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## Improving Customer Service through Statistical Process Control

Doc. Number: P1-1013r4  
Date: 16 July 2010  
By: Rocco M. Luongo, P.E.

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### 2. EXECUTIVE SUMMARY

The use of surveys and statistics is well known and generally understood in the customer service and professional training industries. Customer surveys are routinely conducted with the goal of improving the quality of services provided. Often, however, is the data examined in a overly simplistic fashion using gut-feelings and rules of thumb in place of mathematical rigor and intelligently designed measurement systems.

This report provides a glimpse into methods which can be used to provide significant, measureable improvements to the customer service and professional training arenas. A fictitious, but representative data set is used for example in this report.

The Power Focus Engineering Approach:

- 2.1. Novel application of Statistical Process Control (SPC) to customer satisfaction data analysis.
- 2.2. Generation of easy to read and understand customized, detailed reports.
- 2.3. Actionable conclusions with statistically valid improvement predictions to eliminate variation and improve overall results.

### 3. INTRODUCTION

*"It is not enough to do your best; you must know what to do, and then do your best."  
- W. Edwards Demming*

The product development and manufacturing industries commonly use statistical process control (SPC) techniques to improve the quality of products and ultimately the satisfaction of customers. This is achieved through continuous improvement activities targeted at reducing the loss function of a given product and/or service. The key to the entire process can be summed up in one simple sentence: Make decisions based on data. The assumption is that a suitable measurement system exists to generate that data, and a competent management team is trained to analyze

108 Bebb Court  
Richland, WA 99352  
+1.509.942.9597  
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and implement order-of-magnitude improvements based on the results of the analysis. Power Focus Engineering has over a decade of volume product development experience and can aid in the development of measurement, analysis, and customized statistics tools for any application.

The basic goal of undertaking any SPC activity is to affect positive measurable change. One must start from a known position and project a target ahead which will be worked for and achieved within a defined time frame. The goal must be specific and measurable. "Improving customer service." is too general of a goal. "Improve mean online training survey 5th percentile scores from a 2.9 out of 5 to a minimum of 4 out of 5 by the end of the fiscal year." is a good goal. The current condition is defined, the expectation is defined, and a timeline has been established.

### **A goal must be measurable to be achievable. A change that is immeasurable is not a change at all.**

A note on terminology: The English language, along with all other languages, is ambiguous. Written words can be interpreted in many ways depending on their context. Power Focus Engineering uses simple, direct language. Terms like: pass, fail, success, failure, problem, execution are just a few. They are meant to describe a situation as efficiently as possible. The first, and often most difficult, step to solving a problem is to define the problem.

#### **4. PLAN - DO - CHECK - ACT CYCLE**

The first method described is the Plan Do Check Act cycle. It is a true cycle in that it always ends at the beginning where the previous action is assessed. This simple concept, in one of many forms, lies at the heart of all continuous improvement activities.

- 4.1. Plan: A new plan for improvement is made.
- 4.2. Do: The plan is executed.
- 4.3. Check: The new results are checked against the old results (this step is most often skipped, with poor results),
- 4.4. Act: The difference from the previous to the current run are analyzed to determine where further opportunity for improvement lies.

#### **5. THEORY IN ACTION**

A fictitious body of data representing survey responses from 243 students, a good valid statistical population, is presented. The students were asked eleven (11) questions to be answered on a scale of 1 - 5 where answers of 5 correspond to strong positive responses and answers of 1 correspond to strong negative responses. For the analysis of this fictitious body of data the mean, the standard deviation, and the 5th percentile mean are calculated and plotted in section 7. The normal (Gaussian) distribution is used for this calculation.

### **The normal distribution is a good first start for this kind of work,**

but ultimately other, customized statistical parameters are indicated for the type of distribution which has discrete values on a short number line (scale of 1-5).

Nevertheless, the method is valid and applicable for a starting point. The mean and the standard deviation are used together to calculate the 5th percentile mean. The 5th percentile mean is used to determine which of the 11 areas of the class should be improved to make the biggest return in the shortest time.

