

Quality Approaches in Higher Education



Development of
a train-the-trainer
model in distance
education
for process
improvement.

Striving for Operational Excellence in Higher Education: A Case Study Implementing Lean for Distance Learning

Karen L. Pedersen, Melisa J. Ziegler, and Lacy D. Holt

Abstract

In partnership with the Intel Corporation (Intel) Mentoring and Planning Services (MAPS) Program, senior leadership from a distance education division of a large university in the southwest instituted an initiative to engage, train, and empower employees. The primary goal of the initiative was to improve the learning experience for students while driving innovation, cutting costs, and enhancing internal effectiveness. To realize long-term success, a train-the-trainer approach was deployed that involved a cross-functional team of division employees. Through a series of division-wide training sessions, 135 staff were trained and 96 processes were identified as targets for improvement. Priority projects were identified as having a relatively simple implementation schedule yet with potential to have a significant positive effect on improving performance. This case study details the train-the-trainer model as well as progress made toward comprehensive process improvements.

Keywords

Change Management, Continuous Improvement, Lean

Introduction

With a network of more than 35 statewide campuses and an expansive online operation, the Extended Campuses division of research-intensive Northern Arizona University (NAU) embarked on a mission to change its organizational culture to better meet the needs of the 21st century marketplace. With numerous indicators coming from internal and external sources, division leaders knew it was time to take purposeful steps to enhance organizational effectiveness as part of its efforts to increase enrollment. Employee engagement to meet the evolving needs of learners, employers, and other key stakeholders was determined to be the most effective avenue for this effort.

Senior leadership instituted an initiative during the 2012-2014 academic years to engage, train, support, and empower employees with the primary goal to improve the learning experience while cutting costs and enhancing internal effectiveness. To reach this goal, senior leadership turned to lean experts from Intel's Mentoring and Planning Services (MAPS) Program. This program matches the skills of Intel employees with the unique needs of not-for-profit organizations. Through this partnership, members of Extended Campuses' lean team were provided with more than 144 hours of training and support to implement a train-the-trainer approach that incorporated operational excellence thinking and lean principles into the workplace. This case study describes the application of lean in higher education, the evolution of NAU-Extended Campuses along its transformational journey, the training and mentoring support received from Intel, the effect of the initiative since its inception, and key steps other educational institutions can take to begin a lean journey.

Literature Review

Lean is a broad term that "refers to a collection of principles and methods that focus on the identification and elimination of non-value added activity (waste) in any process"

(Piccolo & Knobloch, 2012). Lean strategies are tools that help organizations increase quality, drive innovation, and increase value while reducing waste and costs. Lean is about setting goals of improvement by having “continually declining costs, zero defects, zero inventories, and endless product variety” (Womack, Jones & Roos, 2007, p. 12). For education, the focus is more than just saving money; it is about improving the quality of learners’ experiences and creating an environment of operational excellence while maintaining academic rigor.

According to Miller (2014), “operational excellence is the relentless pursuit of doing things better. It is not a destination or a methodology but a mind-set that needs to exist across an organization” (p.1). Miller’s (2014) work encouraged organizations to balance the lean philosophy in a more comprehensive framework by pushing beyond efficiency, productivity, savings, standardization, and eliminating waste. These “early experience” years are generally focused on operational projects (KPMG, 2013). Once employees start to see the benefits of lean, the organization continues to adopt a lean culture into daily work on its way to having a “culture of continuous improvement” (KPMG, 2013). To reach this state, organizations must focus on effectiveness, improving performance, growth, increasing value, retention, and customization while driving innovation (Miller, 2014).

While there are different models for describing organizational change (Barnett & Carroll, 1995), the progression of NAU-Extended Campuses during its lean journey can best be described within the five Stages of the Evolution of Continuous Improvement (Bessant, Caffyn, & Gallagher, 2001). Bessant, Caffyn, and Gallagher (2001) conducted a series of in-depth case studies that led them to describe the journey of continuous improvement (CI) as “a cluster of behavioral changes which establish innovation routines in [enterprises]” (p. 67). There are five levels in the model, from Level – 1 Pre-CI to Level 5 – Full CI Capability, that exemplify the underlying continuum of organizational change. The levels are shown in Figure 1.

