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Evaluation of Teaching Process Using Capability Index

Abstract- This study introduces an application of using Process Capability Index as an approach in evaluating the teaching process. The goal of the study is to build and represent a measure to the effectiveness of teaching process and its impact on the learning level of students. Two groups of students in AL- Mustaqbal University Colledge are taken as a sample. Many quizzes (short exams) were done with each group and their scores were recorded. A statistical analysis is made and the process capabilities are calculated. Results shows that this control technique was effective in improving scores of students and hence the learning level of them .The impact of teaching process on the learning level of a group of students can be represented by two aspects first of them is how far the average score from the target put by the teacher and the second is the range of diversion of these scores about the target value. There are many ways to investigate the learning level of students but the scores gained in consequent exams still be the more direct and representative way. Therefore, this study takes scores as a distinct variable to monitor the process.

Keywords- Learning Level, Pareto Diagram, Process Capability Index, Quality Control

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1. Introduction

The recent methods in evaluating the teaching process in higher education are based on philosophy that is considered not deep enough in treating the data (represented by students' scores) and reaching to the real level of students' learning. Those methods usually use success / fail percentages in evaluation without considering any previous planned values for scores or the variability in these scores [1,2]. This study tries to take in account these issues and introduces an alternative method that is considered more efficient.

2. The Model

The following steps can represent the model of this study:

A. First exam: to Identify x-bar and σ .

This step is made on two groups of students separately. After finishing exam, the scores of students are recorded and they were as in Table 1. Note that these scores are from a maximum of (10) and that they are only for the existing students during exam, for any absent student score is neglected.

Table 1: Scores of the first exam

Scores(S)	Group A	Group B
	Frequency(f)	Frequency(f)
3	5	3
4	2	5
5	10	12
6	5	7

7	6	3
Sum = 28		Sum = 30

The values of x-bar and σ for group A are calculated as following:

$$\bar{x} = \frac{\sum(S \times f)}{\sum(f)}$$

$$= 145 / 28 = 5.2$$

$$\sigma^2 = \left[\frac{\sum(S^2 \times f)}{\sum(f)} \right] - \left[\frac{\sum(S \times f)}{\sum(f)} \right]^2$$

$$= [801 / 28] - [145 / 28]^2 = 1.7895$$

$$\sigma = \sqrt{1.7895} = 1.3$$

$$3\sigma = 3.9$$

$$\text{Lower limit} = \bar{x} - 3\sigma = 5.2 - 3.9 = 1.3$$

The values of x-bar and σ for group B are calculated as following:

$$\bar{x} = \frac{\sum(S \times f)}{\sum(f)}$$

$$= 152 / 30 = 5.1$$

$$\sigma^2 = \left[\frac{\sum(S^2 \times f)}{\sum(f)} \right] - \left[\frac{\sum(S \times f)}{\sum(f)} \right]^2$$

$$= [806 / 30] - [152 / 30]^2 = 1.1956$$

$$\sigma = \sqrt{1.1956} = 1.1$$

$$3\sigma = 3.3$$

$$\text{Lower limit} = \bar{x} - 3\sigma = 5.1 - 3.3 = 1.8$$

The mean value is taken as the target for each group and three standard deviation are taken below this value as lower limit. For any process to be under control, all values of specimens should be greater than the lower limit. As a score of a student, there is no meaning for the provision of being less than the upper limit. Hence, the only provision here is to be higher than the lower limit for all scores. If it is not so, the process is considered out of control and the exam should be repeated [3].

Coming back to Table 1, it can be shown that all scores satisfies the provision in that they are all greater than the lower limits (1.9) for group A and (1.8) for group B. Thus the process is under control for both.

The target value for the next step is taken equal to the mean value of the previous step so that the lower specification limit equals this mean value minus three standard deviations (which is the lower action limit of the previous step). The philosophy under this assumption can be summarized in the following statement:

"Survive and improve"

This means maintaining at least the level of learning that reached by students which can be represented by the mean value and standard deviation of their scores in last exam and in the same time searching deeply the problems of students' learning through a system which is proposed as following:

3. Aspects of Learning Problems

- A: Remembering
- B: Understanding
- C: Application

D: Analysis

The process of identifying problems in learning of students can be listed in a systematic way as follows:

1- Studying problems in the answers of students for each exam and matching each one to one of the aspects listed above (A, B, C and D).

For example:

-Student cannot list the functions of management (or parts of them). This is matched to aspect A

-Student lists the functions of management completely but cannot decide correctly in which of them a time schedule should be considered This is matched to aspect B

-Students cannot construct correctly the network of time schedule. This is matched to aspect C

-Students cannot make suitable analysis to the activities involved and their start and finish dates. This is matched to aspect D

2- Making descending frequencies for the A, B, C, D aspects resulted from (1). This can be presented in a Pareto diagram as in Figure 1 according to data shown in Table 2.

Table 2: Frequencies of learning problems

Aspect	Problems (Second Exam) Frequency	%
D	66	54
A	30	24
C	21	17
B	6	5
Sum	123	100

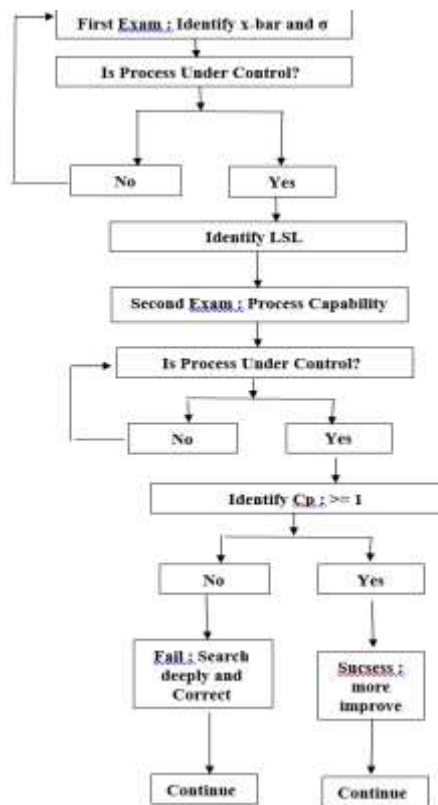


Figure 3: Model Flowchart

4. Conclusions

Conclusions can be made from this study as following

1. A measure of teaching process performance can be built and represented using student scores.
2. The measure indicated in (1) can be used to improve the learning level of students.
3. Numerical evaluation rather than traditional evaluating ways like success percentage and so can be used as a more efficient tool in teaching process.

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