# Identifying the variables that favor the application of the course system instead of the annual system

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## Abstract

Iraqi higher education institutions vary in the application of educational systems. Some of them adopt the annual system, others adopt the course system, and a few adopt the credit hour system. Technical education in Iraq has taken its share of applying the different educational systems, and recently it has relatively settled on applying the course system. A mathematical model was built to predict the likelihood of applying the course system instead of the annual system, using the logistic regression analysis technique, by identifying the independent variables with a significant impact from the total number of variables, which amounted to 13 variables. It was found that 7 variables were statistically significant, and they were arranged according to their importance. The tests proved the accuracy and strength of the model, as the percentage of correct classification reached 90.8%.

## 1. Introduction

Iraqi higher education institutions vary in the application of academic systems. Some of them adopt the annual system, others adopt the course system, and rarely apply credit hours. If we compare the advantages of each of the two semester systems, we find that in the semester system, the student studies more and more diverse subjects, and the number of weekly hours is flexible.

As for technical education in Iraq, it also had its share of applying different educational systems, and recently it has relatively settled on applying the course system [1, 2].

Our research deals with studying the course system and the annual system by identifying the variables that have a significant impact on the preference to use the course system instead of the annual system, through studying a sample of lectures in technical education. A special questionnaire prepared for this purpose was used, and the logistic regression analysis method was applied, through which the variables with a significant impact are identified and arranged according to their importance and variables with nonsignificant impact are excluded.

The importance of the research stems from the necessity of having a mechanism to choose the most effective educational system from the lectures' point of view. The research aims to identify and arrange the variables that have a significant impact on the preference for the course system or the annual system by building an effective mathematical model. The hypothesis was represented by the importance of all the independent variables and their parameters referred to in the research.

The issue of construct a model has been addressed by many researchers, and the most critical research and studies on the subject were: Study (2022) studied job satisfaction among private university lecturers, and the study identified (16) as an independent variables that has an effect on the dependent variable that represents job satisfaction for a sample of size (50) of private university lecturers, and the logistic regression analysis technique was applied and an effective mathematical model was built in the classification of the vocabulary, where the percentage of correct classification reached (90%) and the variables with a significant effect are (7) variables [2]. Study (2022) where the study aimed to identify the effectiveness of the educational system at the university stage towards (administration - faculty member - student - university environment - curricula - university tendencies), and the study was conducted on a sample of faculty members, and the study found that there are statistically significant differences in the sample responses between males and females in favor of males, and there are statistically significant differences in favor of the doctorate degree in all study axes [3]. Study (2021), where the variables with significance impact on the e-learning system that was adopted as an alternative to formal education due to the COVID-19 were studied. The study identified a set of variables (8 variables) that have an impact on e-learning. The research was conducted on a sample of (325)    students from one of the higher education institutions. The research concluded with the identification of four variables that have   significance impact, and an effective mathematical model was built that reached its ability to correctly classify is (80%) [4].

## 2. Theoretical Framework

The system as a concept means an entity that includes within it a group of parts that are linked together by relationships, and each part performs a function that in turn complements the other parts. Educational systems include all the elements of the educational process and its components, from goals and objectives, human and material capabilities, curricula and courses, and the functional relationships that link these components and the interaction that occurs between them. Thus, educational systems are a set of rules and regulations within which the educational process takes place, and the success of any educational system is measured by the extent to which the educational process that it organizes achieves goals. The educational system can be divided in terms of its interaction with the environment into two types: The open system which is the system that is characterized by the existence of a basic relationship between it and the surrounding environment, and this characteristic focuses on the importance of continuous interaction between the open system and the surrounding environmental conditions and situations, and thus it is affected by and affects them at the same time. The closed system which is the system that tends to isolate itself and stay away from interacting with the data of the environment, its needs and expectations, and ignores external considerations, which limits its flexibility and interaction with the environment [1, 5, 6].

The educational system consists of a group of components that interact with each other according to specific rules and procedures, including inputs, processes, and outputs. As for educational indicators, they aim to create a comprehensive picture of the educational system, as they work to provide the appropriate environment for making sound decisions by identifying the weaknesses and strengths of the educational system, which facilitates the development of appropriate solutions to address the defects and shortcomings [5, 7].

