Proceedings of Science and Mathematics
Faculty of Science, Universiti Teknologi Malaysia
Vol. 8, 2022, page 269-277

# Perspective of Malaysian Mathematics Lecturers on Online Teaching

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**Abstract**
As a result of the COVID-19 pandemic, online teaching and learning has been implemented. Nonetheless, online instruction takes up a lot of time and puts a lot of pressure on lecturers. Lecturers must not only learn technological skills, but also deliver engaging online instruction. The goal of this study is to investigate the perspective of lecturers in Malaysia on online teaching and learning. The respondents of this study are mathematics and statistics lecturers from universities in Malaysia. A survey of questions are collected to get information and data from the respondents. Regression model, ANOVA and t-test are used to analyze the data. Based on the analysis, lecturers who favor online teaching agree that the online tools are easy to use for teaching mathematics/statistics subject and they think that online teaching has more advantages compare to the traditional teaching. There is a strong relationship between better engagement of the lecturers with students and the lecturer-student interaction during online class. In addition, most of the mathematics and statistics lecturers agree that they face difficulties while teaching mathematics subject online and from the t-test, the lecturers who love online teaching do not have similar score with the lecturers who love physical teaching.
**Keywords:** Online teaching and learning; regression model; ANOVA; t-test

## 1. Introduction

The advent of information and communication technologies has undoubtedly altered today's teaching and learning process. In truth, integrating technology in the classroom and teaching and learning through online education systems may have been widely recognised as a good approach of teaching and learning in the twenty-first century [1].

A proper learning system in higher education institutions may be considered one of the most essential technological breakthroughs, particularly in terms of controlling the teaching and learning system. A good learning management system provides a secure environment for online teaching and learning for both lecturers and students. Because it offers a platform for lecturers and students to connect academically, using a learning management system is critical for enhancing the teaching and learning experience for online and remote students.

The rapid spread of the COVID19 in late 2019 has had a devastating impact on society in general, including schooling. Several universities around the world have switched from physical teaching to online teaching. Universities have to look into various online platforms and tactics to find new ways to continue teaching. However, a number of lecturers around the world reported that a lack of the availability of electronic devices, as well as online pedagogical skills, and other technical concerns (e.g., electricity, internet access, etc.) as well as the lack of an online teaching platform were the main problems they faced.

The COVID19 pandemic in Malaysia has had an influence on teaching and learning in all of Malaysia's universities. As a result, physical teaching had to be temporarily halted, and other colleges were compelled to switch to online teaching. According to research, entirely online teaching of undergraduate mathematics is ineffective [2]. Undergraduate mathematics students in online learning environments do worse than those in traditional classrooms. These data support claims that fully online mathematics teaching is difficult to offer and that students are disappointed with the totally online

mathematics courses that they are taking. Regardless, many people feel FO teaching manage to transform mathematics education.

The perspectives and experiences of Malaysia university mathematics and statistics lecturers with online teaching and learning during the COVID19 pandemic are presented in this research study. The outcomes of this study are hoped to add to the growing literature on remote learning perspectives and experiences when there are disruptions in classes and a proper learning management system is unavailable.

This research study aims to (1) investigate the perspectives of mathematics and statistics lecturers from universities in Malaysia on online teaching and learning using regression model, (2) examine the engagement of the lecturers with their students and their difficulties during online teaching using regression model and (3) test whether the lecturers who love online teaching have similar score with the lecturers who love physical teaching using t-test. The study's research area is based in universities, Malaysia. The respondents must be mathematics and statistics lecturers.

## 2. Literature Review

### *2.1. E-Learning during COVID-19 Pandemic*

In March 2020, the Director of the World Health Organization (WHO) publicly declared COVID 19 as a pandemic. Universities in many countries around the world had to rely solely on e-learning to pause or stop activities on campus and continue student education [3]. E-learning is implemented in almost every discipline and education level. Offering e-learning includes easily accessible information, content updates, standardization and distribution [4]. The COVID-19 pandemic ended in a mission and a possibility to apply and get right of entry to e-learning in higher education. Transition from conventional in-class teaching to remote studying is an unavoidable step, whether fully or blended.

### *2.2. Experiences, Challenges and Acceptance of E-Learning*

As a result of the COVID 19 pandemic, certain schools and institutions were forced to close temporarily. Face-to-face instruction has been phased out at many universities and colleges. Because social distance is vital at this period, this has a negative impact on educational efforts. Many faculties have worked together to provide the greatest online course materials, encourage student participation, and conduct assessments [5]. This crisis will lead to the acceptance of new technologies by organizations that previously resisted adaptation.

