

# Can Lean Six Sigma be implemented in Higher Education while ensuring that all customer needs are being met?

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## Abstract

A rigorous investigation of customer identity, needs and expectations with respect to higher education will be conducted. This study starts with an in depth discussion focused on the "definition of customer" in the realm of higher education. Often times the student is seen as the immediate customer in the academic setting. Upon deeper analysis, it becomes apparent that the student is not the only customer and maybe more of a "product" of the academic system. The analysis will begin with an identification of stakeholders in various categories connected to institutions of higher education. Stakeholders include employers, parents, and legislators in the case of public institutions. The difference between a stakeholders and customers is closely examined in the sector of higher education. This study is designed to garner information concerning the needs and expectations of all relevant customers. More importantly, data is gathered concerning how these customer needs and expectations are being met currently. Finally, the question, "How might the level of customer satisfaction change if various Lean Six Sigma tools and techniques are utilized in institutions of higher education?"

The cost of college continues to rise and student loan debt has become one the largest financial burdens in the history of the United States. These findings will be important as many universities seek ways to manage costs and maintain value simultaneously. This paper describes the challenges and competing agendas of several categories of customers in a quest to cut cost without cutting quality or diminishing the desired outcome.

## Introduction

College costs are increasing and institutions of higher education are looking for ways to contain these increases. The need to explore new ways to reduce costs has led several institutions to the application of lean practices in higher education. The University of Michigan and the University of Wisconsin are leading the efforts to apply lean methods to university business systems. It has been common practice to pass cost increased on to the students through annual increases in tuition [1]. Lean practices often focus on outsourcing, collaborative efforts, the increased use of technology and "the reduction and elimination of duplicate effort, staff reductions, and closing non-core operations."

It is clear that major public universities have begun to apply the practices of lean that have proven themselves in industry to the business operations of institution. They are changing processes and systems and are moving away from the way things have traditionally been done. [1] The University of Wisconsin System report from February 2010 on lean initiatives for

collaborative business process redesign presents an excellent example of the application of lean principles and methods to university business processes [2] The University of Michigan Business and Finance Leadership Academy report from October 2010 by Patterson, describes process changes driven by lean practices.

The Michigan document includes a summary of lean efforts at 15 public universities in the United States. The use of lean methods and techniques to address waste in the academic side of higher education is much less clear. Only one of the 15 universities mentioned in the Michigan report, Rensselaer Polytechnic Institute (RPI) implemented a program redesign for substantial cost savings and improved learning outcomes. RPI optimized their Master of Science program in Management to eliminate ambiguity. The redesign included standardizing many academic processes such as grading, syllabus, assignments and course sequencing. [3]

Evidence of the need for lean to eliminate waste in academics can be found in the public university data available on the internet. For example, the Purdue University Data Digest reports to the public on key data trends. The cost of attendance increased from \$28,020 in the 2004-05 academic year to \$42,194 for the 2013-14 academic year, a 50% increase during this 10-year period. During this same time student debt increased by \$14, 174, a 67% increase [4]. Since 2013, tuition prices at Purdue University have been frozen, and some housing costs have been reduced slightly. The days of annual tuition increases to balance the budget may have come to an end.

## **Literature Review**

S. J. Spanbauer, past president of Fox Valley Technical College in Oshkosh, Wisconsin, documented their plan for applying the principles of quality management to all areas of the institution in 1992. The 16-step model presented was built on the theories and teachings of the quality experts, Deming, Crosby and Juran. He stated. "...schools must be even better in the future to meet the needs of a rapidly changing world..."[5] "The needs and challenges facing education are too great to continue with cosmetic changes.

He describes creating a climate at the institution in which excellence can thrive. Selected guiding elements of particular importance from Spanbauer include:

- Help students succeed to the best of their ability
- Change to incorporate institutional reforms common in business and industry (quality and lean)
- Teachers (faculty) must play active roles in reforming
- Develop and enhance learning theories which assure that students are mastering needed knowledge and skills
- Establish educational standards that ensure every student leaves with demonstrated skills and abilities
- Guarantee that students leave with labor market-readiness and mastery of skills

The concepts we now know as "lean" were just coming to the United States during the early 1990s. The lean revolution in production in American industry began with the release of the

book, *Lean Thinking*, by Womack and Jones in 1996 and expanded in 2003[6]. The fundamental concepts of lean were first demonstrated by Tiiachi Ohno (1988) at the Toyota Motor Manufacturing Company on the manufacturing floor. The Americanized version of the Toyota concepts is known as lean production.

Lean thinking has become a driving force in the enterprise, on the shop floor, in the office and in accounting. The foundation is the elimination of waste in all activities. Waste is anything that does not add value. The application to industry and production in the seven wastes is clear. The application education is not as clear but is definitely important.

