



RESEARCH ARTICLE

The Full Factorial Design Approach to Determine the Attitude of University Lecturers toward e-Learning and Online Teaching due to the COVID-19 Pandemic

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ABSTRACT

The purpose of this study was to determine faculty members' attitudes toward online learning in Kurdistan region universities. The study examined the biographic and personal characteristics of the lecturer toward e-learning. The data were collected among faculty members at Cihan University-Sulaimaniya, and to analyze the data, a full factorial design with five main factors at two levels and no central points was applied for this specific purpose. The study's findings indicated that there was no significant relationship between gender and lecturer attitude toward e-learning. In comparison to teachers with an MSc degree, those with a PhD have a more negative attitude toward e-learning. Furthermore, full-time faculty members have a greater positive effect on teachers' attitudes than part-time lecturers. Likewise, the results indicate that lecturers who earned their most recent education degrees outside of Iraq have a more favorable attitude. Similarly, lecturers in the sciences are more favorable to e-learning than those in the arts and social sciences. In addition, the findings demonstrated that the interaction factors (Gender) and (Education Degree) have a negative effect on lecturers' attitudes when they are combined. Besides that, the interaction of factors (Country of Last Education Degree) and (Faculty Member Types) improves attitudes toward e-learning. Based on the results, it is suggested that academic staff receive e-learning training to deepen their knowledge and understanding of such a modern teaching system. There is also a need to enhance factors related to positive attitudes toward e-learning among university lecturers. The findings of this study are necessarily significant to both teachers and educational organizations in Kurdistan Region universities.

Keywords: e-Learning, attitudes, COVID-19, faculty members, factorial design

INTRODUCTION

One of the most influential sectors of human life that were stopped due to the coronavirus in most countries was the university education system. According to reports by UNESCO, numerous governments around the world have closed their educational institutes for the short term to control the spread of the COVID-19 Pandemic. Approximately 1.725 billion college students globally have been suffering from the closure of colleges due to the coronavirus pandemic. In line with the UNESCO monitoring report, 192 countries have applied for nationwide closures.^[1] Staying in quarantine at home and avoiding daily physical interactions with others is one way to control the severity of this virus and prevent its rapid spread. That is why most countries and universities have decided to use online teaching as an alternative educational methodology.^[2]

In most developed countries, universities offer not only face-to-face instruction but also distance learning options for students who prefer to study at home rather than on campus. Based on the effects of the COVID-19 disease, a new education

system was mandated by the Ministry of Higher Education for the Kurdistan Region universities, which was a blended education system, or a mixed education system, in which the practical lectures are taught face-to-face on the campus, but the theoretical ones are online.^[3,4]

When compared to developed countries, developing countries such as Iraq and the Kurdistan Region face several

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obstacles when applying for online education. It might be due to the lack of having a strong internet connection and insufficient skills in the use of information technology.^[5,6] Likewise, learning how to use a new modern platform and an advanced application is still a weird thing, even at universities in developing countries.^[7,8] The problem statement for this project is students' dissatisfaction with the online system, as well as teachers' performance in using it.

The main research questions that guided the study are:

1. What are teachers' attitudes toward e-Learning, In general?
2. Is there any association between each the factors (Education Degree, Types of Faculty Members, the Country of the Last Education's Degree, Gender, Stream of Education), and Teachers' Attitude Toward e-Learning?
3. Is there any interaction effect between the factors towards e-learning?

The Objective of the Study

The essential goals of this research are to examine teachers' attitudes toward e-learning in Kurdistan Region universities and find out the factors that influenced their attitudes toward e-learning during the COVID-19 Pandemic.

The Significance of the Study

The importance of this research is to increase the desire of teachers for the use of an online education system that may, in the next few years, replace the current system of on-campus education.

The Hypothesis of the Study

The first hypothesis (H1): there are no statistically significant differences in the attitudes of lecturers toward e-learning implementation, whether they are male or female.

