A new lean paradigm in higher education: a case study

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Abstract

Purpose – This case study aims to demonstrate that lean principles and practices utilized in industry can be successfully applied to improve higher education administrative processes through an innovative and engaging learning experience involving undergraduate students.

Design/methodology/approach – This is a first-hand account by the instructor of a small group of undergraduate students in a seminar course working as a team to identify waste and redesign the university's grade change administrative process.

Findings – This case study found that a small group of undergraduate students can quickly learn basic lean principles, tools and practices, and reinforce that learning by applying them in a team effort to significantly improve a university administrative process.

Practical implications – With the changing higher education environment, where efficiency and effectiveness have become more imperative due to increasing budget constraints and competition for students, this case study shows that students can play a major role in the improvement of university administrative processes while at the same time gaining new knowledge and skills that are highly valued in industry.

Originality/value – This case study confirms an opportunity for universities to create a valuable learning experience for their undergraduate students, by involving them in improving the administrative processes of the university.

Keywords Lean production, Higher education, Universities, Colleges, Process improvement, Continuous improvement, Kaizen, United States of America

Paper type Case study

Introduction

As I sat in the Associate Provost’s office and listened to her describe the dysfunctional state of the university’s grade change administrative process, it struck me that this would be an ideal opportunity for a new lean paradigm, if you will, in higher education. The paradigm shift would be to involve a team of students instead of employees in a semester long process improvement effort called a Lean Workout. This is a major shift that to my knowledge had not been undertaken before in a higher education environment.

A new course would be developed where a team of undergraduate students would learn about lean in a seminar setting and then apply lean tools and techniques to redesign the grade change process by eliminating waste in the process. This course would advance the university’s academic mission while at the same time working to improve the efficiency and effectiveness of one of its basic administrative processes. The focal point of the seminar course would be the Lean Workout which includes elements of Toyota’s kaizen and jishuken event. (Kato and Smalley, 2011) The new paradigm follows the basic philosophy of one of the developers of lean, Toyota’s Taiichi Ohno, and that is to make changes based on the needs and purpose of the enterprise (Ohno, 1988).
I had recently created a new undergraduate course – Lean Principles and Practices – and had taught the course the past two semesters. Lean which has evolved over the past century was introduced or re-introduced depending on your perspective in the United States with the publication of The Machine That Changed the World: the Story of Lean Production (Womack et al., 1990). Lean is a comprehensive approach to operating an organization, with a primary focus on the identification and elimination of waste within its processes. Lean is now a well-established best practice in business globally. Although its origins are in manufacturing, lean has increasingly been applied to a wide variety of settings, including higher education, with excellent success (Balzer, 2010).

I had been considering supplementing the Lean Principles and Practices survey course with a seminar course in which a team of students would participate in a Lean Workout which is much like an extended kaizen event or jishuken event (Liker, 2004). The term “kaizen” means “change for the better” or “continuous improvement” (Emiliani, 2005; Liker, 2004), which is a hallmark of the lean culture (Mann, 2005). The jishuken event’s main purpose is to develop the “leadership and problem solving skills of the managers” (Liker, 2004). In this seminar course the Lean Workout would adapt the kaizen/jishuken event to the realities of an undergraduate student team and semester timetable.

The grade change process seemed to be the perfect opportunity to apply this new paradigm. According to the Assistant Provost, an internal audit had been conducted and the auditor himself had noted that the grade change process “was an ideal Lean project given its noted inefficiencies and bureaucracies”. I could not agree with the auditor more. This was a true win-win opportunity. It was a win for the students because they would have the chance to immediately apply their learning in the context of a very relevant and understandable process. It was a win for the university because an inefficient and ineffective process would be improved through the direct involvement of its students, faculty and administrative staff.

On hearing the proposal, the Associate Provost quickly grasped the potential benefits of an undergraduate team working on the grade change process. With her support, the Lean seminar course was added to the upcoming summer semester. It was amazing how quickly this went from an idea to an approved course.

