Constant), Q5, Q1, Q2, Q3, Q4

Table 12: ANOVA analysis for overall effectiveness and quality of education

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	53.243	5	10.649	385.646	.000[b]
	Residual	6.213	225	.028		
	Total	59.456	230			

a. Dependent Variable: OveralQ

b. Predictors: (Constant), Q5, Q1, Q2, Q3, Q4

Table 13. Coefficients analysis for overall effectiveness and quality of education

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Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	.043	.090		.479	.632
	Q1	.167	.015	.339	11.442	.000
	Q2	.189	.013	.366	14.569	.000
	Q3	.179	.011	.422	15.760	.000
	Q4	.202	.013	.430	15.132	.000
	Q5	.231	.014	.413	16.807	.000

a. Dependent Variable: OveralQ

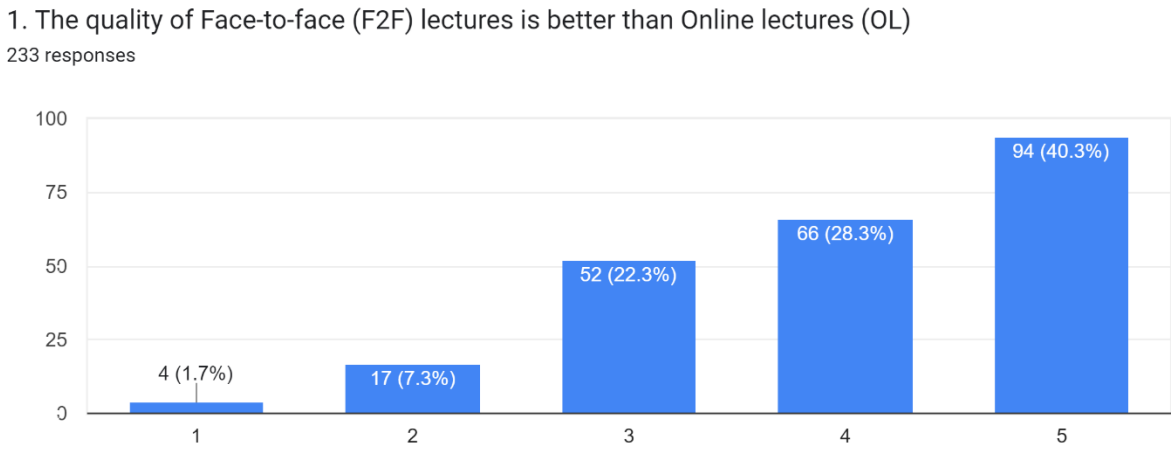

Figure 5: The quality of face-to-face lectures is better than online lectures (5 highly agree, 4 agree, 3 neutral, 2 disagree, 1 highly disagree)

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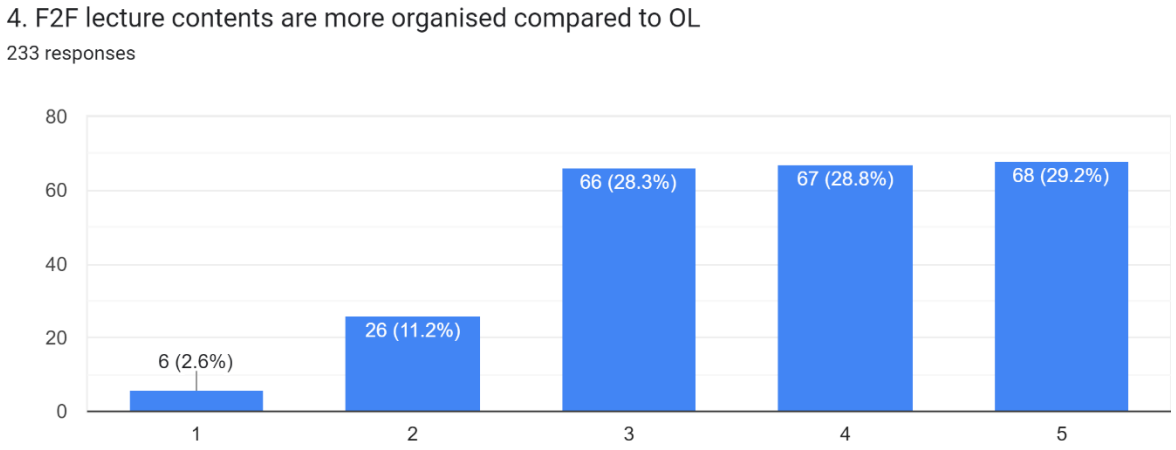