The second hypothesis (H2): There are no statistical differences in lecturers' attitudes toward e-learning based on the type of faculty members.

The third hypothesis (H3): There are no statistical differences in lecturers' attitudes towards e-learning based on their education degrees.

The fourth hypothesis (H4): There are no statistical differences in lecturers' attitudes toward e-learning based on the last education degree in a country.

The fifth hypothesis (H5): there are no statistically significant differences in the attitudes of lecturers toward e-learning implementation, whether their stream of education is art or science.

LITERATURE REVIEW

Lecturer attitudes are extremely crucial for successfully establishing and implementing an educational method in the teaching and learning process. On the other hand, teachers are the central figures in all formal education, and their attitudes toward e-learning have a significant impact on their decisions to accept or reject the system. In other words, the success of e-learning in education is highly dependent on the lecturers' attitudes toward it.^[9,10]

Effectively initiating and implementing instructional innovation in e-Learning processing at the university is highly dependent on lecturers' attitudes. Thus, understanding lecturers' personal characteristics is a prerequisite for implementing an e-learning system.^[11] Academic staff demographic and personal characteristics, such as educational degrees, gender, educational stream, faculty type, and country of last educational degree, may influence lecturers' favorable attitudes toward the e-learning system. Several previous studies have examined the demographic and personal characteristics of teachers in relation to e-learning.

There was a study that investigated the factors of gender in e-learning and discovered that gender has no influence on teachers' attitudes. In other words, there is no statistically significant difference in attitudes regarding e-learning between men and women.^[8,12] In addition, the literature links teachers' attitudes to their personal characteristics. Demographic characteristics, including gender, education level, and age, had no significant effect on their attitudes toward online learning. Teachers' nationality and marital status, on the other hand, have significant attitudes toward e-learning.^[13] University teachers in the arts have negative attitudes toward e-learning, whereas lecturers in the sciences have positive attitudes.^[14]

Methodology

The general purpose of this study is to examine lecturer support and attitudes toward e-learning in terms of several personal variables and to determine the direction of their attitudes and the level of correlation between these variables. The questionnaire consists of two main sections. The first section contains the demographic profile of the participants, such as gender, education degree, types of faculty members, last education degree country, and stream of education, while the second part includes 15 statements that describe overall attitudes toward e-learning, and a five-point Likert scale was used to rate each item from strongly disagree to strongly agree. Then, JMP statistical software was used to analyze the data to apply a full factorial design. Since there are five main factors, and each factor has two levels with a response variable, we used a 2^k factorial design. which included (five main factors) indicates five main effects, and a $\binom{5}{2} = 10$ two-factor interactions). Three-factor interactions and above are very rarely significant effects.^[15]

Description and Selection of Levels

To conduct a 2^5 full factorial design, all factors must be set to two levels, the low and high levels. The factors used in the experiment and their associated levels are given in the following Table 1.

The Planning Matrix and Experiment Results

The planning matrix and experiment results for 2^5 full factorial design with 32 runs, and without any center point get the following raw data. Then, a randomized order was used to execute test runs of the design Table 2.

Data Analysis

We need to achieve a model between the response variable (University lecturers' attitudes toward e-learning) and the five factors to clarify their power of relationships and the

Table 1: Factors and their levels

Factors	Low (-1)	High (+1)
A: Gender	Female	Male
B: Education Degree	MSc degree	PhD Degree
C: Types of Faculty Members	Part-Time	Full-Time
D: Last Education degree's country	Inside (Iraq)	Outside (Other Countries)
E: Streams of Education	Art	Science