**Teaching methodology**

Given the high visibility of this effort and the compressed timeframe of the summer semester (eight weeks) it was evident that the best candidates for the seminar would be serious, high achieving students. Fortunately, several of my former students registered for the course and they formed a solid core for the team. It was critical to involve students who knew each other and were willing to jump into this intensive project quickly because it was necessary for the team to function effectively early on. As it turned out, this team of students was most impressive; their work ethic and determination to learn lean and successfully complete this new type of kaizen/jishuken Lean Workout were amazing.

Three main changes needed to be incorporated into the existing Lean Principles and Practices syllabus: introducing lean tools much sooner in the schedule, focusing on a few key lean principles initially and designing the team Lean Workout schedule.

The first lean tool, process mapping, was introduced to the students on day one with a simple **Brown Paper Bag** exercise, in which the team mapped out a home delivery pizza process – from the customer calling in the order for a pizza to the delivery at the customer’s home. This “hands on” exercise was designed to use a familiar process
(what college student hasn’t ordered a pizza) to teach the basics of what constitutes a process, and to begin to see which activities or steps within a process are valued by the customer and which are not (waste). This exercise was also very valuable in starting the teambuilding process.

In the next few classes the students learned about other key tools and techniques of the lean system, including kaizen, value v. waste, 5S (sort, set in order, shine, standardize, sustain) (Ohno, 1988), brainstorming, teambuilding, value stream mapping and the A3 Report.

The students were quickly introduced to the Lean Workout concept. They learned how kaizen teams can be natural work teams or cross-functional teams, but that in any case they are focused on specific problem areas and have a set amount of time to research the situation, identify wasteful or non-value-added activities, analyze root causes of the problem(s) and propose a solution to management (Liker, 2004). Although different types of kaizen or continuous improvement teams, often known as Employee Involvement teams (Magjuka and Baldwin, 1991) and Quality Circles (Lawler and Mohrman, 1985) have been used in US industry with mixed success since the late 1970s, Toyota has perfected the approach.

For the purposes of the Lean Workout, the concept of “value” in this academic administrative process needed to be translated from the customer-orientation in industry. In a for-profit enterprise (Flinchbaugh, 2004), value-added activity is something that must:

1. be valued by a customer who is willing to pay for it;
2. change the product or service; and
3. be done right the first time.

In academia, customer-oriented concepts are foreign and frowned upon (Emiliani, 2004). And, I might add, such concepts are not inclusive enough to cover all the relevant stakeholders in academic matters and their respective interests and requirements. Instead, the students identified key participants in the process, which they called key players, as well as the internal and external constituents or end-users of the grade change process, and judged the “value” of the various steps of the process from the perspective of their requirements. This will be described more fully later in the A3 Report – Current Condition section.

The student team learned to “see” waste in a process (Rother and Shook, 1999). Waste (also referred to as “muda” in the Toyota system) consists of the non-value added activities in a process (Liker, 2004). It is the opposite of value-added. Identifying waste/muda is a critical first step in the Lean journey. The team used process mapping and value stream mapping to identify waste/muda in the grade change process. While the Toyota system focuses on eight types of waste/muda (Dennis, 2007), the team predominantly focused on just four:

1. Delay – the amount of time that the people who are next in line in the process are waiting for the information to flow to them.
2. Overprocessing or incorrect processing – people in the process are doing more than is required by the customers, or end-users of the process.
3. Correction – defects are being corrected by downstream people in the process or being sent back upstream for correction.
Knowledge disconnection – people in the process are disconnected from one another. The key players in the process don’t know what who is doing what in the process and, in many cases, don’t care.

Ironically, one of the most valuable tools that was introduced to the students early on in the course was the simple “What do you know and what don’t you know” worksheet. This worksheet helped the team members gather the necessary facts and not jump ahead to conclusions and recommendations before they had all their questions answered and facts verified.

