The Case for Lean Six Sigma Certifications for Engineering Faculty

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Abstract

Given the rising expectations for engineering graduates to have Lean Six Sigma knowledge upon entering corporate America, a need has developed for engineering schools to offer LSS courses and certifications at the undergraduate level. In order to address this need, the faculty members who teach this methodology should hold LSS certifications at least at a Black Belt level themselves to ensure they understand the methodology as a whole and to be viewed upon as credible teachers, trainers, and project coaches. Currently, all credible Black Belt and Master Black Belt certification programs require that applicants conduct a real world project within a manufacturing environment or some other type of service environment such as healthcare, finance, or government. This project requirement may pose a significant obstacle for career educators. These circumstances provide the justification for the creation of a specialized Lean Six Sigma certification for post-secondary engineering educators. This post-secondary educator specialty certification would include an experiential component that involves using the Lean Six Sigma methodology to improve the engineering education process for students, as well as a knowledge assessment component that involves passing a certification exam similar to industry-standard Lean Six Sigma exams.

Keywords

Lean, Lean Six Sigma, Six Sigma, Lean Six Sigma Certification, Black Belt Certification

Demand for Lean Six Sigma Knowledge

Companies today are looking for ways to improve their competitive edge. With the tremendous growth of the internet, social media, and other technological platforms, companies now have to compete on a global scale as opposed to smaller local and national scales. Given this situation, along with heightened demand from customers for high level products and services, companies are looking for ways to improve customer satisfaction, and reduce rising operational costs. Many companies are turning to Lean Six Sigma (LSS) in an effort to improve their competitive edge[1]. According to George[2], Lean Six Sigma is a methodology that maximizes shareholder value by achieving high levels of improvement in customer satisfaction, process speed, quality and cost. It represents a fusion of two well-known process improvement methodologies: Six Sigma and Lean.

This increase in the desire for professionals with LSS knowledge has sparked growth within university engineering programs to offer courses to teach and certify students for this methodology. The issue, is that they are typically offered at the graduate level or within the engineering school's continuing education or professional studies programs. This poses an issue

because, students at undergraduate level, do not have access to these certification courses and classes making it difficult to acquire LSS knowledge and certifications prior while pursuing an undergraduate degree.

Although LSS knowledge is in demand, especially for engineering professionals, many engineering programs do not offer LSS courses or certification opportunities at the undergraduate level. This could be due to the fact that current engineering faculty are not certified or well versed with the methodology. While the LSS problem solving approach does include some of the statistical and process improvement methods used within many engineering disciplines, putting those methods together, along with other business operational aspects, does require a specific skill set. The attainment of this skill set is often signified by certifications. Most, if not all, certification requirements for higher level belts (Black and Master Black) require a number of Lean Six Sigma projects to be performed which is something many engineering faculty members have not yet accomplished or may not have the opportunities to perform given their work environment. This lack of certification, and potential gap in knowledge within faculty members, does have an impact whether or not LSS courses and certifications are offered to students. Furthermore, a search of entry-level engineering positions for job search sites such as indeed.com or carrerbuilder.com, shows that these skills are desired by companies looking to hire new engineers.

Because of the demand for professionals with LSS knowledge, and because this methodology has a significant statistical component, something most engineering students are already well-versed in, more engineering programs need to start or strengthen LSS courses and offer certifications. To do that, faculty members must first ensure they have proper LSS knowledge and upper level certifications to effectively teach students.

Benefits of Having Certified Black Belts and Master Black Belts Teaching Lean Six Sigma Courses

There are many benefits for faculty members to earn upper level LSS certifications. The first benefit is acquiring more extensive knowledge. As stated earlier, many of the statistical and quality management concepts that make up LSS are already taught within the traditional engineering curriculum. However, going through a certification program and gaining the knowledge and approach as to how LSS meshes these concepts all together is required to effectively teach it as a holistic approach to problem solving.

A second benefit is that having a certification distinction increases the confidence of the students in a faculty member's depth of knowledge and also makes the program appear to be more credible to outside employers and potential students. If an engineering school plans to offer any type of certification, then the instructor(s), should possess a certification level at least one level higher than what they are teaching. This is the accepted industry standard and is also one set forth by the *The Council for Six Sigma Certification*[8], which is the most prominent and reputable certification accreditation body in the world. This means that a program offering Green Belt Certifications must have a certified Black Belt or Master Black Belt teaching and administering certification courses. Below is a list of the hierarchy of belt levels starting with the lowest and going up to the highest.

White Belt
Yellow Belt
Green Belt
Black Belt
Master Black Belt

A final benefit of faculty members earning a certification is for them to gain hands on experience using the methodology to solve a problem. All credible Black Belt and Master Black Belt certification programs require that at least one LSS project be conducted. Therefore, if a faculty pursuing certification, they will be required to complete a project and this project will offer them real hands on experience using the methodology, giving them further exposure and more intimate use of the principles they are teaching, thus helping them to teach LSS more effectively.

Current Lean Six Sigma Body of Knowledge (BOK) and Certification Requirements

Currently, all Black and Master Black Belt certification programs require passing a written exam encompassing questions based on the specific body of knowledge. LSS certifications have bodies of knowledge that encompass all of the concepts and statistical methods one should be familiar with to achieve a specific level of certification and to perform relative to the project at hand. These bodies of knowledge vary slightly depending on the certifying body; however, for the most part, they are fairly consistent. For a Black Belt level certification, the BOK contains a significant amount of statistical methods. The entire BOK for the American Society of Quality (ASQ), one of the most reputable certifying Six Sigma organizations, can be seen at www.asq.org/cert/six-sigma-black-belt/bok.

