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Gaps Between Industry Needs and Lean Six Sigma in Higher Education

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Abstract

Purpose: The purpose of this paper is to explore and evaluate the current gaps between industry needs and higher education on Lean Six Sigma (LSS) from the published literature. Industry exhibits constant changes in workforce and practitioner needs of professionals, making the development and management of educational pathways difficult. This research focuses on identifying if current LSS curriculum in higher education prepares students adequately, based upon specific industry current and more importantly, emerging needs.

Design/Methodology/Approach: The researchers will conduct a scope review of the literature on key concepts such as LSS education and training, workforce development, to result in a preliminary assessment of the industry needs currently, and for the future of LSS and LSS education.

Findings: The research is still in its embryonic stage and the findings are forthcoming.

Research Limitations: We have restricted our study to the literature published in the past 5 years.

Practical implications: The result of this research identifies the current issues with LSS education and provides a direction for improving curriculum on LSS in higher education based upon emerging industrial needs.

Originality and Value: LSS practitioners face a dynamic and uncontrolled environment compared to academia environment. There is only limited time for instructors to teach student LSS concepts, methodologies, and tools. This article discusses the alignment of LSS teaching outcomes and industry needs.

Keywords: Lean Six Sigma, Higher Education Institutions, Quality, Process Improvement, Curricula Improvement, and Higher Education, Future state.

Introduction

The deployment of Lean Six Sigma (LSS) in the industrial world has been increasing, especially in Western countries and some developing nations (Albliwi, Antony, & Lim, 2015). The LSS methodology has been widely accepted and adopted in a variety of industries including manufacturing, service, large and small enterprises, and even

non-profit endeavors. Various sectors have shown tremendous interest in implementing of LSS to improve quality and efficiency.

Higher education institutions (HEIs) play an important role in educating engineering or technology students with LSS knowledge (Mitra, 2004). Students are exposed to LSS knowledge with limited time in coursework or programs. Students may only apply LSS knowledge and utilize the most common tools on a few projects or classroom activities. When students become practicing engineers, graduates usually face more complex environments and problems than what they practiced in school. Insufficient preparation may lead to high failure rate of industry projects. To avoid costly unsuccessful efforts, organizations that are determined to successfully adopt LSS may have to offer internal training programs to incoming employees. This redundancy may be a form of waste in terms of time and resources for both the organization and practitioners.

In addition, with the development and application of new technologies, the LSS methodology itself is in the process of evolving. For example, robotics may be implemented in manufacturers to realize Lean benefits through automation (Kolberg & Zühlke, 2015). The teaching content in HEIs is usually subsequent to research efforts on the evolution of LSS methods. Organizations expect practitioners to be able to apply the latest techniques based upon the most recent research to improve processes and solve problems. Therefore, to better prepare students, HEIs can more closely align research efforts to inform LSS curricula with a stronger emphasis on scholarship of teaching and learning. This paper presents a model and preliminary efforts for researching the gaps among the most recent LSS principles and practices, HEIs, and practitioner needs.

Literature Review

HEIs play a pivotal role in providing proper foundational knowledge and education as students become practitioners to avoid misapplications of LSS in industry (Mitra, 2004). HEIs link the gap between theoretical learning and subsequent practice (Mitra, 2004). For example, as the trend of applying Lean management principles in modern enterprises continuously evolves, the market demands for highly educated practicing engineers increases (Vukadinovic, Djapan & Macuzic, 2017). HEIs ensure industry have qualified LSS practitioners through understanding and applying of the appropriate curricula (Mitra, 2004). However, current LSS education in HEIs does not satisfy industry needs. A solid understanding of industry needs should be considered when HEIs create new Lean programs, which incorporate new delivery methods and new content areas, or improve the current ones (Flumerfelt, Ross, & Wade, 2017).

