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Using a Simulated Project to Teach a Six Sigma Green Belt Certification Course

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Abstract. This paper presents a project that has been used successfully to teach Six Sigma Green Belt classes for over 10 years. Using simulated data for an insurance company's claims processing, it helps students learn to identify possible improvement projects based on routine reports, and walks them through the Define, Measure, Analyze, Improve, and Control steps of the process (typically called the DMAIC process). They work in teams to analyze data and make recommendations as they would in a real-life project. Student feedback showed that this was a more effective way of teaching and testing than just lectures alone followed by a multiple-choice certification test.

Keywords: lean, six sigma, service industry, teaching, learning, active learning, simulation, project based learning.

1. Introduction

Lean Six Sigma training programs typically certify students at two levels – Green Belt and Black Belt, although other levels have been added, like a Yellow Belt (basic training). According to the American Society for Quality (ASQ), a Green Belt indicates enough knowledge to lead a small process improvement project, or to assist on a process improvement team for a larger, more complex project typically led by a Black Belt (https://asq.org/quality-resources/six-sigma/belts-executives-champions). Green Belt certification typically is based on a multiple-choice test of the key concepts involved, after roughly 40 hours of training in various aspects of the methodology that follows a 5-step process – Define, Measure, Analyze, Improve and Control – generally referred to as the DMAIC process. Black Belt certification typically requires work on a real-life project after further training. Some programs include a less intensive project even in the Green Belt certification.

Briefly, the goal of any Lean Project is to reduce waste and improve efficiency, while the focus of a Six Sigma project is to improve the quality of some output. Both emphasize the analysis and improvement of the underlying process to achieve the objectives. The metric for quality is usually a reduction in errors, or a reduction in the variation (sigma) in the process outcome. This

improvement in quality is achieved by following the DMAIC process, a sequence of steps that begin with a clear definition of the problem and the objective (called a SMART objective – Specific, Measurable, Achievable, Relevant, and Time-bound). The *Define* phase includes an assessment of the current state of the outcome, the desired outcome, then potential benefits from the project and doing a cost-benefit analysis, clearly identifying the underlying process, and coming up with a project charter that lays out the key objectives of the project. The *Measure* phase includes brainstorming to identify potential root causes, organizing them (typically in a Fishbone diagram) and collecting data on the same. The *Analyze* phase is where the relationship of the potential root causes to the outcome is analyzed to identify the most important ones. The *Improve* phase uses the results of the analysis to implement changes to the existing process and measure the outcome again to compare with the original values and confirm that an improvement indeed occurred. Finally, the *Control* phase includes ideas to ensure that the changes stick, and that the process does not slide back to the less effective ways of the past.

2. Literature Review

The Lean Six Sigma (LSS) methodology has wide application in both manufacturing and service industries (Makwana & Patange 2019). While both Lean and Six Sigma methodologies were independently developed by Toyota and Motorola respectively, the methodologies were combined in 1997 when they were applied to the aerospace industry to improve productivity, lead time, and reliability (Smith & Adams 2001). Olanrewaju, Uzorh, and Nnanna (2019) reviewed the literature on LSS applications in manufacturing, and report on studies that show applications in a wide range of industries like healthcare, automotive, food, oil and gas, and pharmaceutical industries.

George and George (2003), in their book "Lean Six Sigma for Service", discuss how the origins of the methodologies in manufacturing made it difficult for people to apply the methods easily to services, referring to both the service industries, as well as service activities in both manufacturing and service industries, noting that there was tremendous opportunity for improvement in these areas, as there was a great deal of waste and variation present.

Lean Six Sigma programs are commonplace in many universities and colleges, and several business schools even incorporated them into MBA programs (Shafer 2005). Weinstein, Castellano, Petrick, and Vokurka (2008) proposed that industry projects be implemented in an MBA course on quality management.

From a pedagogical standpoint, experiential learning has long been suggested as a more effective and engaging method of learning (Kolb 1984).