Figure 6: Face-to-face lecture contents are more organised compared to online lectures (5 highly agree, 4 agree, 3 neutral, 2 disagree, 1 highly disagree)

Figure 7 shows students' preferences between online and face-to-face lectures, 64.2 % of the students preferred face-to-face lectures, compared to online lectures, this result corresponds to other findings in the literature (Zamri et al., 2021).

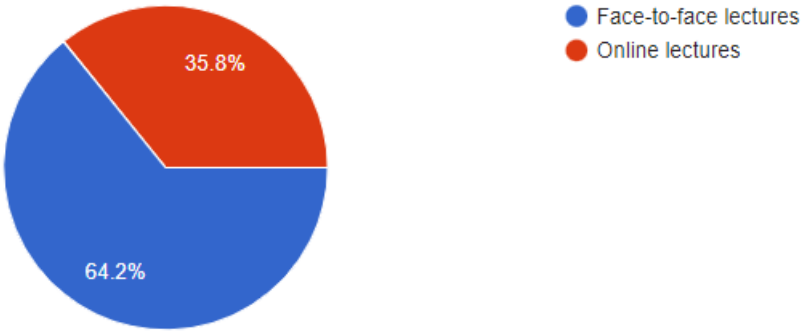

Figure 7: Students' preference between online and face-to-face lectures

4.0 CONCLUSION

In conclusion, this research demonstrates the comparison of the effectiveness of online and face-to-face classes. This paper reported the empirical study towards the effectiveness and quality of engineering education. Statistical analysis on the survey data show key indicator for effectiveness and quality model are significant. This implying that the key predictors play a crucial indication to improve the effectiveness and quality of the engineering education. From

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the survey, students prefer face-to-face lectures compared to online lectures, and perceive that overall, face-to-face lectures are better than online lectures in the three aspects, effectiveness & quality of teaching, student motivation and experience, and lecturer-student engagement and interaction. The outcome of this study is important in the implementation of Future Ready Curriculum and Digitalising Education in the Education 4.0 framework. In the era of borderless learning, where online classes are becoming more common, it is important to ensure that students' needs and course learning outcomes and programme learning outcomes are attained.

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6.0 REFERENCES

Al-Fodeh, R. S., Alwahadni, A. M., Abu Alhaija, E. S., Bani-Hani, T., Ali, K., Daher, S. O., & Daher, H. O. (2021). Quality, effectiveness and outcome of blended learning in dental education during the Covid pandemic: Prospects of a post-pandemic implementation. *Education Sciences*, 11(12), 810.

Allam, S. N. S., Hassan, M. S., Mohideen, R. S., Ramlan, A. F., & Kamal, R. M. (2020). Online distance learning readiness during Covid-19 outbreak among undergraduate students. *International Journal of Academic Research in Business and Social Sciences*, 10(5), 642-657.

Bahasoan, A. N., Ayuandiani, W., Mukhram, M., & Rahmat, A. (2020). Effectiveness of online learning in pandemic COVID-19. *International Journal of Science, Technology & Management*, 1(2), 100-106.

Birch, E., & de Wolf, M. (2020). A novel approach to medical school examinations during the COVID-19 pandemic. *Medical Education Online*, 25(1), 1785680.

Chung, E., Subramaniam, G., & Dass, L. C. (2020). Online learning readiness among university students in Malaysia amidst COVID-19. *Asian Journal of University Education*, 16(2), 45-58.

Received: 01 December 2022, Accepted: 15 December 2022, Published: 20 December 2022
https://doi.org/10.17576/ajtlhe.1402.2022.12

Esa, M. B., Ibrahim, F. S. B., & Kamal, E. B. M. (2020). Covid-19 pandemic lockdown: The consequences towards project success in Malaysian construction industry. *City*, 25(2).