Table 2: Planning matrix and experiment results

#	Pattern	A	B	C	D	E	Y
1	-----	-1	-1	-1	-1	-1	2.44673
2	+-----	1	-1	-1	-1	-1	1.98352
3	-+-----	-1	1	-1	-1	-1	1.54322
4	++-----	1	1	-1	-1	-1	2.05211
5	---+---	-1	-1	1	-1	-1	3.10284
6	++++---	1	-1	1	-1	-1	2.19841
7	-++---	-1	1	1	-1	-1	2.273441
8	+++---	1	1	1	-1	-1	2.31429
9	-----+	-1	-1	-1	1	-1	3.49831
10	+-----+	1	-1	-1	1	-1	3.40167
11	-+-----+	-1	1	-1	1	-1	3.39617
12	++++---	1	1	-1	1	-1	3.38519
13	---+---	-1	-1	1	1	-1	3.73804
14	+-----+	1	-1	1	1	-1	3.51055
15	-++---	-1	1	1	1	-1	3.68208
16	++++---	1	1	1	1	-1	3.44734
17	-----+	-1	-1	-1	-1	1	2.95147
18	+-----+	1	-1	-1	-1	1	2.22851
19	-+-----+	-1	1	-1	-1	1	2.11037
20	++++---	1	1	-1	-1	1	2.4
21	---+---	-1	-1	1	-1	1	3.26823
22	+-----+	1	-1	1	-1	1	2.77876
23	-++---	-1	1	1	-1	1	2.67552
24	++++---	1	1	1	-1	1	2.974158
25	-----+	-1	-1	-1	1	1	4.32626
26	+-----+	1	-1	-1	1	1	4.59298
27	-+-----+	-1	1	-1	1	1	3.84214
28	++++---	1	1	-1	1	1	4.62367
29	---+---	-1	-1	1	1	1	4.26693
30	+-----+	1	-1	1	1	1	4.60214
31	-+-----+	-1	1	1	1	1	4.72248
32	++++---	1	1	1	1	1	4.48045

effects which influenced the e-learning during the COVID-19 pandemic.

The results of Table 3 show that R-Square is 0.967806, meaning that the factors altogether explain a large amount of 96.78% of the variance in response variable (university lecturers towards e-learning), and it is evidence that the model is appropriate. Furthermore, Root Mean Square Error shows a quite low 0.22727.

Figure 1 is a half-normal plot of parameter that employed to show the effect of main factors on the Y response (university lecturers' attitudes toward e-learning). All the factors that lie along the blue line (Lenth's Pseudo Standard Error) are negligible. In contrast, the large effects, or significant factors are far from the blue line. The most significant effects based on this analysis show the main effects of D (last Education degree's country), E (Stream of Education), C (Types of Faculty

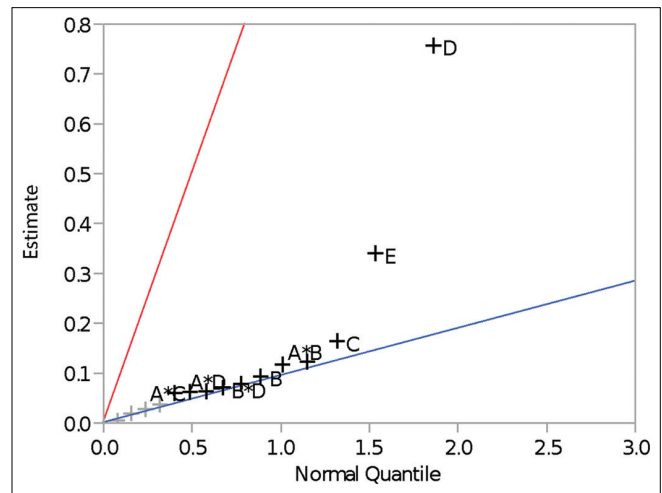


Figure 1: Half-normal probability plot for the factors and their interactions

Table 3: Summary of Fit

R-Square	0.967806
Root Mean Square Error	0.22737
Mean of Response	3.213062
Observations	32