Educational indicators are a measure of the state of change that occurs in the nature of the educational system's work in relation to the desired goals. Therefore, educational indicators help provide information describing the performance of the educational system in reaching the required conditions and results. Some of this information helps improve performance. They also play an important role in monitoring and evaluating the performance of the educational system by employing them in various fields, whether related to the process of submitting objective reports regarding the nature of educational inputs or regarding the strengths and weaknesses of the educational system [7, 8].

The educational system has characteristics, as it can be said that a successful system is the system that can achieve the efficiency of using the inputs of the educational process in the educational institution to produce the best outputs. Among its most important characteristics: it takes into account the diversity and innate difference in the tendencies, abilities and capabilities of students, and works to develop the student's abilities, build his personality and refine his talents, and reduce waste, and address the problem of students' neglect of lectures, and is able to reconcile the requirements of education with the needs of society, and keep pace with the scientific development taking place in the world, and is characterized by flexibility and works to build a broad base of general culture that enables the student to adapt socially to life in its various aspects [9-11].

Logistic regression analysis is considered a suitable technique for studies that aim to build predictive models in which the dependent variable is qualitative. The logistic regression model is a model used to predict the probability of an event by fitting data to a logistic curve. Logistic regression (especially binary logistic regression), which is common in the uses of logistic regression, uses a binary dependent variable and independent variables that are quantitative or qualitative. The

logistic regression analysis technique does not require many conditions as is the case in regression analysis, for example. The conditions for logistic regression are the absence of multicollinearity between the independent variables and the absence of outliers [8, 12-14]

Logistic regression assumes that the dependent variable (y) takes the value (1) with probability (p), and the value (0) with probability (1-p).

$$E(y1x) = P(y = 1) = P \qquad (1)$$

The model is not applicable from the regression point of view because the value of the right side would be limited between (1, 0), and. Here we will make an appropriate change to the dependent variable (y) in order to solve the problem : $\quad 0 \leq P \leq 1$

Thus, the ratio $(\frac{P}{1-P})$ Is a positive value $(\infty, 0)$, explicitly:

$$0 \leq \frac{P}{1 - P} \leq \infty$$

Then:

$$-\infty \leq \ln\left(\frac{P}{1 - P}\right) \leq \infty \qquad (2)$$

Thus, the regression model can be written in the case of one independent variable:

$$ln\left(\frac{P}{1 - P}\right) = b_0 + \quad b_1 \quad x_1 \qquad 3)$$

And the model be , for more than one independent variable:

$$ln\left(\frac{P}{1 - P}\right) = b_0 + \sum_{i=1}^{n} b_j \quad x_{ij} \qquad (4)$$
$$j = 1,2, \dots, k$$
$$i = 1,2, \dots, n$$

And this represents the logistic regression model. The following transformation $ln\left(\frac{P}{1-P}\right)$ is called (Logit Transformation) [3, 15-18]. Figure 1 represents the form of the logistic function taken by the logistic regression model , which is used to predict.
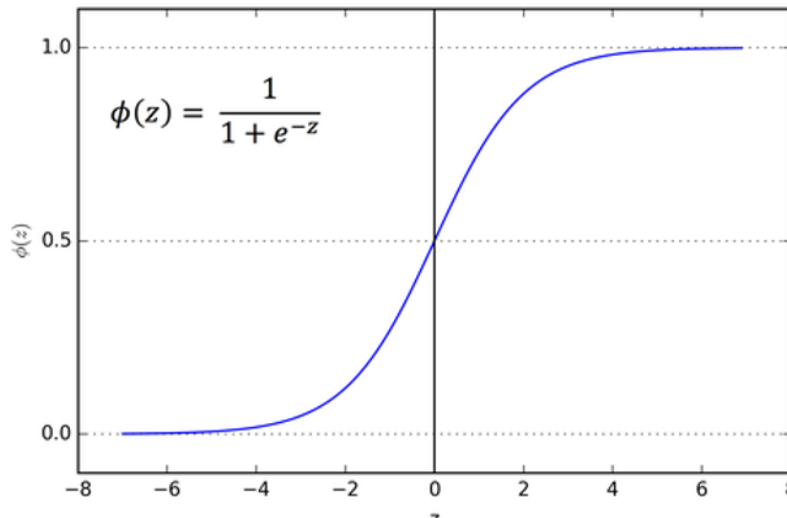


**Figure 1.**
Logistics function.

The above figure, which represents the logistic curve, is based on logistic regression, which takes the following equation:

*2.1. Range*

$$0 \leq f(z) \leq 1$$
$$P = \frac{e^{a+bx}}{1 + e^{a+bx}} = \frac{1}{1 + e^{-(a+bx)}} \dots \dots \dots \dots \dots (5)$$

Instead of the straight-line equation $y = b_0 + b_1 x + e$ . Logistic regression identifies the variables with significant effect and arranges them according to their importance, and excludes the variables with nonsignificant effect. One of the advantages of logistic regression is that it does not require the independent variables to follow a normal distribution, and it is not required that the relationship with the dependent variable be a linear relationship [8, 14, 19].