The eleven (11) questions representing key metrics for the class are listed here:

- 5.1. Enrollment process?
- 5.2. Quality of Material Presentation?
- 5.3. Likelihood of taking another online course?
- 5.4. Ease of use?
- 5.5. Expectations met by course material?
- 5.6. Day to day applicability?
- 5.7. Course objectives achieved?
- 5.8. Logical flow of topic?
- 5.9. Relevance of examples?
- 5.10. Site navigation?
- 5.11. Overall ranking?

## 6. WHAT THESE METRICS MEAN

The 50th percentile mean value is analogous to the average value and is calculated in the same way. The standard deviation is a measurement of how wide a disparity in the answers to the same question exists throughout the population. The 5th percentile mean uses a formula and combines the mean and standard deviation of the responses for each question and defines a lower bound below which only a 5% chance exists that the mean would be below that value. A small hypothetical population is used to illustrate the differences in these values.

	Question A	Question B	Question C
<b>Student 1</b>	3.0	4.0	3.1
<b>Student 2</b>	3.0	3.0	3.0
<b>Student 3</b>	3.0	2.0	2.9
<b>Mean</b>	3.0	3.0	3.0
<b>StDev</b>	0.0	1.0	0.1
<b>5th %-ile</b>	3.0	1.4	2.8

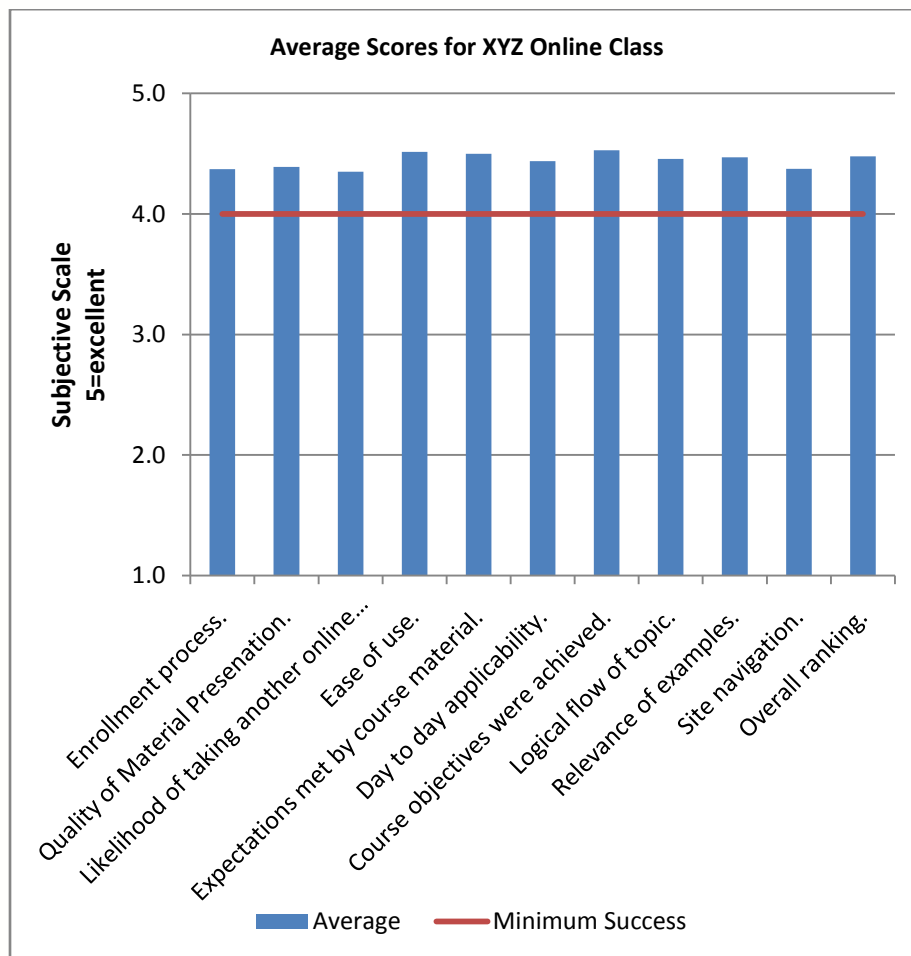
In this example, the population is too small to be statistically significant, and is meant only to illustrate the general methodology. Three students are asked to answer three questions representing qualities of the class they took. Their scores are tabulated. On a scale of 1 - 5 the mean scores are below the success criteria of 4.0. Which of the three class metrics represented by questions A-C should be focused on for the quickest overall improvement? From their answers one can see that the mean

