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## A Comparative Study of Student's Perception in Linear System Course: Face-to-Face and Online Distance Learning

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### Abstract

The perceptions and interactions of students impact the efficacy of online learning. When measuring the success of ODL courses, it is best to use the survey approach, which allows each side of the perspective, such as the teacher, students, and employers, to be recorded. In this study, students' perceptions of course content, lecturer professionalism, teaching and learning activities, and infrastructure were compared across three teaching delivery modes. Once measuring the success of the courses, it is best to use the survey approach. This study employed Introduction to Linear System courses for the Electrical Engineering students, and the survey was acquired through an official university's student feedback system known as SuFO. The relationship between the student's perception and delivery modes was examined using the statistical methods Chi-Square, Phi, and Cramer's V, which revealed a weak relationship between them. This study can assist lecturers to discover deficiencies in their delivery methods and enhancing their abilities over time.

**Keywords:** Online Distance Learning (ODL), Students' Perception, Student Feedback Survey, Statistical Method, SPSS.

### Introduction

Until 2019, the study of online or blended learning was monopolized by developed countries such as the United States (22.71 %), United Kingdom (19.83 %), Australia (11.19 %), and Spain (7.25 %), followed by developing countries such as Malaysia (5.65 %), South Africa (3.52 %), and Brazil (2.675 %), where the majority of the studies were in the social sciences discipline (Raman et al., 2021). In today's world of advancing technology and information technology, online learning is experiencing exponential growth, especially in higher education. Rapid internet access and the Covid-19 outbreak have caused the delivery of higher education to change dramatically, which leads students to prefer online classes over Face-to-Face (F2F) courses (Ilham et al., 2021). A massive number of higher education institutions are

transforming the learning method into online, blended (hybrid), or web-facilitated courses that benefit in reducing the building maintenance cost and enhancing the population of students to enroll in the courses. Online-Distance Learning (ODL) or Web-Based Learning (WBL) in the education industry can be implemented through any internet network or multimedia platforms such as DVD, CD, or flash drive (Singh et al., 2005) (L. Smart & J. Cappel, 2006) (Xie & Du, n.d.). Learners can take the course at their own pace, either synchronously (recorded sessions) or asynchronously (live meetings) (Smart & Cappel, 2006). For some reasons, students prefer ODL over traditional teachers' evaluations because of the formative assessment tools provided by some institutions, such as the flexibility of timing, the possibility of trying several times to receive the desired grade, and the possibility of receiving feedback after performing the assessment (Ogange et al., 2018). Online learning effectiveness is determined by the student's perceptions and engagements. Especially in higher education, this has the potential to greatly improve the student experience and academic performance (Raman et al., 2021). The survey approach is regarded as an indirect measure of student perceptions of their skills rather than their actual abilities, which may be reached through cognitive evaluation. However, employing online survey tools with several sorts of questions such as multiple choice, short response, grouping, and dropdown menus allows for both direct and indirect evaluation (Wright et al., 2016). When determining the effectiveness of ODL courses, it is best to use the survey method, which allows each side of the perspective to be captured, for example, the instructor, the students, and the employers. In this study, the survey technique was used to compare students' perceptions of course content, lecturer professionalism, teaching and learning activities, and infrastructure across three teaching delivery modes: F2F, hybrid, and ODL.

#### *The Course Details*

The course used in this study is Introduction to Linear Systems, which is studied by Engineering students, specifically those studying Electrical Engineering. In general, the course introduces students to signal and system theory, linear differential equations, the Fourier series, and Laplace transforms. Table 1 shows the course structure of the subject throughout the semester. For the first three weeks of the semester, students learn about the introduction of the signal and system. In this topic, students are expected to be able to identify and solve the engineering problems to perform signal manipulations and be able to express the periodic signal. Then, for the next three weeks, the student will learn how to solve the total solutions of the Linear Differential Equations (LDE) for first order and second order differential equations. Students will also learn how to solve the LDE application of Resistive, Inductive, and Capacitive (RLC) circuits as well as zero input and zero state response. From week 7 to week 10, students will learn about the Fourier series (FS). At the end of this topic, students acquire knowledge to identify and solve engineering problems in FS. This topic covered the Trigonometric FS, Exponential FS, the symmetry of TFS, and the frequency spectrum of the signal. The last topic covered in this subject is Laplace Transform (LT). This topic took about 4 weeks same as topic FS. Basically, in this topic, at the end of the chapter students would be able to define the concept and properties of the LT. Besides that, in this topic, students also expected to be able to apply the knowledge of LT to solve the applications of LT such as zero input and zero state response, transfer function, and stability of systems.