Online learning has the potential to create a platform that improves the educational process by making it more student-centered, creative, and adaptable [6]. Most universities implement a number of creative strategies to combat the crisis and take online courses using a variety of software / apps such as Google Classroom, Zoom, and Microsoft Teams. The biggest challenges in accepting e-learning were inadequate / unstable internet connectivity, inadequate computer rooms, lack of computers / laptops, and technical issues. In developing nations, the obstacles and factors that influence the acceptance of e-learning as a tool for teaching in higher education are highlighted, which can lead to strategic e-learning implementation and advancing technology toward transformation.

### *2.3. Effects of Online Learning*

People's lifestyles, habits, beliefs, emotions, and behaviours have all changed as a result of the pandemic. Lecturers in the education department deliver their lectures via the internet. Teaching methods, technology, and content selection for online courses have been the primary role of lecturers in providing students with quality online learning opportunities [7]. Therefore, lecturers were required to refresh their knowledge and learn things they hadn't learned in years. Clearly, lecturers are not the only ones who bear accountability on the task described, but also the commitment of the students.

Many lecturers are compelled to relocate their work in the university into an online environment that is very different from face-to-face education. The difference is that students need to adjust the curriculum and materials used by the lecturers and how they organize the online teaching. Cognition, emotions, and well-trained lecturers are all important things to consider during online teaching.

The majority of children today benefit from this sort of education, but crucial factors such as educational quality, content quality and quantity, student motivation and involvement, interpersonal connections, and mental health may all be improved. [8]. Some learners were forced to experience online teaching for the first time and digitize their respective learning, which was also an opportunity to continue online learning at home. Online learning had a positive impact on educational practices and assessments.

### *2.4. Lecturers' Technostress and Their Continuance Intention*

A rapid transition to online education is feasible, whether or not government-certified university lecturers are ready. Mandatory online education during a pandemic is not the same as spontaneous action, and as a result, lecturers' stress has increased. Family health, workloads and even the blurring of family and work through online education during the crisis contributed to lecturer stress, according to an international sample of language lecturers [9]. It is very important to analyze the underlying factors of lecturer technostress and the intention to continue teaching online beyond the COVID 19 pandemic.

If online education practices are mandatory, it is a good choice for policy makers to understand lecturers' perceptions of services and adjust lecturer education accordingly [10]. In general, policy makers and educators can address privacy concerns and educators' self-efficacy. Maintaining data-subject expertise in areas such as data protection and online education can assist teachers reduce technostress and improve their skills. In any case, if the lecturers are given messages that they have some resources at their disposal, it will help them to continue online teaching. As a result, lecturers can more actively improve their online teaching skills.

### *2.5. Lecturers' Perspective*

The revolution of online education has been hastened due to the Covid 19 pandemic and the 2020 Chinese government quarantine measures. In the face of this massive move to online learning, researchers from other countries have carried out research from different perspectives. Some discoveries, such as major disputes between lecturers and students about the best online learning options, have helped improve online education [11]. Studies also show that online education has the potential to improve the application of knowledge across critical thinking skills and physical classes [12].

However, online education also has many shortcomings. Lecturers' concerns about understanding students' concepts and whether lecturers checked their understanding during the asynchronous online education were two common disadvantages [13]. During online education, the lack of direct contact between lecturers and students, as well as interactions between students themselves, has a negative impact on students' knowledge of practical concepts and their sense of learning [14].

Therefore, the effectiveness of online practical courses can become one of the important issue. Infrastructure is a prerequisite for implementing online education, and online scientific tools for monitoring the students may be required for better online teaching. In addition, new technologies and lecturer training are other promising methods to improve online teaching.

## 3. Methodology

### *3.1. Collection of Data*

Any research study's success is contingent upon the data collection process. As a result, researchers must collect accurate data from respondents to accurately accomplish the research aim and objective. The data collection process should begin once the research problems, goals, and research design have been defined. For the mathematics and statistics lecturers, the primary and secondary data were obtained to have a detail understanding of their perspective about online teaching and online learning.

#### *3.1.1. Survey Questionnaire*

A survey questionnaire was distributed in google form to the mathematics and statistics lecturers from universities in Malaysia to collect primary data. The survey questionnaire comprised a series of

questions relevant to the research objectives and organized logically and methodically. However, the survey questionnaire must be simple to understand and respondent-friendly, and respondents must independently answer all questions. A well-designed survey questionnaire is critical for capturing respondents' attention and eliciting their passion and honesty when responding to the survey questionnaire.