Lean practitioners identified knowledge areas that HEIs could adopt to enhance Lean education. Lean practitioners want college graduates to possess a comprehensive

view of the organization, develop human – relation skills, and obtain industry knowledge and experience based upon genuine work experience (Fliedner & Mathieson, 2009). Employers have come to recognize the need for critical thinking and project management skills in employees to successfully deploy Lean practices (Flumerfelt, Alves, Leão, & Wade, 2016). In addition, the teaching content in HEIs should include more data-driven decision-making (Flumerfelt, Alves, Leão, & Wade, 2016).

Methodology

The researchers chose to conduct this research with a scoping literature review methodology. A scoping review, or scoping study, is “a form of knowledge synthesis that addresses an exploratory research question aimed at mapping key concepts, types of evidence, and gaps in research related to a defined area or field by systematically searching, selecting, and synthesizing existing knowledge” (Colquhoun, Levac, O’Brien, Straus, Tricco, Perrier, Kastner, & Moher, 2014). The scope literature review methodology has become common practice to identify evidence for a broad research question (Peters, Godfrey, Khalil, McInerney, Parker, & Baldini Soares). The purpose of this study was to identify a gap in the LSS field and HEI preparation. Therefore, a scope literature review method meets the need for this study. The researchers adopted an existing framework from Arksey and O’Malley’s (2005) study to conduct the scope literature review. The framework is consisted of five stages:

1. Identifying the research question: the research question guides researchers to build search strategies (Arksey & O’Malley, 2005). The research question is what are the gaps between industry’s needs for college graduates and the teaching in HEIs on LSS. The needs include technical skills and soft skills.
2. Identifying relevant researches: identify as comprehensive as possible primary studies (Arksey & O’Malley, 2005). The researcher will search the articles published in the last 10 years and written in English.
3. Research selection: create a search mechanism to pick up relevant research and eliminate irrelevant search (Arksey & O’Malley, 2005).
4. Charting the raw data: charting the key information from the existing literature by themes or categories (Arksey & O’Malley, 2005).
5. Summarizing results: researchers generate a narrative account of the selected researches (Arksey & O’Malley, 2005).

The researchers plan to search databases that cover topics with engineering, technology, business, quality improvement, process management, engineering education, and curricula development. The databases chosen by the researchers are presented in Table 1.

Databases
ABI/ INFORM Global
ASEE PEER Document Repository
Compendex
Education Resources Information Center (ERIC)
Inspec
Professional Development Collection
Scopus

Table 1: Databases

One of the researchers is a library science faculty member, specializing in engineering, technology, and the engineering/technology education literature. As discussed by Grant and Booth (2009), librarians regularly participate as members of review teams in order “to provide an expert searching component to the team.” The next step in this process involved developing search strategies for databases selected that balance comprehensiveness and precision to provide the researchers with the primary relevant studies.

The researchers will also search the Association for Technology Management, and Applied Engineering (ATMAE) website for journal articles and relevant white papers. White papers supported this study as this literature is typically not indexed in databases curated by HEIs, such as the peer-reviewed literature. In addition, industry perspectives may not be well covered in the scholarly literature. Websites, reports, newsletters, and trade publications, and white papers are useful to this regard. Currently, the research is ongoing in finalize the searching sources and source inclusion/exclusion criteria.

Discussion & Conclusion

This paper presented a methodology and framework to conduct research and initial progress on LSS preparation. The final research results would provide LSS instructors systematic information about the current gaps among LSS research, current development of practitioners through HEIs, and industry needs. HEIs may also apply results as a direction for future research in the area of scholarship of teaching and learning to improve curriculum, teaching content, and pedagogy. HEIs prepare

students as future workforce and leaders. Therefore, it is critical for students to learn the most advanced and latest knowledge from HEIs in developing an advanced, technically proficient workforce. Instructors need to make sure students have relevant, authentic, and advanced learning experience from academia to industry.

This research is still in the preliminary stage. Next, the researchers will continue to follow the methodology and framework. In the next stage of the study, the researchers will generate search strategy with combinations of searching terms (stage 2 in the framework). Then, the researchers will select articles that meet all searching criteria (stage 3 in the framework). The researchers will record the search time frames and inclusion and exclusion criteria. The researchers will make revisions to the methodology as the research is in progress, in consultation with library sciences in identifying and developing strategies for comprehension.

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