108 Bebb Court  
 Richland, WA 99352  
 +1.509.942.9597  
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value is identical for each question. The standard deviation however is largest for Question B, and this drives the 5th percentile mean down. Illustrating for these three students there is a large amount of variation in their levels of satisfaction with question B. Eliminating variation is one of the keys of improving the performance of any system. Going after the "big hitters" in any system is the fastest way to improve the system. The issues should be worked in order of: B, C, A.

### 7. THE DIFFERENCE BETWEEN 50TH PERCENTILE MEAN AND 5TH PERCENTILE MEAN

Returning to our fictitious population of 243 students, and by taking a traditional average, which is really the same thing as the 50th percentile mean (blue bars), the course administrators seem to have hit gold! All scores are above the minimum success criterion. Time to break out the champagne . . . or is it.

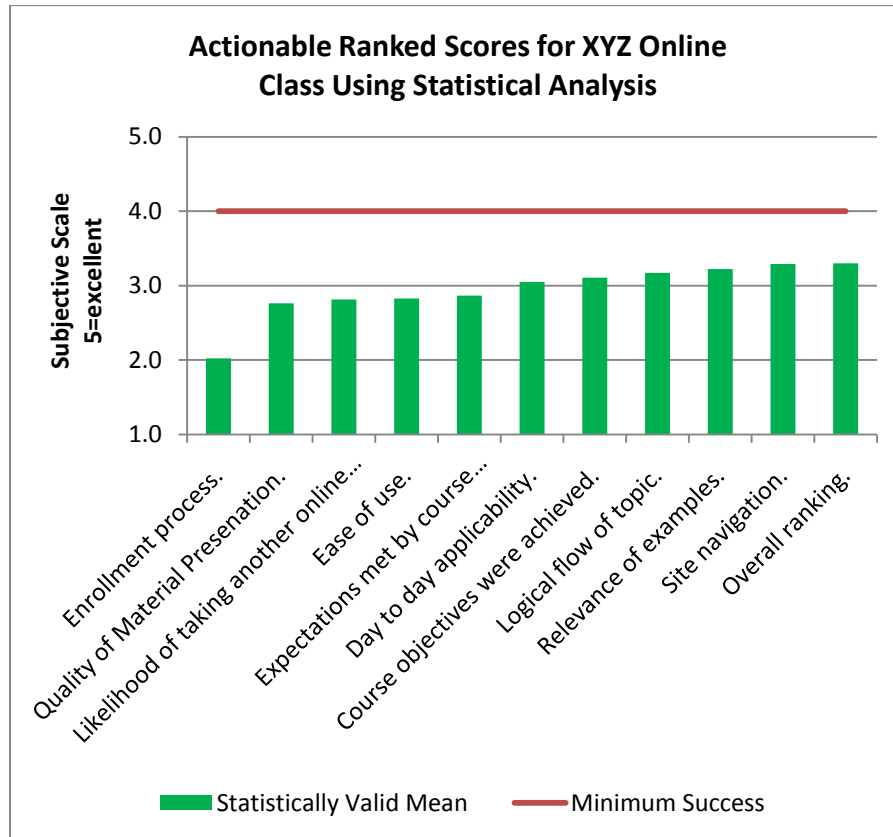


Once the 5th percentile mean (green bars) is calculated and the variability of answers is included we can see that not a single metric has reached the success criterion in a statistically significant way. By ranking the 5th percentile scores we can easily

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identify those areas needing the most attention. The improvements in those areas will come from brainstorming improvements, beta-tests, and focus groups.