In 2015, students were graduating from universities to enter a post-recession economy and rapidly changing workforce. It was theorized that these major changes in the economy may necessitate changes in the requirements of higher education for long term student success. The change in requirements would prompt a change in the determination of what is actually waste and what is a new obligation.

The quality revolution identified by Spanbauer has morphed into a lean revolution. “Eight wastes in education” were identified in a blog website by Ian Wilson and a paper by Martin, Garner, Arokiam and Wilson (2010) [7]. The eight categories of wastes in manufacturing can be directly related to waste categories in education. Putting the seven wastes into education terms:

1. Waste of overproduction (duplication, or doing something that is not needed)
2. Waste of waiting (lost time)
3. Waste of transportation (excessive movement of things)
4. Waste of processing itself (unnecessary activities)
5. Waste of stocks (inventory or things being held or stored for future use)
6. Waste of motion (movement of people)
7. Waste of making defective products (work that must be redone, repaired, replaced... Juan’s “Cost of quality- internal and external to the institution)

Continuous improvement is a common theme of lean initiatives and a company’s quality systems. In this way lean crosses over into “Six Sigma” Quality and data driven decision-making and problem solving. The waste in this scenario is defined as follows:

Scrap:

Credits lost due to failure, low performance, or other reasons.

Cost of non-quality:

redo, delay in completion, cost of inspection (by future employer)

Waiting:

Lost time... retaking a class again, waiting for feedback, students making mistakes because of inability to get questions answered,

Inventory:

Unnecessary stock (credits). Result of a CODO, unused materials, copies, books, resources  
Excess administrative costs

Motion:

Moving between class locations, poor classroom layout, parking, bus schedules, building locations

Transportation:

Hauling needed materials (backpacks, books, papers...)

Skills utilization

Lack of coverage of required learning outcomes and objectives.

Lack of appropriate learning outcomes and objectives.

Inappropriate personnel delivering course materials.

Ineffective course designs

Classes that focus only on lower level learning outcomes

Assessments that do not address the stated outcomes and objectives

No "buffer" - summer school or other make up time

Over processing

Redundant course designs, without increasing student value

Assignments and graded exercises that do not advance objectives

Overproduction

Producing graduates with skills that are not in demand

Offering sections of classes that are not filled to acceptable levels

Student to faculty ratios that impact student learning in a negative way

**Examination of who the customers are and their perspectives for satisfaction**

A customer is someone who purchases a product or service from seller or provider of the said product or service. Typically, the student is the first answer that comes to mind when a person is asked whom is the customer in the case of a college or university. The reasoning is obvious as the student is the immediate consumer of the educational services being provided. This writing questions how many other stakeholders should actually be classified as customers.

A buyer may or may not be the consumer. From the position of a parent in the higher education, parents are the customer who is buying education for their children. In this case they are the buyer of the service, education, but they are not the only consumer. [8]

Parents are often considered customers in concert with the students they financially and emotionally support. Parents may expect higher educational institutions to provide advanced

education after high school, thus making the student more marketable in a competitive job market. A study shows that “While only 37.9 percent of student’s parents had a bachelor’s degree or higher themselves, 74.9 percent expected their student to earn at least a bachelor’s degree.” [9] Their, the parents, expectations from the institutions are to provide superior campus facilities, providing safety, affordable housing and dining system, available transportation system etc. A separate recent study showed that parents want to be more involved in their children’s college life. This need for involvement maybe ties to the financial commitment or helicoptering. “Parents often seem to view higher education as something they purchased for their children.”[10]

“It’s been gradual, but noticeable: the shift toward greater communication between colleges and universities and parents of their students and alumni. The current generation of parents of college students may present as hyper-involved in their children’s lives, their participation continues with a vengeance as their high school student’s move on to college.” [11] Parents are becoming more involved with their children’s higher education life. Technological advancements enable families to communicate more frequently and effectively. Students and parents can email instructors or staff members, voice out their opinion through blogs, articles, and social media. Parents are partners and a resource for the universities; their opinions matter in their children’s education [12].

To determine parental customer satisfaction several metrics needs to be considered. These factors include overall satisfaction, loyalty measurement, intention of repurchases measurement, etc. From the perspective of parents, the quality of the university and the ranking as a higher educational institution is an immediate concern. Depending how reputed the university is, the parents may consider sending siblings, more than one of their children, to the same institution. As parents are getting involved with their children’s studies, they tend to conceptualize how well the university is preparing the student for the future [13]. Parents often view high grades and timely completion of a program as success for their students. Colleges and universities are trying to include parents in agendas that would leverage the commitment and the engagement of the parents. More studies should be conducted to examine the dynamics and further analyze the relationship among students, parents and institutions.