Successful lean initiatives that move organizations through the levels are characterized by the cultivation of a quality culture, the investment of people and resources up front, the realization of quick wins that build to larger benefits, and the level and quality of management effort exerted toward the initiative (Bessant et al., 2001; Freed, Klugman, & Fife, 1997; Roffe, 1998; Simons, 2013). The cultivation of a quality culture begins with an appreciation of the current culture. Roffe (1998) described how change is challenging to any organization and working within the boundaries of a current culture means slowly extending and changing the culture to ensure the sustainability and integration of lean into the culture. The change is most successful when it is owned and championed by executives in the organization. Executives at the top level must be invested in the initiative, via people and resources, or else the potential for a mismatch between the strategic goals and actions of staff will exist. Training that starts at the top level can ensure that the desired message and culture are owned and lived by leadership (Bessant et al., 2001; Simons, 2013).

Background

Organization Overview

NAU is a public institution serving more than 27,700 students, and its focus on an undergraduate residential experience is strengthened by a robust distance education division. Figure 2 shows NAU’s demographic statistics and organization background.

For more than 30 years, NAU’s Extended Campuses became the organizational means by which academic programs were accessible at a distance from the main campus. With a median age of 32, learners served by NAU-Extended Campuses complete undergraduate and graduate degrees as well as certificate

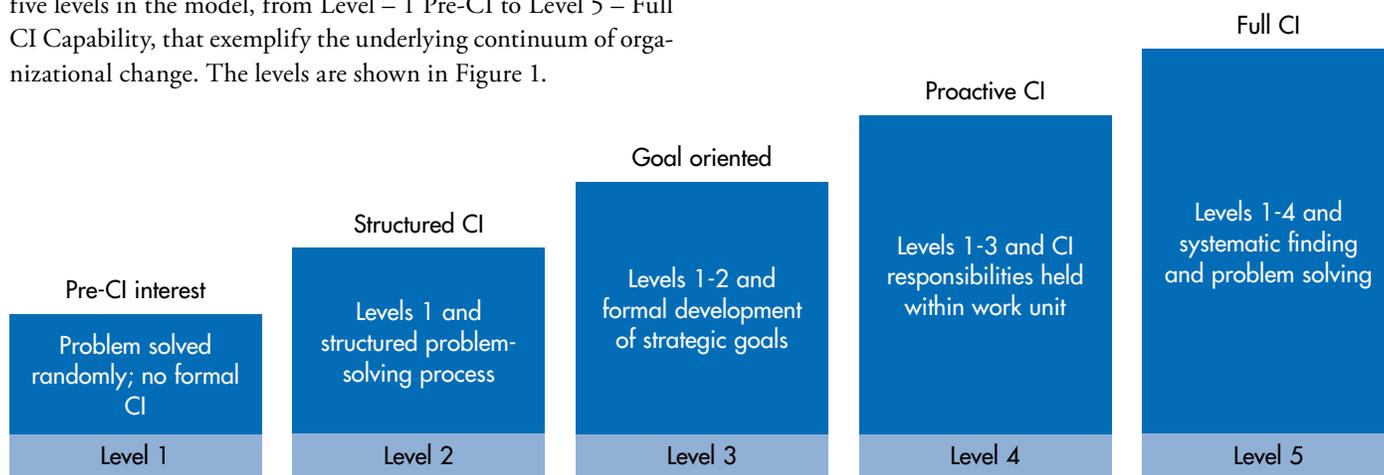
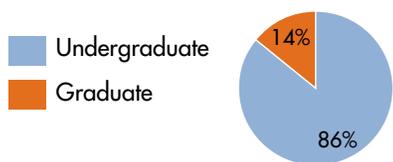
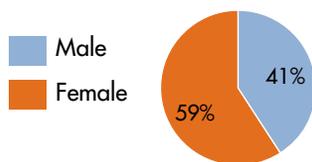


Figure 1: Stages in the Evolution of Continuous Improvement (CI)

University: Percent of Students by Level



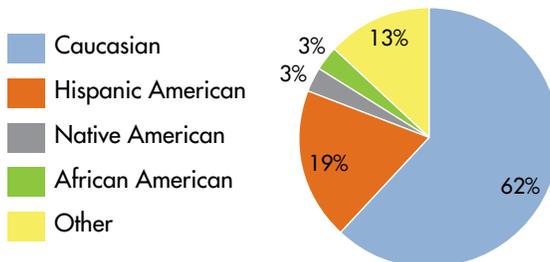
University: Percent of Students by Gender



University Mission

"To provide an outstanding undergraduate residential education strengthened by research, graduate and professional programs, and sophisticated methods of distance delivery."