Table 1

*The Linear system course structure progress from week 1 to week 14*

WEEK 1-WEEK 3	WEEK 4-WEEK 6	WEEK 7-WEEK 10	WEEK 11-WEEK 14
CHAPTER 1 Introduction to signal and system	CHAPTER 2 Solutions of Linear Differential Equations (LDE)	CHAPTER 3 Fourier Series	CHAPTER 4 Laplace Transform

*The student’s feedback process (SuFO)*

UFUTURE is the official database web-portal system established by UiTM for all of its users. The system integrates all registered students and staff data, together with their enrolled courses for the semester. The UFUTURE system usually is used to conduct online classes and quizzes, share notes, and online tests, and also gather student feedback using an online survey. An entrance-exit survey is given at the start and end of each course, and an online student feedback survey (SuFO) is given from Week 10 through Week 14 of the lecture. The SuFO system is dynamic, user-friendly, adaptive, low-cost, accurate, and fast, making it possible to substitute the manual procedure while also providing accurate tools for assessing teaching and course quality across all UiTM campuses in Malaysia (Abedin et al., 2014). SuFO in the UiTM system in general, and especially for these courses (Linear Systems), analyses four components of students' perception: 1. The impression of the overall courses, 2. The teaching and learning activities, 3. The lecturer's professionalism, and 4. The infrastructure of the SuFO, as shown in Figure 1.



Figure 1: The four parts of the SuFO evaluation conducted for Linear Systems courses

**Research Methodology**

Figure 2 depicts the visual timelines of the three samples utilized in this investigation. The first sample was collected on March 1st, 2019, when this batch enrolled in the face-to-face (F2F) modes of the course. The samples comprise 65 students who registered for this course that semester. The second assessment occurred on March 1, 2020, when this group of 127 students registered in the Hybrid mode. The hybrid approach is utilized for half of the semester, with face-to-face instruction and the other half with online instruction. The most current evaluation was accomplished on March 1, 2021, when the complete course was run in ODL mode with 199 enrolled students for the semester.

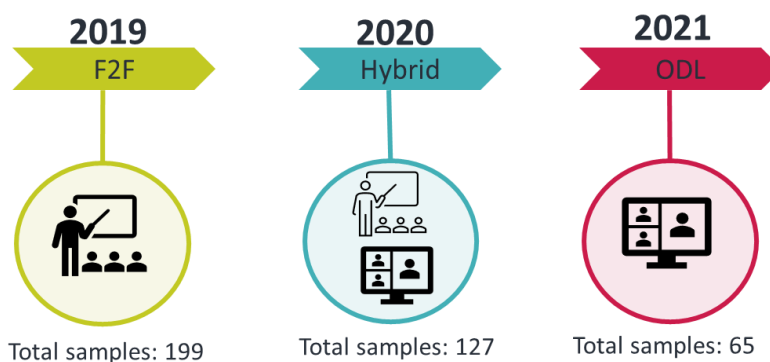


Figure 2: The three samples used in this investigation ranged from 2019 to 2021.