*3.2. Analysis of Data*

The results analysis phase will analyse all of the respondents' data following the data collection phase. These findings will be used to describe the importance of the study's objectives. Data analysis has two purposes: to ensure that respondents' information is accurately interpreted, yielding accurate research results. The data analysis process will reorganize, clean, and tabulate the collected data for interpretation.

*3.2.1 Regression Analysis – Multiple Linear Regression*

Multiple linear regression analysis is quite similar to simple linear regression analysis, with the exception that numerous independent variables are utilised in the model. Multiple linear regression is represented mathematically as follows:

$$Y = a + bX_1 + cX_2 + dX_3 + \in \quad (1)$$

The assumptions underlying the multiple regression model are as follows:

- The dependent variables and the independent variables have a linear relationship.
- The independent variables have a low correlation with one another.
- $y_i$ observations are chosen at random and independently from the population.
- The distribution of residuals should be normal distribution with a mean of 0 and variance σ.

There is another requirement for the model because multiple linear analysis contains several independent variables:

- Non-collinearity - The fact that independent variables should have a low correlation with one another is referred to as this. If the independent variables are heavily related, determining the true relationships between the dependent and independent variables will be difficult.

*3.2.2 One-Way ANOVA*

***Table 1: ANOVA***

| Source of Variation | Sums of Squares (SS) | Degrees of Freedom (df) | Mean Squares (MS) | F |
|---|---|---|---|---|
| Between Treatments | $SSB = \sum n_j(\bar{X}_j - \bar{X})^2$ | *k-1* | $MSB = \frac{SSB}{k-1}$ | $F = \frac{MSB}{MSE}$ |
| Error (or Residual) | $SSE = \sum\sum(X - \bar{X}_j)^2$ | *N-k* | $MSE = \frac{SSE}{N-k}$ | |
| Total | $SST = \sum\sum(X - \bar{X})^2$ | *N-1* | | |

The following is how the ANOVA table is organised:

1. The first column, named "Source of Variation," distinguishes between treatment from error or residual variation. The sum of the between treatment and error variation is the total variation.
2. "Sums of Squares (SS)" is the title of the second column. The difference in sums of squares between treatments is

   $$SSB = \sum n_j(\bar{X}_j - \bar{X})^2 \quad (2)$$

   and is computed by summing the squared differences between each treatment (or group) mean and the overall mean. The squared differences are weighted by the sample sizes per group ($n_j$). The error sums of squares is:

   $$SSE = \sum\sum(X - \bar{X}_j)^2 \quad (3)$$

   and is calculated by adding the squared deviations between each observation and the mean of the group (i.e., the squared differences between each observation in group 1 and the group 1

mean, the squared differences between each observation in group 2 and the group 2 mean, and so on). The double summation (SS) method involves adding the squared differences within each treatment and then adding the totals across all treatments to get a single value. The total sum of squares is:

$$SST = \sum\sum(X - \bar{X})^2 \quad (4)$$

and the squared differences between each observation and the overall sample mean are added together to get the overall sample mean. Data are grouped by comparison or treatment groups in an ANOVA. SST would indicate the numerator of the sample variance estimated on the pooled or total sample if all of the data were pooled into a single sample. SST is not directly figured into the *F* statistic. However,

$$SST = SSB + SSE \quad (5)$$

thus if two sums of squares are known, the third can be computed from the other two.

3. The third column contains degrees of freedom. The between treatment degrees of freedom is

$$df_1 = k - 1 \quad (6)$$

The error degrees of freedom is

$$df_2 = N - k \quad (7)$$

The total degrees of freedom is

$$(k - 1) + (N - k) = N - 1) \quad (8)$$

4. The fourth column contains "Mean Squares (MS)" which are computed by dividing sums of squares (SS) by degrees of freedom ($df$), row by row. Specifically,

$$MSB = \frac{SSB}{k - 1} \quad (9)$$

and

$$MSE = \frac{SSE}{N - k} \quad (10)$$

dividing

$$\frac{SST}{N - 1}$$

produces the variance of the total sample. The *F* statistic is in the rightmost column of the ANOVA table and is computed by taking the ratio of MSB and MSE:

$$F = \frac{MSB}{MSE} \quad (11)$$

*3.2.3 T-test*

The following procedures can be used to calculate the t-test formula:

1. To begin, determine the observed sample mean as well as the theoretical population means. The sample mean and population mean is denoted by $\bar{x}$ and $\mu$, respectively.
2. Next, calculate the sample's standard deviation, and it is denoted by $s$.
3. The sample size, or the number of data points in the sample, is then be determined. It is denoted by $n$.
4. Finally, utilising the observed sample mean (Step 1), theoretical population means (Step 1), sample standard deviation (Step 2), and sample size (Step 3), the t-test formula can be obtained, as shown below.

$$t = \frac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}} \quad (12)$$

## 4. Results and discussion

***Table 2: Description of Respondents***

| Personal Details | Number | Percentage |
|---|---|---|
| University | | |

| | | |
|---|---|---|
| UTM | 22 | 50.00% |
| Non UTM | 22 | 50.00% |
| Age Category | | |
| 20-30 | 7 | 15.91% |
| 31-40 | 22 | 50.00% |
| 41-50 | 8 | 18.18% |
| 51-60 | 7 | 15.91% |
| Gender | | |
| Male | 13 | 29.55% |
| Female | 31 | 70.45% |
| Stay with | | |
| Alone | 8 | 18.18% |
| Family Members | 34 | 77.27% |
| Housemate/Roommate | 2 | 4.55% |

Table 2 summarises the respondents' demographic characteristics by university, age category, gender, and whether they stay alone or with their family members/ housemate/ roommate. There number of respondents from UTM and non UTM are the same that is 22 respondents from each group. Additionally, half of the respondents (50.00%) are from the age category of 31-40. They are thought to be capable of providing a broader perspective on this research study. Additionally, 70.45% of the respondents are female while 29.55% of the respondents are male. It demonstrate that there are more female mathematics lecturers provide responses to the survey questionnaires than male mathematics lecturers. Additionally, more than half of the respondents (77.27%) stay with their family members followed by 18.18% of the respondents stay alone and 4.55% of the respondents stay with their housemate/ roommate.

***Figure 1: Online Teaching***

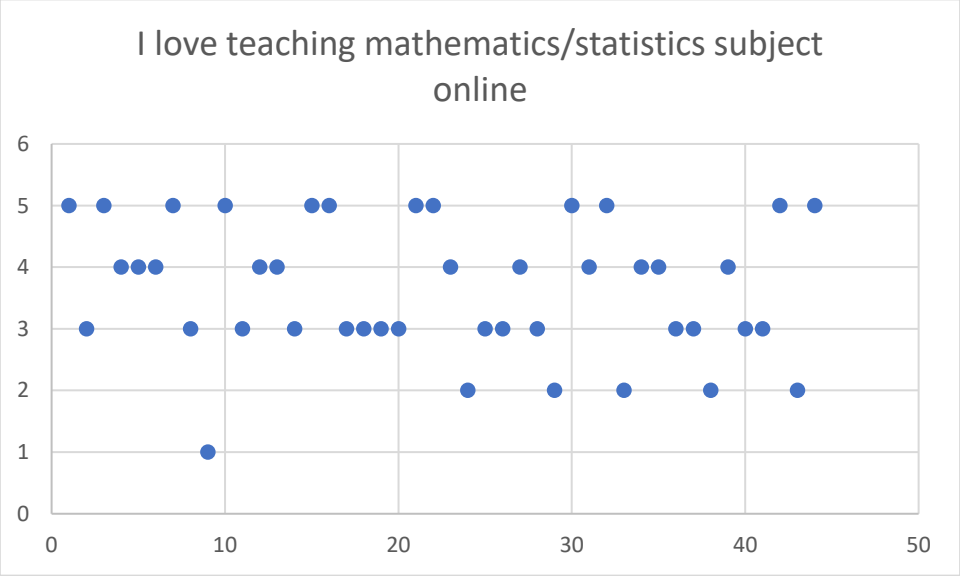


Figure 1 shows the scatter plot on the lecturers who love teaching mathematics and statistics subject online. Based on the plot, we can see that most of the mathematics and statistics lecturers neither agree nor disagree that they love teaching mathematics and statistics subject online.