### 3. Applied Aspect

*3.1. Research Data*

The research data was collected through a questionnaire prepared for this purpose (Appendix No. (1)) and the data represents the opinions of a sample of teachers in technical institutes with a size of (100). To applying the logistic regression analysis technique, the dependent variable (Y) and its values were named, and the independent variables (X, s) and their values were named:

Y = 1, if the teacher's answer to the first question was ≥ 50%

=0, if the teacher's answer to the first question was < 50%

The independent variables (X, s), each one from X1 to X11 only, each one =1, if the answer ≥ 50%, and =0, if the answer< 50%,

X1= The course system gives the administration the opportunity to give the student more subjects.

X2= The time allocated for each semester is proportional to the time required to complete the semester requirements, which is 15 weeks.

X3= The necessity of reviewing and rearranging the syllabus of the study subjects in a manner consistent with the course system.

X4= Providing study requirements such as halls, laboratories, and important educational tools to implement the course system.

X5= Using modern methods in teaching and examination is necessary to increase the student's benefit from the subject matter.

X6=The teacher's experience and academic title have a positive impact on the student's benefit from the scientific subject.

X7= Adopting precise foundations for those teachers assigned to teach the subjects and observing the accuracy of the specialization.

X8= Adopting a flexible approach with the teaching methods and educational tools used by teachers, if they are evaluated considering the outcomes.

X9= Adopting a feedback system by asking students questions and evaluating exam questions and results.

X10= The course system is affected by the student's financial reality.

X11= The nature of the student's specialization has an impact on the application of the course system.

X12= Academic title - Assistant Lecturer (1) – Lecturer (2) - Assistant Professor (4) – Professor (6).

X13= Experience—less than 5 years (1)-5 years to less than 10 years (2) – more than or equal 10 years (3).

X14= Administrative responsibility - has responsibility (2) - has no responsibility (1).

*3.2. Statistical Analysis and Results*

After reviewing and tabulating the sample data, the net sample size (98) was approved, and the SPSS package   was approved. To find the model parameters and tests specific to the model according to the logistic regression analysis technique, the second negative maximum likelihood function was approved, where the lowest value was reached at the seventh rotation, and

-2Log likelihood = 47.950, as in Table 1.

**Table 1.**
Iteration History.

| Iteration | | -2 Log likelihood | Coefficients | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Constant | X1 | X2 | X3 | X4 | X5 | X6 | X7 | X8 | X9 | X10 | X11 | X12 | X13 | X14 |
| Step 1 | 1 | 64.960 | -.109 | .713 | 1.594 | .378 | -.290 | -.545 | .376 | 0.194 | -0.712 | -0.228 | 0.609 | 0.371 | 0.310 | 0.186 | -0.909 |
| | 2 | 52.341 | .101 | 1.193 | 2.511 | .599 | -.413 | -.973 | .520 | -0.030 | -1.204 | -0.444 | 0.890 | 0.601 | 0.548 | 0.353 | -1.370 |
| | 3 | 48.639 | .687 | 1.555 | 3.204 | .876 | -.518 | -1.430 | .560 | -0.527 | -1.535 | -0.666 | 1.056 | 0.648 | 0.802 | 0.477 | -1.730 |
| | 4 | 47.982 | 1.249 | 1.752 | 3.587 | 1.110 | -.606 | -1.757 | .556 | -0.908 | -1.708 | -0.809 | 1.121 | 0.554 | 0.984 | 0.537 | -1.957 |
| | 5 | 47.950 | 1.444 | 1.806 | 3.686 | 1.181 | -.633 | -1.867 | .561 | -1.009 | -1.763 | -0.850 | 1.129 | 0.508 | 1.033 | 0.551 | -2.017 |
| | 6 | 47.950 | 1.457 | 1.810 | 3.692 | 1.186 | -.634 | -1.876 | .562 | -1.013 | -1.768 | -0.853 | 1.128 | 0.505 | 1.036 | 0.551 | -2.020 |
| | 7 | 47.950 | 1.457 | 1.810 | 3.692 | 1.186 | -.634 | -1.876 | .562 | -1.013 | -1.768 | -0.853 | 1.128 | 0.505 | 1.036 | 0.551 | -2.020 |