*The Student Feedback Survey (SuFO) data*

For part A of the SUFO question, the investigation was to measure the student’s perception of overall course content. There are four (4) questions asked to the student such as the student’s basic knowledge about the course, the significance to study the course, the enhancement of the student’s learning ability, and the student’s confidence level about the course. In the SuFO system output, the student scores either strongly disagree, disagree, agree, or strongly agree were produced in the frequency form. The actual frequency is obtained from the number of students' scores times the number of questions in that particular part. For example, in part A, the number of questions in this part is four, while in the ODL delivery mode, there is a total of 65 respondents leads to the total actual frequency being equal to  $65 \times 4 = 260$  (Table 2 ODL columns for part A). Refer to total score in part A, total actual frequency score is  $0 + 1 + 122 + 137 = 260$ . The frequency calculations are the same in part B, part C, and part D. Table 2 shows the SUFO frequency outputs collected from three batches of delivery mode (F2F, Hybrid, and ODL).

Table 2

The SUFO score of student's perception from three different learning (ODL, Hybrid, and F2F)

SUFO Question		Actual Frequency			Percentage Frequency		
		ODL	Hybrid	F2F	ODL	Hybrid	F2F
<b>Part A</b> Student's Perception of Course Content	1. Strongly disagree	0	1	0	0.0	0.2	0.0
	2. Disagree	1	14	7	0.4	2.8	0.9
	3. Agree	122	297	440	46.9	58.5	55.3
	4. Strongly agree	137	188	349	52.7	37.0	43.8
<b>Part B</b> Student's Perception of Lecturer Professionalism	1. Strongly disagree	0	1	0	0.0	0.1	0.0
	2. Disagree	4	21	14	0.9	2.4	1.0
	3. Agree	213	491	710	46.8	55.2	51.0
	4. Strongly agree	238	362	669	52.3	40.7	48.0
<b>Part C</b> Student's Perception of Teaching and learning activities	1. Strongly disagree	0	0	1	0.0	0.0	0.0
	2. Disagree	6	42	20	0.8	3.0	0.9
	3. Agree	321	770	1148	44.9	55.1	52.4
	4. Strongly agree	388	563	1020	54.3	40.3	46.6
<b>Part D</b> Student's perception of infrastructure	1. Strongly disagree	0	2	0	0.0	0.8	0.0
	2. Disagree	0	5	2	0.0	2.0	0.5
	3. Agree	63	140	215	48.5	55.1	54.0
	4. Strongly agree	67	103	181	51.5	40.6	45.5

In part A of the SUFO question, the significant relationship between student perception of course content can be measured by using some statistical analysis. The Chi-Square test was performed to evaluate the following hypothesis:

H<sub>0</sub>: Student's Perceptions of course content and the delivery mode are independent

H<sub>1</sub>: Student's Perceptions of course content and the delivery mode are **NOT** independent

The IBM SPSS software was used to run the data collected in Table 2. The Phi and Cramer's V tests were also used to measure the strength of the relationship between two variables.

### Result and Discussion

In the result section, the Chi-Square analysis was performed on part A of SUFO frequency output to test the significant relationship of the student's perception to the overall course content within three delivery modes. Table 3 output shows the percentage of students' perception of the course content within the three different delivery modes of F2F, Hybrid, and ODL. Of the total 796 scores in F2F delivery modes, 349 scores strongly agreed that the course increases their knowledge, learning abilities, confidence level, and related to their field of study. The student perception of course content in F2F modes is 51.8 %, in hybrid modes is 27.90 %, and in ODL modes is 20.30 %, indicating that students are less interested in the course content. It is possible that this is because the course required strong mathematical



fundamental application in its problem-solving process. In terms of delivery modes, students prefer ODL modes (52.70%) because they can learn at their own pace and have more flexibility in its assessment process.

Table 3

The Crosstabulation table between the delivery mode vs course content (Part A)

PART A			Course content Score				Total
			Strongly disagree	Disagree	Agree	Strongly agree	
Delivery mode	F2F	Count	0	7	440	349	796
		% within Delivery mode	0.00%	0.90%	55.30%	43.80%	100.00%
		% within Course content	0.00%	31.80%	51.20%	51.80%	51.20%
		% of Total	0.00%	0.40%	28.30%	22.40%	51.20%
	Hybrid	Count	1	14	297	188	500
		% within Delivery mode	0.20%	2.80%	59.40%	37.60%	100.00%
		% within Course content	100.00%	63.60%	34.60%	27.90%	32.10%
		% of Total	0.10%	0.90%	19.10%	12.10%	32.10%
	ODL	Count	0	1	122	137	260
		% within Delivery mode	0.00%	0.40%	46.90%	52.70%	100.00%
		% within Course content	0.00%	4.50%	14.20%	20.30%	16.70%
		% of Total	0.00%	0.10%	7.80%	8.80%	16.70%