***Figure 2: Regression Model for Online Teaching***

| *Regression Statistics* | |
|---|---|
| Multiple R | 0.844 |
| R Square | 0.712 |
| Adjusted R Square | 0.682 |
| Standard Error | 0.609 |
| Observations | 44 |

ANOVA

| | *df* | *SS* | *MS* | *F* | *Significance F* |
|---|---|---|---|---|---|
| Regression | 4 | 35.720 | 8.930 | 24.083 | 4.32696E-10 |
| Residual | 39 | 14.462 | 0.371 | | |
| Total | 43 | 50.182 | | | |

| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* |
|---|---|---|---|---|---|---|
| Intercept | 0.279 | 0.545 | 0.512 | 0.611 | -0.824 | 1.383 |
| Online tools are easy to use for teaching mathematics/statistics subject | 0.475 | 0.119 | 3.984 | 0.000 | 0.234 | 0.716 |
| Online teaching give me flexibility with teaching hours | -0.033 | 0.117 | -0.280 | 0.781 | -0.269 | 0.204 |
| Online teaching has more advantages compare to the traditional teaching | 0.438 | 0.127 | 3.444 | 0.001 | 0.181 | 0.696 |
| I can apply many teaching techniques during online class | 0.074 | 0.116 | 0.643 | 0.524 | -0.160 | 0.309 |

Figure 2 shows the regression model result that is represented as:

$$Y = 0.279 + 0.475X_1 - 0.033X_2 + 0.438X_3 + 0.074X_4 \quad (13)$$

Based on the result, we can see that the R Square value which is 0.712 is quite a good fit and this indicating that 71.2% of the values fit the regression model for online teaching. Next, we can see that the value of significance F is smaller than 0.05. We reject $H_0$ at level of significance 0.05. The regression model for online teaching is statistically significance which implies that there is a relationship between the variable $Y$ and the variables $X$. Moreover, most of the independent variables have the positive coefficient except for $X_2$. There is a negative association between $Y$ and $X_2$.

The p-values for $X_1$ and $X_3$ are smaller than 0.05 which indicate that the relationship between $Y$ and $X_1$, $X_3$ is strong whereas the p-values for $X_2$ and $X_4$ are greater than 0.05 which indicate that the relationship between $Y$ and $X_2$, $X_4$ is not strong. This means that the variable $Y$ is highly depend on $X_1$ and $X_3$ but not much affected by $X_2$ and $X_4$. The data shows that the lecturers who love teaching mathematics and statistics subject online are also agree that the online tools are easy to use for teaching mathematics/statistics subject online and the online teaching has more advantages compare to the traditional teaching.

***Figure 3: Student Engagement***

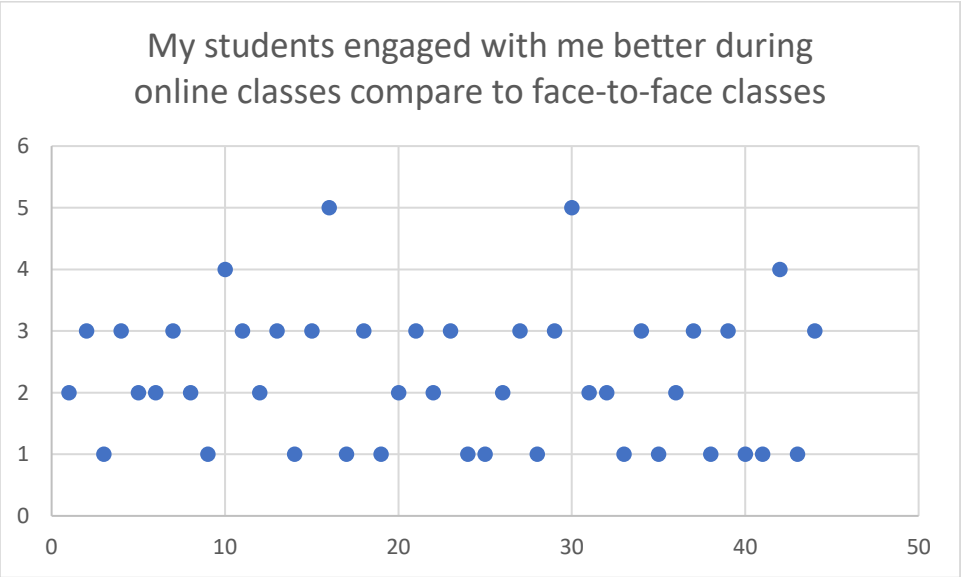


Figure 3 shows the scatter plot on the lecturers who have better student engagement during online class compared to face-to-face class. Based on the plot, we can see that most of the mathematics and statistics lecturers neither agree nor disagree that they have better student engagement during online class compared to face-to-face class.