The average value difference between these data sets is only 0.4. Considering the variation and calculating the 5th percentile mean, we see a difference of 1.5.

**The mathematics have provided roughly a 3x magnifying glass to see this discrepancy more clearly.**

## 8. A SAMPLE OF STATISTICAL TOOLS

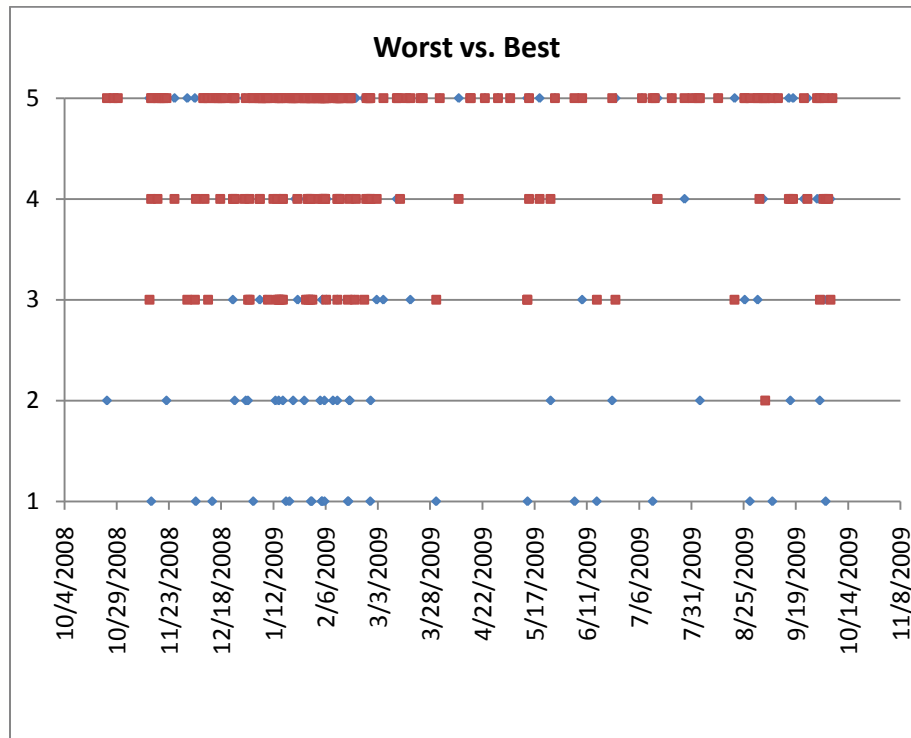
Scatter plots are widely used in statistical process control. These plots show how results are changing with time. Watching how the results change with time can provide tremendous insight into how the level of customer service is improving, which areas are improving quicker than others, and if the changes are real or a figment of a shortcoming in the measurement system or some other "special" case.

Worst vs. best plots are good visual checks to evaluate differences in variability between metrics. Here the best (highest 5th percentile mean) is plotted along with

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the worst (lowest 5th percentile mean). Visually the variation differences are clearly apparent for these two data sets.



## 9. CONCLUSION

The term product development is used almost exclusively in relation to manufacturing businesses, but from the information contained herein it is clear that this is not the case. The client producing sophisticated online training for a global enterprise is in production. She is *manufacturing* a software application for tens of thousands of customers. The same can be said for real estate agents and general managers of restaurants.

**Their metrics are unique, but the mathematics used to optimize the ROI of any business are fundamentally the same.**

**Power Focus Engineering, P.S.** is a dynamic engineering consulting firm specializing in green and break-through product development. The core of the company has provided white board to production-line product development services for over twelve years in the United States and in Europe.

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