By referring to the crosstabulation of Table 3, the degree of freedom (df) is obtained as follows:

$$df = (\text{number of rows} - 1)(\text{number of columns} - 1)$$

Where the number of rows is equal to 3 and the number of columns equal to 4. Refer to Table 4, df obtained is equal to 6. The Chi-Square output in Table 4 shows that the test value for the analysis is 26.388, while the p-value is near 0. Since the p-value is less than 5 % ( $\alpha = 0.05$ ), it can be concluded that there has a significant association between overall course content and delivery modes, hence null hypothesis rejected.

Table 4

The Chi-Square test of SuFO output part A

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	26.388 <sup>a</sup>	6	0
Likelihood Ratio	26.045	6	0
N of Valid Cases	1556		

The phi and Cramer's V test was applied to estimate the relationship strength. The relationship strength is in the form of a range between 0 and 1. If the significance level is close to zero (0), both variables are weakly associated. Referring to Table 5 (symmetric table), the strength between course content and delivery mode is weakly associated since the value result is 0.13 which is close to zero. Even though the first Chi-Square test shows that there has an association between them, the association is weak.

Table 5

*The symmetric measure of SuFO output part A*

		Value	Approx. Sig.
Nominal by Nominal	Phi	0.13	0
	Cramer's V	0.092	0
N of Valid Cases		1556	

Part B of the SuFO measured student perceptions of lecturer professionalism for various delivery modes, whereas Part C measured perceptions of teaching and learning, and therefore Part D measured the perception of infrastructure. As indicated in Table 6, the chi-Square, Phi and Cramer's V analysis found a weak relationship of student perception between lecturer professionalism, teaching and learning activities, and infrastructure across three delivery modes (F2F, Hybrid, ODL).

Table 6

*The student's perception of part B, part C and part D of the SUFO for different delivery mode.*

	Chi-Square test	Symmetric Measure	
	Value	Phi	Cramer's V
Part B	24.994 <sup>a</sup>	0.096	0.068
Part C	57.846 <sup>a</sup>	.116	.082
Part D	12.423 <sup>a</sup>	.126	.089

Figure 4 plots the association between all four students' perceptions of the delivery modes to corroborate the findings on Chi-Square, Phi, and Cramer's V analysis. For part A (perception on course content) of the plot, from strongly disagree to agree, all three delivery modes consume the same pattern and do not intersect. In this scenario, it is supposed to be no association. However, when the score increases from agree to strongly agree (scoring 3 to 4), the Hybrid and F2F graph lines begin to show a negative slope, while the ODL trend begins to grow, causing them to collide (result to has association). The minor overlap between scores 3 and 4 makes the association occurs, but the factors was weak. Perceptions of lecturer professionalism, teaching and learning activities, and infrastructure all follow the same trend. This research contributes to the improvement of the teaching and learning process on a specific topic of this course, thereby increasing student perceptions of their knowledge, abilities, and confidence level.

### Conclusion

The success of online learning in the Introduction to Linear System course was determined by how students viewed and engaged with the course material, the lecturer's professionalism, teaching and learning activities, and the infrastructure supplied. Based on the university's online students' feedback survey (SuFO), three variances in educational delivery formats are compared: F2F, hybrid, and ODL. The statistical study of variable relationships within distinct delivery mechanisms was performed using chi-Square, Phi, and Cramer's V analysis. Overall, there is just a weak association between student perception and delivery modes, resulting in a level of association near zero (weak). In the future study, it is ideal to explore and compare students' perceptions and actual abilities using cognitive assessment tools such as quizzes,



tests, and examinations, as well as measuring all cognitive, psychomotor, and emotional capabilities of students who participated in the course.