The key Lean principles that were focused on initially were adopted from the HBR article “Decoding the DNA of the Toyota production system” (Spear and Bowen, 1999). The first three rules of the Toyota system were the most critical to the kaizen team’s analysis:

1. How people work – all work is highly specified in content, sequence, timing and outcome and people perform their work according to these specifications. If not, the deviations are highly visible and immediately apparent.
2. How people connect – each person knows who provides what and when at every step of the process. These connections are standardized and spell out exactly what one person in the process supplies to the next in line person in the process all the way to the ultimate customer or end user.
3. How the production line (or process) is constructed – every product and service flows along a simple, specified path. There are no forks or loop-backs in the flow. The process flows to a specified person, not to the next available person.

The student team Lean Workout was designed to follow the A3 Report format (Liker and Hoseus, 2008) used by Toyota in its global operations. The A3 Report is a standard format used by Toyota’s kaizen and jishuken teams to organize and guide the team on its fact-finding and problem-solving mission. Although different practitioners have introduced various modifications over the years, the substance of the A3 Report is generally very similar. The A3 format used by the team had seven general headings:

1. Theme – what is the student team trying to do?
2. Background – what is the context required for a full understanding of the problem(s) and the importance of the problem(s)?
3. Current condition – diagram the current process and highlight the problem(s).
4. Cause analysis – list the problem(s) and the most likely root causes. Focus on the waste/muda found in the process.
5. Target condition – diagram the proposed new process and note the necessary countermeasures and measurable targets.
6. Implementation plan – describe the WHAT (actions to be taken), WHO (responsible persons), and WHEN (time and dates) and cost.
7. Follow-up – indicate how and when the effects and outcomes will be checked.

To fit the A3 report into the course schedule, the Lean Workout was divided into three parts. In the initial part, the student kaizen team was tasked to describe the theme, background and objectives for the Lean Workout. In the second part, the team was required to perform a comprehensive analysis of the current condition of the process and
delineation of the major problems and their root causes. In the final part, the team was challenged to develop recommendations for the new target process and implementation plan. The team prepared and delivered in class a 15-minute PowerPoint presentation for each of the three parts and a 30 minute final PowerPoint presentation (to their client, the Associate Provost and other key players), which included a completed A3 Report.

Finally, my role as an instructor changed. I tried to become more of a sensei (one who has gone before) (Dennis, 2007; Womack and Jones, 1996), or a coach of the kaizen team, particularly during the latter stages of the course. After initially teaching the basics of lean through lectures, readings, case studies and simulations; I tried to “get out of the way”. The goal of the course was for the students to understand the lean concepts and be able to apply them to this “real” situation. I asked probing questions about how they were going about doing their research and what exactly they were discovering. I continually reminded the team members to use all the lean tools and techniques they had learned and be comprehensive, but I tried not to directly influence their root cause analysis or decision making about the target condition for the grade change process.

A3 Report – theme, background and objectives

When the Associate Provost described the problems with the grade change process in the initial meeting with the student team, she quoted terms from the audit report such as “archaic, ineffective and inefficient”. In lean terms, the grade change process did not effectively achieve its intended purpose and was dominated by waste/muda – non-value added steps. The archaic and completely manual process required routing the Petition for Grade Change form in serpentine fashion to various individuals and departments to obtain multiple authorizations. Many, many, non-value added review and approval steps were conducted by the academic units, supposedly to verify the legitimacy of the grade changes. Then more review steps were added by the downstream administrative units, to detect and correct front-end defects and also to quasi-verify the legitimacy of the grade changes. And, despite all these steps, the audit found that “both the academic and administrative review processes provided little control or value…”

In summary, the grade change process was painfully redundant, riddled with errors, cost too much, took too long, was extremely student unfriendly … and did not accomplish the academic oversight it was supposed to accomplish.

The goals for the team Lean Workout laid out by the Associate Provost were as follows:

(1) Review current procedures and evaluate the need for updating the university grade change procedures.

(2) Develop a Lean Action Plan to address following issues:
   • development of electronic approval process to replace the "petition for grade change" manual form;
   • design an electronic form to enhance efficiency and alleviate administrative burden; and
   • determine required signatories – to increase efficiency without sacrificing academic oversight.