**Table 2.**
Variables in the Equation.

| | | | | | | | | Lower | Upper |
|---|---|---|---|---|---|---|---|---|---|
| Step 1[a] | X1 | 1.810 | 0.874 | 4.290 | 1 | 0.038 | 6.111 | 1.102 | 33.882 |
| | X2 | 3.692 | 0.995 | 13.754 | 1 | 0.000 | 40.107 | 5.701 | 282.158 |
| | X3 | 1.186 | 1.070 | 1.227 | 1 | 0.268 | 3.273 | 0.402 | 26.664 |
| | X4 | -0.634 | 0.952 | 0.444 | 1 | 0.505 | 0.530 | 0.082 | 3.426 |
| | X5 | -1.876 | 2.427 | 0.598 | 1 | 0.439 | 0.153 | 0.001 | 17.807 |
| | X6 | 0.562 | 1.110 | 0.256 | 1 | 0.613 | 1.754 | 0.199 | 15.451 |
| | X7 | -1.013 | 3.087 | 0.108 | 1 | 0.743 | 0.363 | 0.001 | 154.029 |
| | X8 | -1.768 | 1.224 | 2.085 | 1 | 0.149 | 0.171 | 0.016 | 1.880 |
| | X9 | -0.853 | 1.135 | 0.565 | 1 | 0.452 | 0.426 | 0.046 | 3.940 |
| | X10 | 1.128 | 0.896 | 1.587 | 1 | 0.208 | 3.090 | 0.534 | 17.875 |
| | X11 | 0.505 | 0.932 | 0.294 | 1 | 0.588 | 1.657 | 0.267 | 10.283 |
| | X12 | 1.036 | 0.434 | 5.698 | 1 | 0.017 | 2.819 | 1.204 | 6.600 |
| | X13 | 0.551 | 0.556 | 0.984 | 1 | 0.321 | 1.736 | 0.584 | 5.158 |
| | X14 | -2.020 | 1.010 | 4.001 | 1 | 0.045 | 0.133 | 0.018 | .960 |
| | Constant | 1.457 | 2.946 | 0.245 | 1 | 0.621 | 4.295 | | |

The following Table 2 shows, in addition to the values of the parameters and their significance, the standard error for each parameter (S.E), the Wald statistic, and the logit value.

To test the efficiency and quality of the model, we use the Log likelihood ratio, which follows Chi-square distribution, and according to the following relationship:

$$x^2 = 2[log_e l_0 - log_e l_1] \qquad (6)$$

Thus:

   L1 = the value of the Likelihood function containing (i) variable.

   L0 = the value of the Likelihood function containing (i - 1) variable.

Where the value reached ($x^2 = 63.353$). And it is significant, as shown in Table 3.

**Table 3.**
Omnibus Tests of Model Coefficients.

|        |       | Chi-square | df | Sig. |
|--------|-------|------------|----|------|
| Step 1 | Step  | 63.353     | 14 | 0.000 |
|        | Block | 63.353     | 14 | 0.000 |
|        | Model | 63.353     | 14 | 0.000 |

To determine the goodness of fit of the model that was built, we adopt the Hosmer & Lemeshow test, which depends on calculating the difference between the observed values and the expected values, which follow the chi-square distribution. If the test result is not significant, I. accepting (H0), it confirms the goodness of fit of the model. Table 4 shows the test result:

**Table 4.**
Hosmer and Lemeshow Test.

| Step | Chi-square | df | Sig. |
|------|------------|----|------|
| 1    | 8.448      | 8  | 0.391 |

To know the strength of the model that was built in classifying the sample's units, the model was used to reclassify the units, and the classification results are shown in the following Table5)

**Table 5.**
Classification Table.

|        | Observed | | Predicted | | Percentage Correct |
|--------|----------|--|-----------|--|--------------------|
|        |          | | Y | | |
|        |          | | 0 | 1 | |
| Step 1 | Y | 0 | 20 | 5 | 80.0 |
|        |   | 1 | 4 | 69 | 94.5 |
|        | Overall Percentage | | | | 90.8 |

Referring to Table 2 and noting the values of the parameters (β, s) with significant effect, the model is as follows:
Ln(p/(1-p)) = 1.810X1 +3.692X2 +1.036X12 -2.020X14

The results of Table No. (2) indicate that there are four independent variables that have a significant effect on the dependent variable (y), and they are, in order: (X2) is the first rank, (X2) is the second rank, (X12) is the third rank, and (X14) is the fourth rank, while the remaining variables, which are (X3, X4, X5, X6, X7, X8, X9, X10, X11, X13), have not significant effect on the dependent variable.