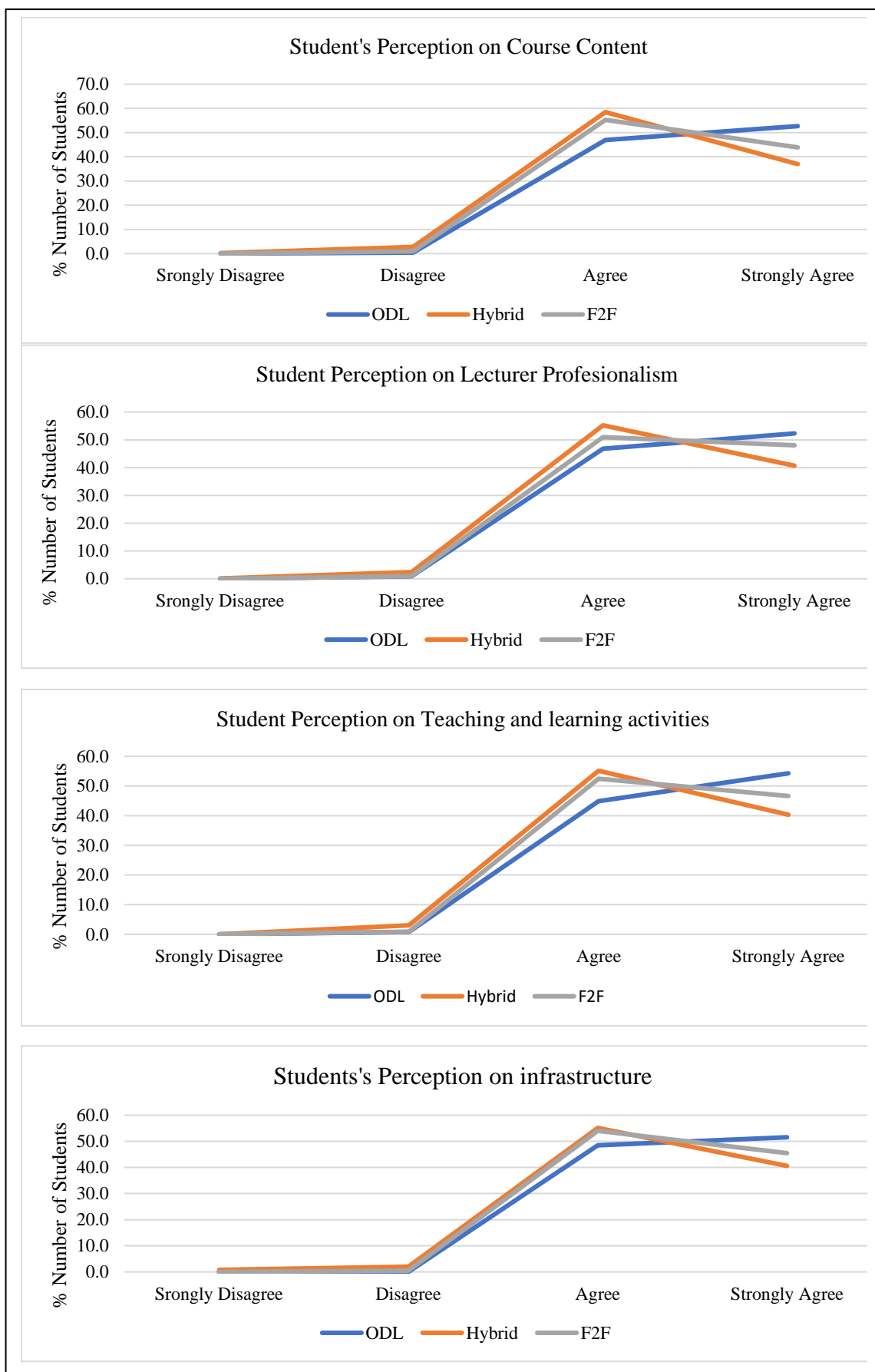


Figure 4: The line graph on of student's perception of course content, lecturer

professionalism, teaching and learning activities and infrastructure within three delivery modes.

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