(3) Make recommendations to the Office of Academic Affairs by the end of the summer semester for implementation in the upcoming fall semester.
A3 Report – current condition

The grade change process is really two processes: one for graduate grade changes and another for undergraduate grade changes. These grade changes include I (incomplete), P (progress), R (Registrar) and grade-to-grade (including student appeals) changes. Approximately 3,000 grade changes are processed throughout the university annually. More than 30 percent of the grade change forms are defective, meaning that the grade changes are sent through the grade change process to the Registrar’s Office with incorrect information. The Registrar’s Office then sends the forms back to the originating Dean of the College and/or School or the Department for correction. The corrected (hopefully) forms go back through the entire process again.

The student team decided that the best approach to understand the current condition, highlight the problems and prepare for the root cause analysis was to determine at the outset:

- the key players involved in the process (in lean terms, these participants would be the internal suppliers → customers in the process); and
- the “end users” or the internal and external constituents impacted by the process.

Once these were determined, then the team would need to identify the specific requirements of each key player and constituent with respect to the grade change process. This is how the team defined value-added activity. From there, the team could begin to map the processes and identify the value-added steps and the waste/muda – non-value added steps.

The team started its fact-finding mission by researching the university requirements for the grade change process. The team found that the grade change process was established by a 1962 University Senate Ruling. The ruling stated that in order for an instructor to change a grade, the instructor must submit a written petition to the Committee on Instruction (COI) and COI approval is required. The only subsequent changes to the process made by the Senate over the decades were the establishment of and modifications to the incomplete (I) grade change process. Other than these I grade changes, the 1962 Senate ruling has stayed intact. It became clear to the team that what the university leadership body (Senate) envisioned in 1962 was a very simple process. Over time, that very simple process had morphed into a waste-laden labyrinth.

Next, the team split up and conducted one-on-one interviews with the COI representatives in the College and various Schools. These individuals were usually the Deans or Assistant Deans. The students used a structured interview with standard questions so that they would get the same detailed information from each person.

In the third step, the team members interviewed key administration personnel in the undergraduate and graduate departments, the Graduate Study Program and the Registrar’s Office.

Finally, and most importantly, team members went “to the gemba”. This again is a Toyota concept that means “going to where the work is actually performed ... using a structured method to observe, analyze, and understand how work is done and why it is done this way (Flinchbaugh and Carlino, 2006). In this case, the students went to the various offices and watched the academic and administrative personnel do their jobs and actually process the grade change forms.
Throughout these steps, the team members were repeatedly asked to use the “What Do You Know and What Don’t You Know” worksheets to ensure a common understanding among themselves as to what facts they were certain about and in what areas they still had outstanding questions.

From these fact-finding efforts, the team was able to determine who the key players were and the internal and external constituents impacted and their specific requirements from the process.

The key players in the process were determined to be: the students, instructors, the COI representatives, the Graduate Study Program, the Registrar’s Office and the Departments’/Deans’ secretaries.

The internal constituents impacted by the process were determined to be: the Provost, the University Senate, the students, Financial Aid, Scholarships, Academic Skills Center and Academic Advisors.

The external constituents impacted by the process were determined to be: employers (tuition reimbursement, pay increases, job changes etc.), graduate schools and other universities (transfers etc.).

The team found that the specific requirements of the key players and various constituents centered on the following:

- accurate grade changes with valid reasons supplied by the instructors;
- minimized collaboration between student and instructor;
- easy-to-use, fast process; and
- fast, accurate, valid grade changes entered into the on-line Banner system, with timely notice to key players and constituents and available on SAIL as soon as possible.

What the student team ultimately mapped out as the current condition of the undergraduate grade change process was a process that included 16 steps, including three formal review and approval steps and several other informal review steps (see process map in Figures 1 and 2). With respect to the graduate grade change process, the current condition consisted of 43 steps, including six formal review and approval steps, and several other review steps possible throughout the process (see process map in Figure 2).