University: Percent of Students by Ethnicity



Institutional Accreditation

The Higher Learning Commission (HLC) of the North Central Association

Degrees Offered	Number
Baccalaureate	91
Masters	49
Doctoral	11

Carnegie Classification	
Basic	RU/H: High research university
Size and setting	L4/R: Large four-year, primarily residential
Enrollment profile	HIU: High undergraduate

Sources:

- <http://www4.nau.edu/pair/quickfact.asp>
- http://carnegieclassifications.iu.edu/lookup_listings
- <http://nau.edu/president/mission-vision-values/>
- <http://nau.edu/provost/accreditation/institutional-accreditation/>

Figure 2: Demographic Statistics and Organization Background

programs. Over the years, the number of academic programs has grown to accommodate the education needs of the state. Today, Extended Campuses serves more than 9,500 learners annually who complete coursework in a classroom away from the main campus, online, or through a new competency-based online approach. Currently, Extended Campuses composes approximately 34% of NAU's enrollment with the stated goal of increasing their enrollment percentage to 52% by 2020 (Board of Regents, 2010). Through partnership programs, transfer initiatives, and innovative online offerings, Extended Campuses is strategically prepared to expand access to higher education to place-bound learners throughout the state and beyond.

Organizational and Staff Readiness

To improve relatively stagnant enrollment observed from 2008-2012, strategic alignment and integration became a focal point for Extended Campuses' leadership during the 2012-13 academic year. Goals were clearly communicated to staff through a series of online modules, email communications, as well as in-person and online meetings. This served as one of the first accelerators of movement from Level 1 – Pre-CI Interest to Level 2 – Structured CI (Bessant et al., 2001). It was a priority of the leadership team to ensure all employees had access to and understood the strategic plan, vision, mission, values, and goals that Extended Campuses was pursuing.

In the initial phases of the transformation, Extended Campuses was at Level 1 – Pre-CI Interest because not all internal processes were well documented or communicated across the division. In many cases, processes were separated into silos,

inconsistently deployed, and each campus or unit was functioning on its own set of processes. The lean initiative moved the division toward a more streamlined and integrated organizational approach by adopting a crawl, walk, run philosophy. This allowed Extended Campuses to move into Level 2 – Structured CI where small continuous improvement gains were observed while long-term goals remained in view (Bessant et al., 2001).

One of the benefits of using lean principles in higher education is that it helps establish measures and indicators to reflect project success (Simons, 2013). As the lean initiative gained momentum and the need for staff metrics regarding learner recruitment goals became apparent, Extended Campuses sought the support of NAU's office of human resources to incorporate performance metrics tied to enrollment goals, while ensuring compliance with the U.S. Department of Education's incentive compensation regulations. Some of the metrics implemented included percentage of staff participation and engagement, cost benefit analysis, outreach action plans, and student participation and retention rate changes. These metrics continued to shape Extended Campuses' movement into Level 2 – Structured CI (Bessant et al., 2001) by standardizing expectations and outcomes for staff and benchmarking progress toward the division's strategic goals.

A major challenge organizationally was that each of the 35-plus campuses was operating like its own mini-campus. Each provided learner services, scheduled classes, worked with academic departments to identify qualified faculty members, and trained staff locally on division processes. This operational structure worked well when the majority of the enrollment was face to face. However, it was not sustainable as the trajectory of online program

enrollment increased while face-to-face program enrollment decreased. In fall 2003, 91% of learners in Extended Campuses completed coursework face to face with only 9% completing coursework online (PAIR, n.d.). In 2013, enrollment patterns had shifted with just under 48% of learners completing face-to-face coursework and more than 52% completing coursework online.

As online enrollment grew, Extended Campuses began offering some centralized services while other services remained local. However, systems and processes were often complicated, inconsistent, and operationally complex across NAU's campuses. To achieve Extended Campuses' key results (e.g. deploy high quality, market-driven academic programs, substantially grow enrollment, and provide support services to enable learners to graduate on time), the leadership knew a transformation of the organizational culture, including greater levels of consistency and continuity in systems and processes across campuses, was necessary to move forward.

