

Developments in Business Simulation & Experiential Learning, Volume 27, 2000
AN APPLICATION OF PROCESS CONTROL CHARTS FOR ATTRIBUTES AS A FORM
OF CLASSROOM ASSESSMENT FOR EXPERIENTIAL LEARNING

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ABSTRACT

The use of Total Quality Management Techniques in classroom assessment aids in determining whether a particular process (experiential exercise) is either in or out-of-control and to assist in identifying possible causes of variation in various aspects of this process. Control charts for attributes (non-conformance) were used to assess this process. It was found that sources could be identified where adjustments can be made that would enhance the process. Limiting the number of standard deviations associated with the control also assisted in identifying where the process would be considered to be in or out-of-control.

INTRODUCTION

In an effort to improve the learning process and enhance experiential learning in the classroom the application of Total Quality Management (TQM) concepts can assist in determining where changes to the learning process can be made. Every process involving humans and/or machines displays variations. Excessive variations, however, causes the process and systems to be erratic and unpredictable and mediocrity and poor quality result. (Cornesky, 1993) By applying the concepts of TQM to classroom assessment, we can attempt to identify causes of variation in the process of classroom learning and begin to make any adjustments necessary. The causes of variation can be identified as being either "common" or random causes or "special" or assignable causes of variation.

TQM's goal in classroom assessment is to ensure that students work together to create the best possible system of learning rather than assuming the current one is the only way.

(Cornesky, 1993) Research was conducted in the fall of 1995 to explore faculty and student perceptions of the effectiveness of the use of the Cross-Angelo Classroom Assessment Techniques (CAT's) as a method of improving the quality of teaching and learning process. (Soetaert, 1998) From this study four areas were identified where assessment techniques were found to be particularly helpful. These areas are: 1) student learning, 2) the process of instruction, 3) the classroom environment, and 4) promotion of student cognition. (Exhibit I) (Soetaert, 1998)

In the exercise under study in this paper, concept mapping, control charts for attributes were used to test the stability of the system and measure variations within that system. Statistical Process Control (SPC) for attributes uses qualitative characteristics and measurements, in determining the success or failure of a product or service. Whereas the normal application of process control is to check for defects or errors occurring in a process, the application in this instance is to test the stability of the process in relation to whether student's realized benefits from the exercise.

METHODOLOGY

Students (n=32) were exposed to a series of three concept mapping exercises over the course of a semester. They were then asked to complete a survey questionnaire that included in their responses the following five areas. These are: 1) when they completed the exercise in relationship to an exam, 2) how much time they spent working on the exercise, 3) whether they worked on it individually or in a group, 4) the instructions concerning the exercise, and 5) which did they find most beneficial in

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developing their understanding, primarily individual work or group work.

A C-chart was used to test the stability of the process. This type of chart is useful when the characteristics or attributes under study are too complex for just a simple yes/no type answer. This complexity is found in non-conformance attributes. Non-conformance attributes are defined as those that do not demand the yes/no response. Those attributes and their response choices are found in Exhibit II. Charts were constructed and upper and lower control limits were calculated for each exercise and then for the exercise as a whole. Totals for each person for each time were plotted on the chart to determine if there were any instances where the process may be considered out of control. These were then compared to what was most beneficial in developing their understanding. (Exhibit III)

The upper and lower control limits were set to two standard deviations rather than three because narrower limits make it easier to detect changes in the process that are not random and have assignable causes. Wider limits (three standard deviations) make it less likely to erroneously conclude that the process is out of control when points outside the control limits are due to normal, random variations.

RESULTS

There were 26 responses to the survey, of which 23 were valid because three people did not complete the second page of the survey.

For each separate iteration of the exercise, the process was found to be in control as no points exceeded either the upper or lower control limits calculated. It was also noticed that for each subsequent iteration of the exercise, the range between the control limits became smaller.

When the separate times were aggregated, and then combined with their perceptions of which

mode was most beneficial, there was only one instance of the upper control limit being exceeded and none that fell below the lower control limit. A majority (n=19) were found to be within 1 standard deviation of the mean.

EXHIBIT I Assessment Area

Student Learning	Identify concepts that are unclear, confused, or missed completely.
Process of Instruction	Monitor new Instruction strategies
Classroom environment	Recognizing student's opinions
Student cognition	Enable students to organize concepts and clarify their thinking about the concepts.

EXHIBIT II Non-Conformance Attributes

1. Was the map completed either:
 - Before attempting the exam
 - While completing the exam
 - After completing the exam
2. Time spent completing the exam:
 - Less than 1 hour
 - 1 to 2 hours
 - 2 to 3 hours
 - More than 3 hours
3. Mode used when completing the map:
 - Worked individually
 - Worked individually, then in a group
 - Worked in a group, then individually
 - Worked in a group
4. Were the instructions concerning the exercise:
 - Poor
 - Fair
 - Adequate
 - Good
 - Excellent

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EXHIBIT III

Which did you find most beneficial in developing your understanding?

- Working individually
- Working individually, then in a group
- Working in a group, then individually
- Working in a group

REFERENCES

Cornesky, Robert., (1993). *The Quality Professor: Implementing TQM in the Classroom*, MAGNA Publications Inc.

Soetaert, Elaine, (1998). Quality in the Classroom: Classroom Assessment Techniques as TQM, *NewDirections for Teaching and Learning*, #75, 47-55