As indicated in the Figures 1-3, excessive waste/muda is present in both the undergraduate and graduate grade change processes (see the pie charts in Figure 4). In the undergraduate process, the team determined that 72 percent of the steps should be classified as waste/muda, and only 28 percent as value added. The graduate grade change process was even worse. The team determined that 90 percent of the steps were non-value added.

There are significant unnecessary costs in both processes including time, labor, office supplies and storage space. The internal and external constituents are also negatively impacted by the dysfunctional grade change process.

_A3 Report – causal analysis_

After completing its fact-finding and doing an extensive series of 5 Why analyses to get to the real causes of the problems (Ohno, 1988), the student team determined that the grade change process evolved fitfully over the past 50+ years, but predictably, given the following causes:
The process is a 100 percent manual process.

The process starts with 600+ full and part-time instructors in the various academic units inputting grade changes and winds its way through several administrative units.

The process is not standardized across the university.

There is no process owner(s).
Figure 3.
Graduate process map (Continued)
A new lean paradigm in HE

Figure 3.
There are no process metrics.

There is no formal end user feedback system.

There is no formal training for front-end participants.

There were multiple “fixes” and “band-aids” over the decades that added more administrative procedures and people to “check the checkers”, but did not fix the root causes. As one administrator said “there were so many band-aids applied over the years, the process had become a mummy!”

Graduate study does not follow proper roles according to the Senate ruling.

The student team zeroed in on the fact that a high degree of waste/muda in the current process is due to front-end errors being input by the various instructors in various departments across the university. The team found that there are no automatic “poka-yokes” at the beginning of the process to prevent errors from flowing downstream. In a lean system, “poka-yokes” or mistake proofing are simple, creative devices that make it nearly impossible to make an error (Liker, 2004). There is also an absolute lack of formal feedback and training to educate the front-end participants (instructors, COI and departments’/deans’ secretaries). The only type of feedback from the back-end administrative units is informal, episodic and more attuned to “fix it and send it right back” than creating a formal feedback and learning system to prevent future defects.

The student team concluded that the 50-year-old process was an orphan process that nobody managed. While there was a lot of complaining and finger-pointing about its defects and “fixes”, there was no one accountable for its overall performance. Nobody, until
now, had taken the time to understand how the process actually functioned, identified the problems and tried to fix the root causes of the ineffective and inefficient performance.

**A3 Report – target condition**
The student team redesigned the grade change processes based on the key players’ and constituents’ requirements and the Associate Provost’s goals. The team created one, paperless, standard process for the entire university that covers both undergraduate and graduate grade changes. The new lean process eliminated much of the waste/muda or non-value added steps from the two processes. The new process takes only five steps to process any type of grade change (see process map in Figure 5). The new grade change process uses an on-line routable form that conforms to the Senate rulings and maintains academic oversight. The new lean process establishes automatic poka-yokes at the point of entry for the instructor and COI to prevent defects from flowing downstream.

A new process owner (the Registrar) was proposed to manage the performance of the overall process. The team also recommended that a new training program be developed and delivered to the key players, especially instructors, COI representatives and departments'/deans' secretaries. Three new key process metrics were recommended to
track the performance of the process and provide timely information the process owner and key players to continuously improve the process as follows:

1. Number of grade changes by type, College/School and instructor (after all grade changes are themselves defects occurring within the initial grading process).
2. Cycle time between steps 2 through 5 by College/School.
3. Number of disapprovals from COI by College/School and instructor.

The team used the Lean Workout to not only redesign a “waste/muda-free” process, it also set in place lean policies, procedures and tools to insure that the process owner and key players in the process will be able to better understand how the process works, easily track its performance, know how to fix root causes and continuously improve the process in the future.

A3 Report – implementation plan
The student team made a PowerPoint presentation containing its current condition analysis and new lean process recommendation to the Associate Provost (client), the Registrar, the Senior Associate Registrar and the Executive Director of Graduate Study at the end of the course.