With the hiring of a trained CI leader who served as a champion at a high level, the organization was well positioned to move into Level 2 – Structured CI (Bessant et al., 2001). As Freed, Klugman, and Fife (1997) stated, “leaders are essential in creating a quality culture and they play a significant role in ensuring that the necessary resources are available to support quality initiatives” (p. 8). Additionally, the senior leadership team remained consistent during this time and was committed financially and strategically to the lean implementation. They served on cross-functional teams that worked on different projects which incorporated staff at all levels. This demonstrated to staff that lean was a transformational initiative meant to permanently change Extended Campuses' culture and how they did their work and was not considered a one-time initiative.

In addition to the commitment the senior leadership made to implementing lean, a lean team was formed that pooled the talent, expertise, and unique perspectives of seven individuals across Extended Campuses. The lean team was comprised of Extended Campuses' associate vice president, assistant vice president, director of strategic initiatives, director of technology, director of strategic marketing, coordinator of training and development, and business process improvement coordinator. The lean team furthered the organization's movement into Level 2 – Structured CI by adding structure and organization to the operational excellence initiative (Bessant et al., 2001). The team was provided with the financial resources needed to accomplish their work, including support for the online and in-person training, payment for travel expenses, creation of a resource library of relevant books, and the purchase of eVSM software. Given the need for involvement of employees at all levels to move through the CI stages, all employees were invited to participate in the lean

initiative at the direction of the senior leadership and lean team. By relying on the employees doing the work to improve the processes, Extended Campuses came together to resolve issues, drive innovation, improve quality, and increase value, thus creating a better educational experience for learners.

Methodology

Train-the-Trainer Approach

While Extended Campuses worked with Intel mentors for two years, it was in fall 2013 when the Intel mentors worked directly with the lean team to implement a train-the-trainer program with the intent that the lean team would then train the Extended Campuses' employees. Throughout the year, the lean team received monthly training and mentoring on specific lean principles, methodologies, and software. Topics of the trainings included: business process improvement (BPI), stakeholder management, lean principles and methodologies, kaizen event management, and relevant software applications such as eVSM.

Prior to the lean team implementing the division-wide training initiative, a Blackboard Learn (BbLearn) shell was developed to serve as the primary go-to location for lean information and resources. In December 2013, the lean team began the division-wide lean training effort by conducting a one-hour basic lean introduction and overview using a standard online meeting format. The live training had 135 individuals or sites logged on and, the recording has since been accessed 75 additional times through BbLearn.

The initial training was followed by nine, four-hour process-map activity and training sessions strategically located throughout the state with 135 staff members participating (59% of NAU-Extended Campuses' total staff). These trainings ensured that every person across the division had the same basic understanding and starting point so that lean principles could be infused into the workplace. During these training sessions, 96 processes were identified as targets for improvement. Between December 12, 2013, and February 18, 2014, more than 675 division-wide training hours (135 participated in the one-hour training and in the four-hour in-person training) were recorded.

The train-the-trainer approach was intended to give the division the foundation to move from Level 1 – Pre-CI Interest to Level 2 – Structured CI (Bessant et al., 2001). In addition, the approach allowed the organization to begin to develop a lean culture, bring quality to the forefront, and streamline internal processes.

Priority Processes

Care was taken in selecting initial projects. High-priority projects that are smaller in scope can be chosen at the beginning

phases given they have a visible impact on the organization. Simons (2013) called these “burning platform” projects because they are “critical to [the organization’s] survival” (p. 3). The need for quick wins cannot be understated during the early stage of a lean implementation. In this regard, motivational and operational issues must be addressed at the same time for the initiative to achieve success (Alagaraja, 2010). Therefore, Extended Campuses chose first-priority projects that were identified as having a relatively simple implementation schedule with potential to provide a significant positive effect on performance.

Selection: In the second round of employee lean training, participants worked individually or in small teams to identify processes within their functional area over which they had direct oversight. These process map trainings identified 96 processes that could benefit from improvement. As shown in Figure 3, processes were identified division wide. The greatest opportunity for improvement was observed in the enrollment management area because there are more staff members in this area and, therefore, more process improvement ideas were submitted. Furthermore, this area had experienced more process alignment activities and initiatives over the previous two years.