Table 4: Parameter estimate

Term	Estimate	Std Error	t Ratio	Prob> t
D	0.7567132	0.040194	18.83	<0.001*
E	0.3396924	0.040194	8.45	<0.001*
C	0.1641668	0.040194	4.08	0.0009*
D*E	0.1226638	0.040194	3.05	0.0076*
A*B	0.1166893	0.040194	2.90	0.0104*
B	-0.092898	0.040194	-2.31	0.0345*
C*D	-0.077691	0.040194	-1.93	0.0711
B*D	0.0705625	0.040194	1.76	0.0983
A*D	0.0629263	0.040194	1.57	0.1370
A*C	-0.061764	0.040194	-1.54	0.1439
A*E	0.0595318	0.040194	1.48	0.1580
B*C	0.0368887	0.040194	0.92	0.3724
A	-0.027203	0.040194	-0.68	0.5082
B*E	0.0187418	0.040194	0.47	0.6473
C*E	0.0041624	0.040194	0.10	0.9188

Members), and it looks like there are some interactions effects between the factors.

The above Figures 2 are the visualization of confidence intervals (CI) that can be applied to the F-test by using a leverage plot. The first panel shows the overall test of the model which explains the linearly relationship between actual values and the predicted values of response Y. Likewise, the other panels are the main factor effects for A, B, C, D, and E, respectively. Each panel displays the mean as a horizontal line (blue line), a regression line (red line), and a 95% CI. Since, the significance of each effect is indicated by the CIs and the mean, when the CI crosses the mean line, indicating a significant effect. As the result, there are some significant effects of the main factors (B), (C), (D), and (E), whereas factor A (gender) is insignificant.

$$Y = -0.092898 (B) + 0.1641668 (C) + 0.7567132 (D) + 0.3396924 (E) - 0.1163893 (A*B) + 0.1226638 (D*E) \quad (1)$$

According to the results in Table 4, the main factors of D, E, C, and B are statistically significant due to their small P-values

which are less than. On the other hand, since the P-value of the main factor A (Gender) is equal to 0.5082 and it is larger than, indicates that gender is statistically insignificant or shows no effect. Furthermore, there is a meaningful interaction between factors D and E which shows a positive effect on the response Y. Likewise, there is a significant interaction between factors A and B toward a positive direction. Consequently, the regression model equation becomes as below:

In the linear regression equation (1), factor (B: Education Degree) has a negative effect on the (University lecturers' attitudes toward e-learning), indicating that teachers with a PhD degree 9.22898% have a more negative attitude towards e-learning than holders of MSc degree. As well, factor (C: Types of Faculty Members) has a positive impact on the teachers' attitudes. In other words, full-time lecturers 16.411668% have more positive towards e-learning than part-time lecturers. Furthermore, factor (D: Last Education Degree's Country) has a positive influence on the teachers' attitudes towards e-learning, and the results illustrated that the lecturers whose last