Another requirement for Black Belt certification is the completion of at least one documented project. This project must in some form or fashion show a reduction in variation. The project can be performed in any manufacturing or service environment. The project must quantify the impact of the improvements made. For the project to be approved as certification component, there must be some form of the measurement of cost-benefit before and after.

Taking a writing exam encompassing questions concerning the topics and concepts of the body of knowledge and completing at least one project meeting the guidelines stated above are the activities required to achieve most Black Belt certifications.

Proposed Engineering Educator (EE) Black Belt Certification Requirements Overview

Recently, area specialization LSS certifications have risen within the industry. For example, some organizations offer a Healthcare Green Belt certification or a Government Black Belt certification. These types of certification programs are specifically designed to train employees to lead projects and solve problems relative to the organization. Within a healthcare certification program, example problems use healthcare type data and situations. Solutions, templates, and data analysis are tailored to fit into the operation of that particular organization. This focus or specialization gives the trainee a more concentrated approach on how to effectively solve problems within their own working environment.

This move to specialized certification supports the idea of the creation of a certification program for engineering educators. The program would focus on how to teach the LSS methodology, how to coach students on projects supporting the senior design aspect of engineering programs, and how to use LSS to improve various aspects of education. The certification program would be three-fold as suggested by Laureani and Anthony[9], and consist of the following: 1) Body of Knowledge (written exam), 2) Body of Experience (evidence of projects, teaching, and coaching), and 3) Maintaining Certification and Re-certification, (continuing education).

This three-fold approach to certification will ensure engineering educators required to meet these certification standards will possess the knowledge, skills, and coaching abilities to effectively teach students LSS and certify lower level belts (White, Yellow, and Green).

Because LSS is requires the usage of statistical analysis, using software to analyze data is imperative. Within most Six Sigma (SS) and LSS certification programs, Minitab skills are taught and participants are expected use Minitab for data analysis. With the specialized EE certification program, Microsoft Excel along with Minitab will be taught. The reason for this is that the majority of companies in corporate America use Excel to analyze data and newly hired engineers will be expected to be able to use this program. Also, Minitab is not readily available and as educators preparing engineers to enter corporate America, we need to teach our students how use both Excel and Minitab to analyze data.

Proposed Body of Knowledge Requirements

The specialized engineering educator Black Belt certification would closely aligned with ASQ's Black Belt BOK[10] which contains the following ten sections:

I. Organization-Wide Planning and Deployment
II. Organizational Process Management Measures
III. Team Management
IV. Define
V. Measure
VI. Analyze
VII. Improve
VIII. Control
IX. Design for Six Sigma

The concepts within each section would be identical; however, the Analyze (VI) and Improve (VII) sections would be slightly different. Within ASQ's BOK, these sections have a heavy focus on statistical techniques such as regression analysis, hypothesis testing, ANOVA, and correlation coefficients. Because engineering educators teach these tools on a regular basis, focusing on the computation and calculation aspects of using these tools offer little value. With the specialized EE BOK, the focus would not be on learning how to compute results using these techniques, but how to apply the results to make business decisions.

Within these two sections, case studies and situations would be presented in which these tools could be used to make business decisions and certification candidates would have to take these tools and articulate how they can make business improvements using the output data from the analysis. This will take their knowledge to a level past that of computing, which is something

engineering educators are very comfortable with, to applying the knowledge to make larger business decisions. This type of learning would add the most value and knowledge to the certification candidate because it would take what they currently know, and enhance it.

All of the concepts within the BOK will be tested on a written multiple choice exam, just as all of the current LSS and SS certification exams; however, there would also be a written portion in which a case study would be presented and given the parameters and business conditions present, the test taker would have to analyze data, and write out a conclusion based on their data analysis. This would help to gauge the overall knowledge of problem solving and usage of LSS to improve business aspects.

Proposed Body of Experience Requirements

Another component of the specialized EE certification is attainment of a certain body of experience (BOE). The BOE would include a certain number of hours of teaching and coaching LSS classes and projects. It would also include the completion of at least two LSS projects within their university in some capacity. Having a requirement of a specific number of teaching hours will ensure that engineering educators have enough exposure to LSS to be considered an expert. Also the requirement to coach student projects would provide create project coaching skills which are a staple for LSS Black Belts. Finally, completing an actual project using the methodology would allow the educators to gain hands-on experience using the tools, as well as provide a benefit to the university by improving an internal process.

Proposed Requirements to Maintain Certification

The requirements to remain certified as an EE would be similar to the recertification requirements established for ASQ's advanced certificates. Recertification would be required every three years in order to maintain the integrity of the certification. A specific number of recertification units (RUs), would need to be earned and documented. Fifty percent of the RUs could be earned by teaching quality-related courses. The other fifty percent could be earned through conference attendance, conference presentations, journal publications, service to professional organizations, or coaching LSS projects for students or educators. Following ASQ's lead, documentation would be through a recertification journal[11] that is submitted to the certifying organization.

Conclusion

Overall, a specialized LSS certification program for engineering educators would offer great benefit to undergraduate students, the educator themselves, the community, and the university as a whole. Students would have the opportunity to interact with a professor and coach who has a very strong knowledge base. With the attainment of certification, the engineering educator would have increased credibility and also the knowledge and experience needed to develop an in-house lower level certification program (Yellow Belt or Green Belt) to certify students. The community would benefit because, if a certification program were started and opened up to surrounding companies and organizations, they would have an avenue to expand the knowledge of their employees without taking on the burden of facilitating a certification program themselves. Finally, the university would benefit from process improvement projects performed

in-house to improve various aspects of educating students whether it be concerning finances, university operations, student retention, etc. Furthermore, certification programs open to working individuals in the surrounding communities could provide an additional source of revenue for the university.

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