Using the 96 processes as a foundation, the lean team rated each on two dimensions (ease of implementation and impact to the organization) to prioritize the processes into a manageable work flow. Using an implementation prioritization and scoring process, scores of 1, 3, 6, or 9 were assigned to each dimension. Impact scores ranged from 1 = Low Impact to 9 = High Impact. Ease of implementation scores ranged from 1 = Complex Implementation to 9 = Easy Implementation. Scores on each dimension were multiplied together and the resulting final score served as a guide to rank the projects from highest to lowest. Once prioritized, cross-functional teams were formed to begin work on the top four projects (see Table 1). Other projects followed, and, to date, these teams have completed 13 projects

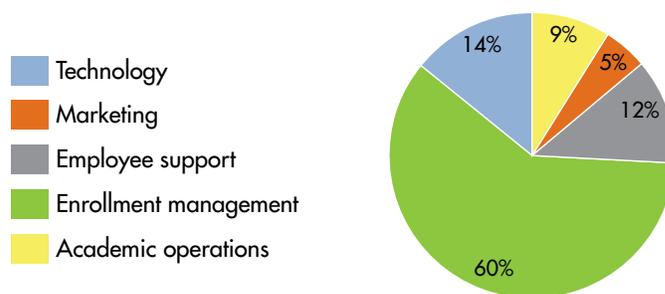


Figure 3: Percentage of 96 Processes by Functional Unit

with four still in progress. In addition, there are a number of staff members and work groups who have incorporated lean thinking into their daily work.

Description: Each of the top four priority projects (e.g. new student orientation [NSO], event management alignment, class presentation data collection, and computer support processes for new employees) required cross-functional teams to utilize their new lean knowledge and skills to solve problems and evaluate improvements. Historically, new student orientations were handled at individual campuses across the state. The challenges to the NSO process included: declining participation in many locations at in-person orientation sessions, a growing number of online students who may or may not have access to the orientation, and many staff hours needed to facilitate and deliver quality sessions. An examination of the problem demonstrated the need to create a standard orientation to onboard all new learners successfully with the potential to also enhance retention efforts. A cross-functional team was formed to address the issues discovered in the process maps. The team collected orientation materials from every location across the state and gained a detailed understanding of the individual campus work flows. Next, comparable peer institutions were investigated to see how they managed their

Table 1: Implementation Prioritization of Top Four Processes

Process/Project Title	Impact	Ease of Implementation	Score (Impact x Implementation)	Evidence of Success
New student orientation	9	3	27	375 hours x \$18/hour average salary = total cost savings \$6,750 annually
Computer support processes for new employees	6	9	54	Qualitative value added to organizational success
Event management alignment	9	9	81	Qualitative value added to organizational success
Class presentation data collection	9	9	81	No significant change/success noted

NSOs and what best practices could be applied to the division. An online NSO was piloted in spring and summer 2014 with initial learner feedback prompting several modifications. The improved NSO was launched for all new learners in fall 2014.

The intent of the event management alignment project was to create a streamlined process and expectations for staff regarding planned outreach events. The primary challenges to the current state of event management included: inconsistencies in processes across the state, varying approval processes for events requiring admissions fees, specific regions focusing on only one type of event, and prioritization of certain events within the recruitment process. Creating a standard operating process was identified as the primary need to ensure that student recruitment opportunities were consistent and equally distributed across regions and recruiters. A team was formed and began by defining and organizing the types of events, standard event materials required, and the pre- and post-event process. The team collected information from all recruiters, marketing materials, and approval processes. Next, the team identified a standard process for each area through discussion and compromise before deployment across the state.

The class presentation data collection project involved the amount of data a recruiter was required to collect from prospective learners during a class presentation. The importance of a class presentation is to relay program information quickly and create enthusiasm about pursuing a bachelor's degree. The primary challenge with the required amount of data was that recruiters spent the majority of their time in the presentation confirming that prospective learners completed the form correctly. Therefore, the marketing team reduced the amount of information required, created a new form, and sought input from staff members who used the form. Once feedback was collected, the new form was created and distributed at all events.