## 4. Conclusions and Recommendations

The following are the most important conclusions and recommendations reached by the research:

1-The model parameters with a significant effect are {$\beta_2$ , $\beta_1$, $\beta_{12}$, $\beta_{14}$ } , , while the parameters with non-insignificant effect are { $\beta_3$ , $\beta_4$, $\beta_5$, $\beta_6$, $\beta_7$ , $\beta_8$, $\beta_9$, $\beta_{10}$ , $\beta_{11}$ , $\beta_{13}$}    , and thus some of the research hypotheses have been achieved while others have not been achieved.

2-The results showed the possibility of using the logistic regression analysis technique to identify the variables that favor the use of the course system instead of the annual system, and that the variables with a significant impact, ranked according to their importance, are:

   X2= The time allocated for each semester is proportional to the time required to complete the semester requirements, which is 15 weeks.

   X1= The course system gives the administration the opportunity to give the student more subjects.

   X12= Academic title - Assistant Lecturer (1) – Lecturer (2) - Assistant Professor (4) – Professor (6).

   X14= Administrative responsibility - has responsibility (2) - has no responsibility (1).

3-The tests proved the significance of the model that was built, as the value of the chi-square calculated( $x^2 = 63.353$), with a degree of freedom was (14), which is significant. And the goodness of fit of the model was also verified by adopting the Hosmer& Lemshow test, and the results showed that the test was not significant, which indicates the differences are non-significant, and this confirms the goodness of fit of the model that was built.

4- The classification results showed the strength of the model that was built, as the correct classification percentage of the model reached (90.8%) , which is an excellent percentage for determining the factors that favor the use of the course system rather than the annual system.

5- Because the logistic regression analysis technique represented an effective method in identifying the factors that favor the use of the course system instead of the annual system, we recommend expanding its use in educational studies.

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**Appendix 1.**
Dear Lectures
Good Day

The questionnaire in your hands is to express your point of view regarding determining the variables that favor the use of the course system instead of the annual system. Our dear Lectures, we have been keen to make the questions short and not take up much of your time to answer, so we kindly ask you to answer all the paragraphs of the questionnaire by placing a mark in the field that represents your point of view on the question. Thank you for your cooperation and interaction. We appreciate you.

*First: General information:*

Scientific title: Assistant Lecture  ----      Lecturer  ---      Assistant Professor --      Professor---

Years of experience:  Less than 5 years ----5 years to less than 10 years---- 10 years or more---

Administrative and scientific responsibility: I have responsibility---- I have no responsibility---

Certificate:  Doctorate--- Master---- Other (please mention) ---

Specialization:  General----- Exact---

Second: Questionnaire questions

Please read each of the following statements carefully and put a check mark in the field that represents your point of view regarding the statement and your conviction about it, whether it is 50% or more or less than 50%.

| | | ≥ 50% | < 50% |
|---|---|---|---|
| | I support the application of the course system instead of the annual system. | | |
| 1 | The course system gives the administration the opportunity to give the student more material. | | |
| 2 | The time allocated for each semester is proportional to the time required to complete the semester requirements, which is 15 weeks. | | |
| 3 | The necessity of reviewing and rearranging the vocabulary of the study materials in a manner consistent with the course system | | |
| 4 | Providing study requirements such as halls, laboratories, and important educational tools to implement the course system | | |
| 5 | Using modern methods in teaching and examination is necessary to increase the student's benefit from the subject matter. | | |
| 6 | The instructor's experience and academic title have a positive impact on the student's benefit from the scientific material. | | |
| 7 | Adopting precise foundations for those instructors assigned to teach the subjects and observing the accuracy of the specialization | | |
| 8 | Adopting a flexible approach with the teaching methods and educational tools used by teachers, if they are evaluated in light of the outcomes. | | |
| 9 | Adopting a feedback system through asking students questions as well as evaluating exam questions and results. | | |
| 10 | The course system is affected by the student's financial reality. | | |
| 11 | The nature of the student's specialization has an impact on the application of the course system. | | |