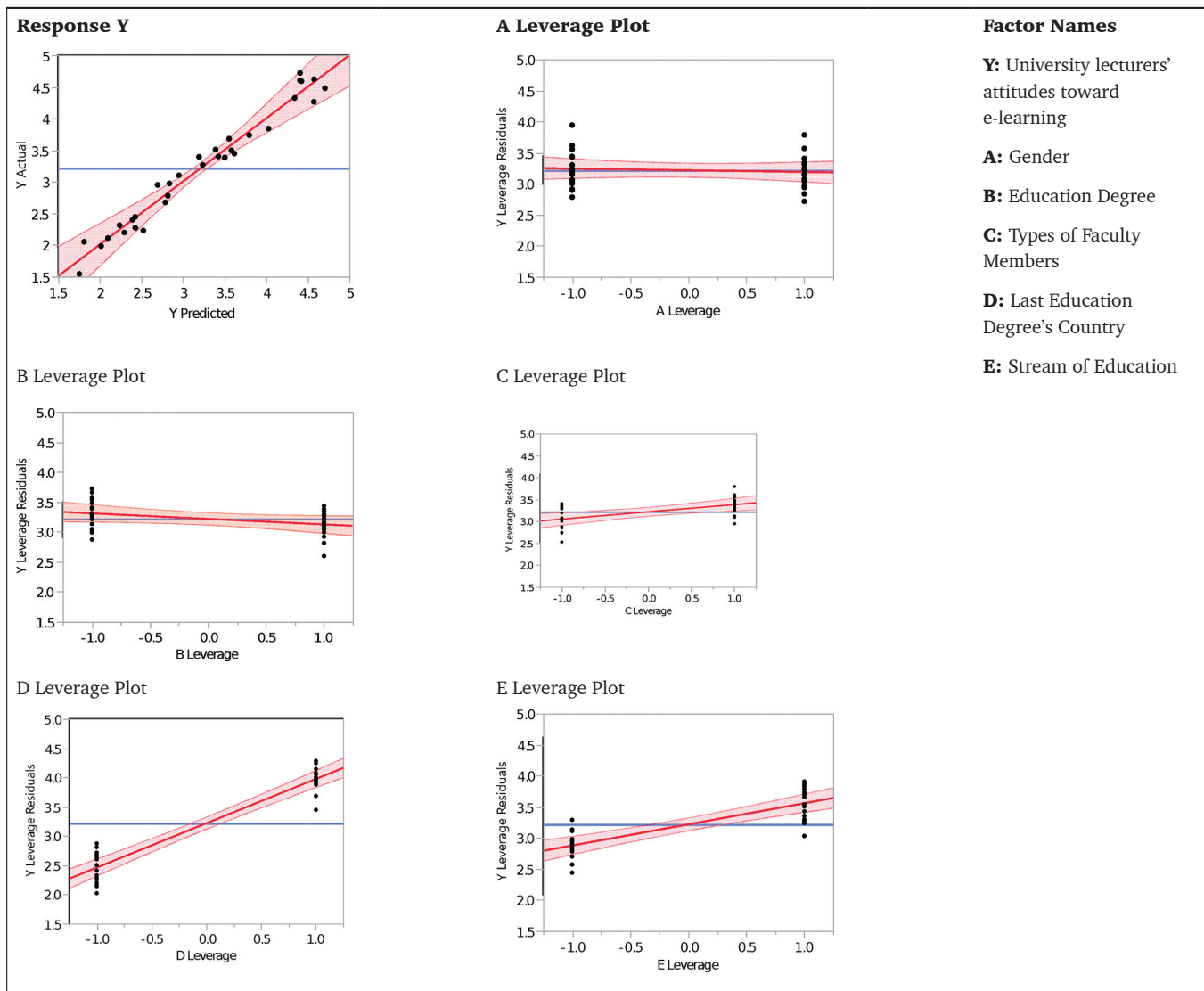


Figure 2: Leverage plots important factors

education degrees were outside of Iraq 75.67132% have a more positive attitude. Likewise, for the main factor (E: Stream of Education), the results show a positive effect on the teachers' attitudes. To clarify, the lecturers in the scientific field 33.96924% have a more positive attitude towards e-learning than those in the art field. When it comes to interaction cases, the results demonstrate that factors (A: Gender) and (B: Education Degree) together have a negative impact on the lecturers' attitudes. In other words, male lecturers with a doctoral degree 11.63893% have a more negative attitude. Furthermore, the interaction of factors (D: Last Education Degree's Country) and (C: Types of Faculty Members) together have a positive impact. In such a way, full-time faculty members that got their last degree outside the country 12.26638% have a more positive attitude towards e-learning during the covid-19 pandemic.