The computer support processes for new employees were handled individually by hiring supervisors at individual campuses across the state. The challenges faced included: amount of notice given to the technology team prior to a new employee starting, supervisors setting up technology access without including the technology team, and varying access based on who and when the technology was set up for the new employee. Since technology access is critical within a distributed organization, a streamlined process

was necessary to provide required access close to the start date. The technology team worked with the employee support team to identify the place in the hiring process in which a supervisor would inform them of a new hire. The technology team created an online submission form to allow supervisors to make requests for changes to technology at their campus, troubleshoot issues, and create tickets. The electronic form was deployed through the intranet and messaging was sent to all staff about the updates.

Evidence of Success

Prior to beginning the training initiative, the lean team delineated several success indicators with the objective of measuring participation, involvement, and engagement (see Table 2). The purpose was to establish a baseline for future assessments of impact and long-term results. The success indicators were selected based on discussion among the Intel mentors and the lean team members with the intent of establishing well-trained and engaged staff.

Four Priority Processes

As shown in Table 1, the evidence of organizational success on the top four projects was varied. The NSO project proved more difficult to implement yet had the greatest outcome of organizational success. Based on satisfaction surveys conducted, new learners from the fall of 2014 indicated that they Agreed or Strongly Agreed to the following statements: 91% agreed that the "Subject matter was useful for me as a new student," 90% agreed that "The modules explained each concept well," and 85% agreed that "Time spent was appropriate." Although NAU-Extended Campuses has calculated an estimated time and cost savings for staff (see Table 1), additional calculations regarding

Table 2: Success Indicators and Outcomes

Success Indicator	Frequency	Measure of	Outcome
Number and percentage of staff trained	Quarterly	Participation	132 staff, 59% of staff
59% of staff	6	9	54
Number of lean resources shared and accessed	Monthly	Participation and engagement	23 resources shared; accessed 248 times
Number of ideas submitted	Monthly	Volume	96 submitted
Percentage of people submitting ideas	Monthly	Participation and involvement	43%
Percentage of ideas implemented	Monthly	Effectiveness	14%
Number of kaizen events	Monthly	Participation	None to date
Control plans	Monthly	Transformation	To be determined

student retention, success, and achievement associated with the orientation have not been calculated, as it is too early to measure changes in these areas.

The computer support processes for new employees have shown satisfying results for the supervisor, new employee, and the technology team. Supervisors have responded positively to the new system and have stated that the new system is more efficient than the previous email system, particularly since the previous email system resulted in bottlenecks for assigning tasks. Additionally, the technology team has identified that the ticketing system has improved efficiency in which they are able to respond to requests, plan for travel, and prioritize issues. Additional quantitative data is being calculated and a more comprehensive assessment will be reported in fall 2015.

Since the January 2015 implementation of the event management alignment project, anecdotal indications show that staff are appreciative of the resources, have implemented the checklists, and have reduced the preparation time and paper waste for events. Further quantitative evaluation work has been planned.

As the lean team learned through the class presentation data collection project, not all projects that have the potential for high impact and have a high ease of implementation are a success. Although the collection of data was reduced at the point of a class presentation, it did not prove to have a greater impact on the staff members' time or effort and no significant change was found in the number of prospective students who filled out the data collection card. Although Extended Campuses has returned to a more in-depth data collection card, this project was the catalyst for refining the prospective student qualification process and improving the speed in which a prospective student met with a recruiter to having in-depth conversations with an advisor. As evidenced in this project, there are times when lean will not work for the specific or intended goals. However, when staff begin to move from Level 2 – Structured CI to Level 3 – Goal Oriented CI, the shift that occurs allows the organization to adapt more quickly and efficiently (Bessant et al., 2001).

Additional Evidence of Success

Observed success with the first four priority projects reinforced a culture of continuous improvement and provided the needed motivation to tackle other projects identified as having a complex implementation schedule. It also sparked interest from other areas within the university. The work of Extended Campuses often overlaps with other campus departments, and the lean team saw the multiplier effect of engaging another team leader and how it can continue the ripples of operational excellence across departments. The lean team has observed employees and campuses that have incorporated the lean principles into

their language, thinking, and culture. Further evidence of success includes presentations by members of the lean team at seven local, state, and national conferences in 2013-14. Each presentation allowed team members to reach individuals in the higher education community and showcase the impact of lean and operational excellence thinking. Additionally, members of the lean team have been called upon for advice as an outcome of the connections made at these presentations.