Harun, Z., Hamzah, F. M., Abidin, Z. Z, Zamri, F. H. W., & Hashim, H. Learning Difficulties During the Transition to Covid-19's Endemic Period in Malaysia. *Kongres dan Pertandingan Inovasi dalam Pengajaran dan Pembelajaran* (kNovasi) 2022 Menginsankan Pendidikan Digital, 26.

Harun, Z., Hamzah, F. M., Abidin, Z. Z., Wan Zamri, W. F. H., & Hashim, H. (2021). Basic Needs in Online Learning During Covid-19: A Malaysian Students' survey. *ASEAN Journal of Teaching & Learning in Higher Education*, 13(2).

Karim, W., Haque, A., Anis, Z., & Ulfy, M. A. (2020). The movement control order (MCO) for COVID-19 crisis and its impact on tourism and hospitality sector in Malaysia. *International Tourism and Hospitality Journal*, 3(2), 1-7.

Mat, S., Jieh, I. L. S., Zulkiply, A. N. B., Amaluddin, B., Najmi, A., Yusof, B. M., ... & Singh, D. K. A. (2021). Depression, Anxiety, and Stress Related to Online Distance Learning (Odl) does not Influence Academic Performance: Findings from an Online Survey Among Undergraduates in Malaysia. *ASEAN Journal of Teaching & Learning in Higher Education*, 13(2), 99 – 112.

Mat, S., Chin, L. V., Sean, L. P., Peng, T. W., Xin, T. M., Nordin, N. A. M., ... & Singh, D. K. A. (2021). Preferences, Perception of Readiness and Satisfaction Towards Online Distance Learning Among Undergraduates in Malaysia During Covid-19 Pandemic. *ASEAN Journal of Teaching & Learning in Higher Education*, 13(2)., 151 – 171.

Martín-Sómer, M., Moreira, J., & Casado, C. (2021). Use of Kahoot! to keep students' motivation during online classes in the lockdown period caused by Covid 19. *Education for Chemical Engineers*, 36, 154-159.

Munir, H. (2022). Reshaping Sustainable University Education in Post-Pandemic World: Lessons Learned from an Empirical Study. *Education Sciences*, 12(8), 524.

Nguyen, J. G., Keuseman, K. J., & Humston, J. J. (2020). Minimize online cheating for online

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https://doi.org/10.17576/ajtlhe.1402.2022.12

assessments during COVID-19 pandemic. *Journal of Chemical Education*, 97(9), 3429-3435.

Nik-Ahmad-Zuky, N. L., Baharuddin, K. A., & Rahim, A. A. (2020). Online clinical teaching and learning for medical undergraduates during the COVID-19 pandemic: The Universiti Sains Malaysia (USM) experience. *Education in Medicine Journal*, 12(2), 75-80.

United Nations Educational, Scientific and Cultural Organization. (2020). COVID19 educational disruption and response. Retrieved from: https://en.unesco.org/themes/education-emergencies/coronavirus-school-closures

Sari, F. M., & Oktaviani, L. (2021). Undergraduate Students' Views on the Use of Online Learning Platform during COVID-19 Pandemic. *Teknosastik*, 19(1), 41-47.

Winberg, C., Bramhall, M., Greenfield, D., Johnson, P., Rowlett, P., Lewis, O., ... & Wolff, K. (2020). Developing employability in engineering education: a systematic review of the literature. *European Journal of Engineering Education*, 45(2), 165-180.

World Health Organisation. (2020). WHO Coronavirus Disease (COVID-19) Dashboard. Retrieved from: https://covid19.who.int/.

Yap, J. S., & Tan, J. (2022). Lifelong learning competencies among chemical engineering students at Monash University Malaysia during the COVID-19 pandemic. *Education for Chemical Engineers*, 38, 60-69.

Zamri, W. F. H. W., Abidin, Z. Z., & Harun, Z. (2021). Cabaran Pembelajaran Era Pandemik: Simptom Stres di Kalangan Pelajar Program Kejuruteraan Mekanikal UKM. *ASEAN Journal of Teaching & Learning in Higher Education,* 13(2), 113 – 135.