Figure 3 depicts a normal quantile plot and a histogram that is used to examine the normality of the residuals, which is one of the linear regression presumptions. Since the histogram plot is like a symmetric bell curve and the points on the quantile plot close to the line, the results show a typical normal residual of the data.^[16]

In order to get an unquestionable normality result, the Shapiro-Walk test can be used. As the results in Table 5, while

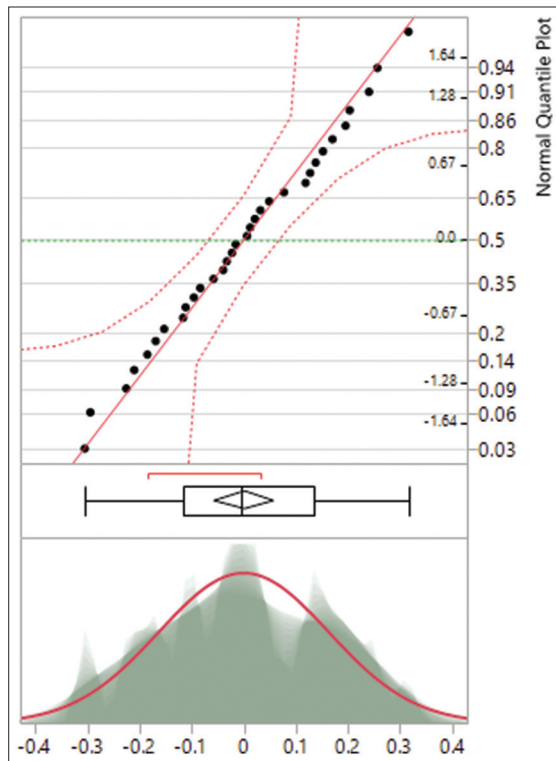


Figure 3: Normal quantile plot

Table 5: Goodness-of-Fit Test

Shapiro-Wilk W Test	
W	Prob<W
0.983344	0.8888

Ho=The data is from the Normal distribution. Small P values reject Ho

the (Prob <W) = 0.8888, and it is larger than 0.05, indicating that there is no evidence to reject the normality distribution of the data.

CONCLUSIONS

The purpose of this study was to identify the most effective factors for increasing positive attitudes toward e-learning among faculty members at Cihan University-sulaimaniya. In the full factorial designs finding the effect of main factors of (Education Degree), (Types of Faculty Members), (Last Education Degree's Country), and (Stream of Education) are positively significant on the e-learning attitudes. Furthermore, the effect of interaction "Gender and Education Degrees" was negatively effective. Likewise, the effect of interaction "Last Education Degree's Country and Types of Faculty Members" is positive significant.

The findings illustrated that the attitude toward e-learning increased when the faculty members were full-time rather than part-time lecturers. It indicates that every university has its own online education system, and full-time lecturers should be more familiar with the system compared to part-time ones. Similarly, faculty members with non-Iraqi education degrees showed a higher level of attitude toward online learning than Iraqi education degrees, and this is because most of the non-Iraqi education degrees came from developed countries such as the USA, Europe, and other advanced countries. Next, lecturers in the scientific field have a more positive attitude towards e-learning than lecturers in the art field. The lecturers working in the scientific fields have a higher level of knowledge about computers and information technology than those working in the art and social sciences fields. On the other hand, higher level of education degrees showed a negative effect on the faculty member's attitude. The reason could be that PhD holders are older, and it is obvious that computer and information technology have been hard to obtain in our country for the last two decades.

When it comes to the interaction between factors, the results showed that male lecturers with a doctoral degree have a more negative attitude, and the full-time faculty members with non-Iraqi education degrees have a more positive attitude toward e-learning.

RECOMMENDATIONS

Based on the finding results of this study, making the following recommendations

- Lecturers must develop their abilities and skills to use technology to the maximum extent possible in their distance education.
- Conduct similar research to obtain additional information about faculty members attitude toward e-learning.
- Additional research is recommended to identify some different variables such as (years of experience and scientific titles) that may affect lecturer attitudes toward e-learning.
- It would be beneficial to see the results from this research expanded to include lecturers and universities in order to ensure the effectiveness of e-learning.

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