Employers may concurrently be classified in many categories of stakeholders that translate to being internal customers. These roles tend manifest as corporate donors, industrial partners, and departmental advisors. Accrediting bodies often view these categories of stakeholders as crucial knowledge bearers. Employers that actually hire recent college grads often have a different perspective and definition of success than parents and students. These different definitions of satisfaction further complicate the priorities for educators. The employer as a customer of higher education is defined as a company who hires a student who has attended a college or university and has obtained knowledge that will help the student in their career. According to Doherty (2003) [14], employers

“... [W]ant to draw on the knowledge and skills of new college graduates after their entry into the labour market” (p. 89). Business should be able to expect students with a college degree to show reasonable proficiency in these areas. Stokes explains that “the real world

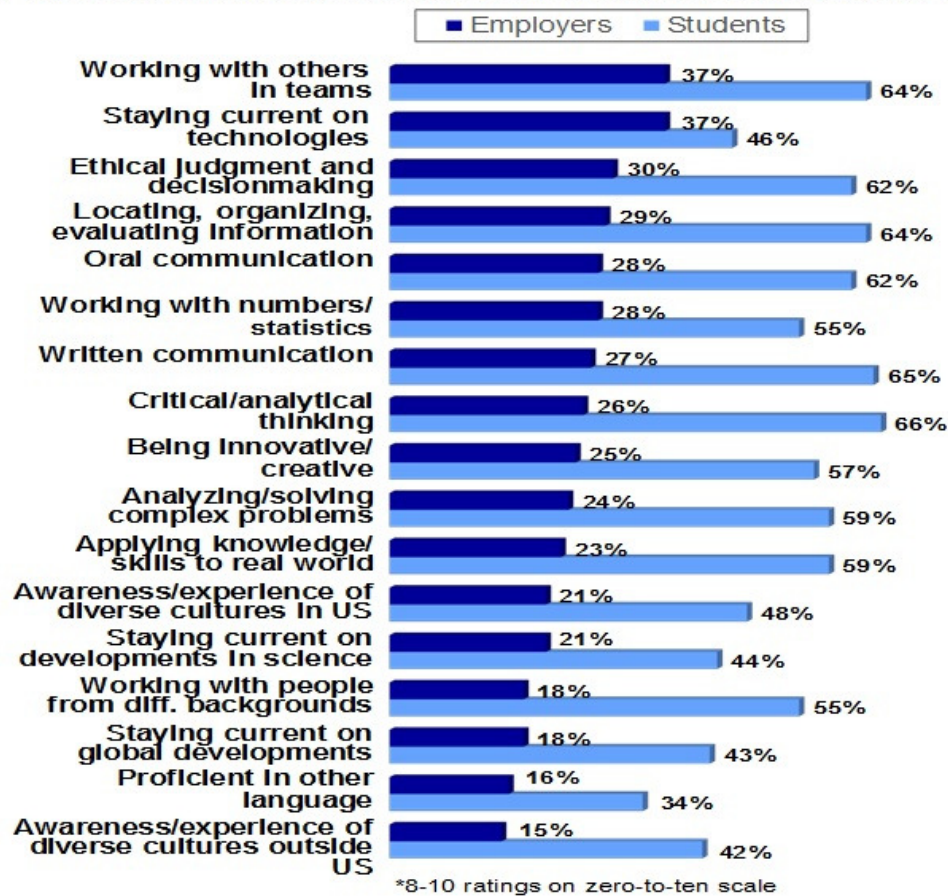
and the world of academic study are intimately and economically entwined and so we have to embrace that reality and work harder at making the connections.”

Hiring managers expect colleges and universities to provide students the opportunity to gain knowledge and skills enabling the student to excel in the market place. According to the Hart Research Associates, *Falling Short? College Learning and Career Success (2015)*, employers’ report students emerging from undergraduate studies are not as well prepared as the students think they are. This difference in perception is shown in Figure 1.

Figure 1 Employers score recent college graduates on preparedness. *Falling Short* by Hart Research Association 2015

**Employers give college graduates low scores for preparedness across learning outcomes; students think they are better prepared.**

*Proportions saying they/recent college graduates are well prepared in each area\**