***Figure 4: Regression Model for Student Engagement***

| *Regression Statistics* | |
|---|---|
| Multiple R | 0.796 |
| R Square | 0.634 |
| Adjusted R Square | 0.596 |
| Standard Error | 0.700 |
| Observations | 44 |

ANOVA

| | *df* | *SS* | *MS* | *F* | *Significance F* |
|---|---|---|---|---|---|
| Regression | 4 | 33.123 | 8.281 | 16.884 | 4.12413E-08 |
| Residual | 39 | 19.127 | 0.490 | | |
| Total | 43 | 52.250 | | | |

| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* |
|---|---|---|---|---|---|---|
| Intercept | -0.415 | 0.394 | -1.051 | 0.300 | -1.212 | 0.383 |
| My students will ask question if they don't understand any part of the lesson during online class | 0.249 | 0.118 | 2.111 | 0.041 | 0.010 | 0.488 |
| I am happy with the lecturer-student interaction during online class | 0.369 | 0.118 | 3.124 | 0.003 | 0.130 | 0.609 |
| My students give a good feedback on my online class | 0.099 | 0.126 | 0.783 | 0.438 | -0.156 | 0.353 |
| Lack of interaction with students is better way of teaching | 0.275 | 0.144 | 1.903 | 0.064 | -0.017 | 0.566 |

Figure 4 shows the regression model result that is represented as:

$$Y = -0.415 + 0.249X_1 + 0.369X_2 + 0.099X_3 + 0.275X_4 \quad (14)$$

Based on the result, we can see that the R Square value which is 0.634 is quite a good fit and this is indicating that 63.4% of the values fit the regression model for student engagement. Next, we can see that the value of significance *F* is smaller than 0.05. We reject $H_0$ at level of significance 0.05. The regression model for student engagement is statistically significance which implies that there is a relationship between the variable $Y$ and the variables $X$. Moreover, all of the independent variables have the positive coefficient. There is a positive association between variable $Y$ and variables $X$.

The *p*-values for $X_1$ and $X_2$ are smaller than 0.05 which indicate that the relationship between $Y$ and $X_1$, $X_2$ is strong whereas the *p*-values for $X_3$ and $X_4$ are greater than 0.05 which indicate that the relationship between $Y$ and $X_3$, $X_4$ is not strong. This means that the variable $Y$ is highly depend on $X_1$ and $X_2$ but not much affected by $X_3$ and $X_4$. The data shows that the lecturers who have better student engagement during online classes compare to face-to-face classes are also agree that their students will ask question if they don't understand any part of the lesson during online class and they are happy with the lecturer-student interaction during online class.

***Table 3: T-test***

| | *I love teaching mathematics/statistics subject physically* | *I love teaching mathematics/statistics subject online* |
|---|---|---|
| Mean | 4.455 | 3.636 |
| Variance | 0.579 | 1.167 |
| Observations | 44 | 44 |
| Pearson Correlation | -0.445 | |
| Hypothesized Mean Difference | 0 | |
| df | 43 | |
| t Stat | 3.448 | |
| P(T<=t) one-tail | 0.001 | |
| t Critical one-tail | 1.681 | |
| P(T<=t) two-tail | 0.001 | |
| t Critical two-tail | 2.017 | |

Table 3 shows the t-test result to test whether the lecturers who love online teaching have similar score with the lecturers who love physical teaching. Based on the result, we reject $H_0$ at level of significance 0.05, since the *p*-value = 0.001 is smaller than 0.05. This means that the mean is not the same. There is a significance difference in score between two groups of data which implies that the lecturers who love online teaching do not have similar score with the lecturers who love physical teaching.

## Conclusion

In conclusion, all the research objectives are successfully achieved based on the results obtained using different analysis of data. The lecturers who love teaching mathematics and statistics subject online are also agree that the online tools are easy to use for teaching mathematics/statistics subject online and

the online teaching has more advantages compare to the traditional teaching. In addition, the lecturers who have better student engagement during online classes compare to face-to-face classes are also agree that their students will ask question if they don't understand any part of the lesson during online class and they are happy with the lecturer-student interaction during online class. Furthermore, the lecturers who love online teaching do not have similar score with the lecturers who love physical teaching.

**Acknowledgement**
The researcher would like to thank the research supervisor, Dr. Nur Arina Bazilah binti Kamisan, for providing encouragement and direction throughout this research. It was a great privilege and honor to work and study under her supervision. Without her continued support and interest, this research would not have been the same as presented here.

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