The student team made the following recommendations to successfully develop and implement its new grade change process:

- introduce the new process through a pilot program in the School of Education and Human Services (SEHS) beginning the fall semester;
- during the SEHS pilot, an intern from the kaizen team and I will work with the process owner and UTS to design the new on-line routable form, then implement and monitor the pilot program in SEHS;
- during the pilot program, a training program will be developed and delivered to the administrators, faculty and staff who were involved in the grade change process; and
- after completion of the pilot program, the new grade change process will be implemented throughout the university in the other Schools and College.

A3 Report – follow-up
The three key metrics will be reviewed at the end of each semester by the process owner – the Registrar.

A report of the key metrics will be distributed to each COI and all Department Heads in the College and Schools and also be available through Workflow/Banner. This information will be compared to the old process using the figures from the previous Academic Year and continuous improvements will be made to the process at the direction of the Registrar.

Summary
From the perspectives of the Associate Provost and the students, the student team’s Lean Workout of the grade change process was a success. Students, faculty and administrators worked together effectively to “lean out” a dysfunctional process. Lean principles, practices and tools were learned and then applied by students to their university’s processes in an innovative and highly engaging learning experience.
The Lean Workout involved a tremendous amount of work for the student kaizen team in a very short period of time, even more than was anticipated. The feedback from the students was that, although it was a demanding workload and they had to come up to speed very rapidly, it was a great learning experience. They all felt very proud of themselves. They were entrusted with a significant problem by the Associate Provost of their university, and, working together with members of the administration and faculty, they were able to design a new process that eliminated much of the waste/muda and accomplished the goals laid out for it – all in the span of eight weeks.

This case study demonstrates that lean principles and practices utilized in industry can be successfully applied to improve higher education processes through an innovative and engaging learning experience involving undergraduate students. This case study found that a small group of undergraduate students can quickly learn basic lean principles, tools and practices and apply them in a real-world setting to dramatically improve university processes. This case study confirms that there is an opportunity for universities to create valuable learning experiences for their undergraduate students by involving them in improving their own administrative processes. With the changing higher education environment, where greater efficiency and effectiveness have become more imperative due to increasing budget constraints and competition for students, this study shows that students can play a major role in the improvement of university processes while at the same time gaining new knowledge and skills that are highly valued in industry – a true win-win opportunity for universities and their students.

Epilogue
The implementation plan was taken over by a team of university administrators including the Registrar, Senior Associate Registrar, the CIO and the Executive Director of the Graduate Study Program. That team developed the new on-line Grade Change Request process (which reflected the process redesign by the student team). The new on-line form was simple, direct and lean. The new on-line process was successfully beta tested. Then the new grade change process was made available to a small pool of selected faculty members for further testing and improvements. The new process proved to be faster, cheaper and easier to operate for all the key players and produced better outcomes for the internal and external constituents. Most recently, the Registrar announced to the University Senate that the new on-line grade change process developed by the student team was available to all faculty members for their use.

The success of this effort prompted the Dean of the School of Education and Human Services to identify two inefficient processes to be the focus of a lean seminar course I taught a year later. One major change, though, is that the class size was doubled. It consisted of twelve students who formed two teams. The positive buzz from the initial student participants caused the class to fill very quickly.

References
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Further reading

About the author
Mark S. Doman is a Pawley Professor in Lean Studies in the Human Resource Development Department at Oakland University, and a member of the Leadership Team at the Pawley Lean Institute. He is a recent recipient of a Fellowship in Lean Studies from Oakland University and the Pawley Lean Institute. He has taught Lean courses at both the graduate and undergraduate levels. He has led Lean seminars and webinars through the Pawley Lean Institute. Mark S. Doman received his Juris Doctor degree from the University of Minnesota. Prior to joining Oakland University, he had 25 years of business experience with Ford and AT&T, where he held various executive positions in human resources, legal and operations. He has led several major organizational change initiatives throughout his career that included Lean Workouts, employee involvement, quality circles, TQM, process reengineering, kaizens and corporate restructuring. He has worked with several organizations as a lean consultant and mentor and is a member of the Michigan State Bar Association. Mark S. Doman can be contacted at: doman@oakland.edu

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