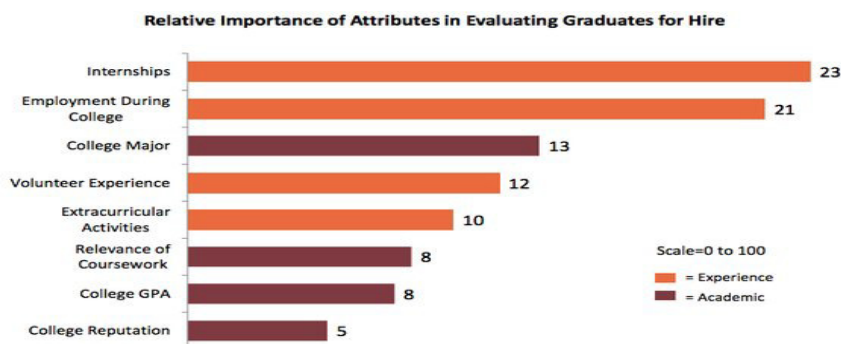
Armstrong has interviewed numerous company leaders who are looking for new hires from colleges who have not only mastered their subject but can also write, speak, think critically and

creatively, and have a general understanding of the world outside of their field. Balzer says employers may define value as well-educated graduates prepared to enter and contribute to the workforce (p. 128). [15]

Higher education institutions get information from the employer customer through meetings, studies and surveys. “The Melior Group recently conducted a qualitative study of 50 hiring managers and top executives at major employers across the United States to find out what they are looking for when hiring and promoting college graduates” [16]. However, Donokov states that there is a limited amount of quantitative data available, so anecdotal and informal information is somewhat more common (p. 172). [17]

While there are volumes of data on instructor performance, student performance, university national ranking, and growth of a college being tracked [18], less emphasis is put on determining the satisfaction of employers. According to Donokov, some colleges survey their employer customers with a series of questions related to the Secretary's Commission on Achieving Necessary Skills (SCANS) competencies (p. 59) [19]. These questions ask if workers are literate, have computational skills, and thinking skills that can put knowledge to work, and personal qualities such as trustworthiness and dedication. According to the Academic Innovations website, the purpose of SCANS is “to help teachers understand how curriculum and instruction must change to enable students to develop those high performance skills needed to succeed in the high performance workplace.” There is an obvious need for more research in this area.

Figure 2. Attributes of Importance in assessing college graduates as potential employees



The Chronicle of Higher Education 2014

Colleges and universities need to reach out to employers to build long-lasting partnerships with deeper discussions. Continuing the use of employer surveys is a good start, but in depth meetings where employers can clearly state their expectations would be an extremely beneficial technique to improve communications and ultimately the product that colleges are producing.

Administrators and faculty should be at the table to ensure clarity of purpose. “Employers want colleges to visit their organization and have a candid discussion about their business challenges and how education and training can help answer these challenges...” [20] This

approach would support the alignment of business objectives with specific skills that colleges are teaching their students. This tactic would also improve the college's ability to meet the student's expectation of getting a desirable job when their higher education is complete. "If the real issue is jobs then the real work of colleges is not only to develop students academically but also to foster their work readiness. It's about creating connectivity to the labor market so students can seamlessly transition from education to employment..." [21]

The perspective of the legislators is considered to be representative of the citizens of the state in public universities. Tax dollars are a primary source of financial support for state institutions and typically compromise 25-65 percent of the budget. [22]. This level of financial commitment most certainly makes the state- as an operating entity, as well as individual citizens of the state customers. This category of customers systematically express a need for a well-educated populous via policy, legislation, community support and cultural practice. The metrics of customer satisfaction in this category are not as obvious. Levels of satisfaction or dissatisfaction may be communicated by key spokespersons such as members of the board of regents [23].

### Summary

There is definitely a need for lean six sigma in higher education to address spiraling costs. When various customer perspectives are considered they are not all the same but there are no glaring unresolvable conflicts. Hence we conclude in the affirmative, lean six sigma could be implemented in higher education and meet a variety of the customer's needs. Perhaps a more appropriate question will focus on the methodology or application. It has become evident that more research is necessary to address the strategy of implementation.

Colleges and universities will need to train and encourage employees to develop more collaborative relationships and engage with different the different categories of customers and employers. Stokes explains that building relationships with employers will require "a need to invest in the necessary infrastructure, the human capital capacity and the skill sets necessary." There may be some upfront costs, but the value creation for students, colleges, businesses, and society could be exceptional.

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## **Biography**

Dr. Donaldson is an Assistant Professor at the University of Texas at Tyler in the College of Business and Technology. She teaches technology courses and provides faculty mentorship on industry sponsored projects. Professor Donaldson is a certified project management professional (PMP). A strong advocate of inclusionary practices in education and business, Dr. Donaldson encourages students to work to their strengths while constantly expanding their skill sets and perspective of life. Her research agenda and commitment to intellectual growth is driven by her life experience. While completing her Master's degree and for several years after, she worked in a family owned manufacturing firm. She has tremendous insight on family owned businesses, manufacturing, technology management and STEM education. In 2015 Dr. Donaldson was selected to become an Entrepreneurial Leadership Academy Fellow. The Entrepreneurial

Leadership Academy is a resource support program for faculty who have entrepreneurial interests.