Conclusion and Next Steps

Networking, mentoring, and training the lean team moved NAU-Extended Campuses in small, incremental steps toward improved effectiveness. The organizational goal was to infuse lean principles into the workforce to enhance efficiency as well as engage and empower staff to change throughout the division. As previously stated, a successful lean initiative must cultivate a culture of quality, make initial investments in people and resources, and look for quick wins to maintain momentum (Freed, Klugman, & Fife, 1997; Roffe, 1998; Simons, 2013). This was the foundational approach Extended Campuses took along its journey, starting with one lean champion, then seven lean team members, and then more than 135 employees. NAU-Extended Campuses made significant human resource and financial commitments to the transformation and then chose the top-priority projects as the quick wins to build momentum toward fostering the culture of operational excellence and quality. Intel provided critical knowledge and resources that allowed the division's leadership to focus on motivating and organizing the effort from the inside.

When NAU-Extended Campuses first began its journey, it was hovering around Level 1 – Pre-CI Interest (Bessant et al., 2001). Today, the division is firmly in Level 3 – Goal Oriented CI (Bessant et al., 2001) by continuing to identify goals of improvement and ways to look at challenges from new perspectives. As Extended Campuses has moved along the CI continuum, there has been an increase in organizational communication, common focus via alignment of goals and initiatives, and improved employee engagement. The organizational transformations will require refinement as the division continues on its journey. Cultural changes take time and effort at all levels, but when owned and lived by leadership, a greater opportunity exists to align strategic goals and the actions of staff (Simons, 2013).

As NAU-Extended Campuses moves to Level 4 – Proactive CI (Bessant et al., 2001), the lean team will look for ways to engage and empower staff to begin using the team members as consultants rather than having lean team members drive process improvement. This shift requires significant confidence and skill building. However, it is essential that employees remain engaged

and empowered to act on their own in order for the division to move to Level 5 – Full CI (Bessant et al., 2001).

The lean team recognizes the need to quantify impacts more specifically. Therefore, the team is focusing on maturing its thinking and understanding on issues around measurement. In spring 2014, members of the lean team completed training on the incorporation of a new software package (eVSM) into projects to assist with process mapping and the budget-saving calculations attained. Using this software and other measurement methods will provide the foundation to report results in succinct and tangible ways.

Institutions interested in embarking on an operational excellence journey must assess their organizational readiness for this type of change. Outside experts may be helpful to guide the organization to think creatively about how to motivate, organize, and truly instill a lean or operational excellence culture. Additionally, institutions must recognize that commitment will require direct investment of resources in addition to understanding opportunity costs. It is critical that higher education leadership engage in self-learning to provide solid foundations. What are you willing to commit to maximize performance and remain competitive? Getting started is a critical first step!

References:

Alagaraja, M. (2010). Lean thinking as applied to the adult education environment. *International Journal of Human Resources Development and Management*, 10(1), 51-62.

Arizona Board of Regents (2010). *Arizona Higher Education Enterprise Plan*. Retrieved from: https://webapp6.asu.edu/corda/dashboards/ABOR_public/main.dashxml.

Barnett, W. P., & Carroll, G. R. (1995). Modeling internal organizational change. *Annual Review of Sociology*, 21(1), 217-236.

Bessant, J., Caffyn, S., & Gallagher, M. (2001). An evolutionary model of continuous improvement behaviour. *Technovation*, 21(2), 67-77.

Freed, J. E., Klugman, M. R., & Fife, J. D. (1997). A culture of academic excellence: Implementing the quality principles in higher education. *ASHE-ERIC Higher Education Report*, 25(1), xv-191.

KPMG (2013). *The three stages of Lean*. Retrieved from <http://www.kpmg.com/global/en/issuesandinsights/articlespublications/breaking-through-the-wall/pages/three-stages-of-lean.aspx>.

Miller, A. (2014). *Redefining operational excellence: New strategies for maximizing performance and profits across the organization*. New York, NY: AMACOM - American Management Association.

Northern Arizona University – PAIR (n.d.). *Institutional Effectiveness*. Retrieved from: <http://www4.nau.edu/pair/>.

Piccolo, J., & Knobloch, P. (2012). *Operational excellence in higher education*. State College, PA: Innate Management, Inc. and The Pennsylvania State University.

Roffe, I. M. (1998). Conceptual problems of continuous quality improvement and innovation in higher education. *Quality Assurance in Education*, 6(2), 74-82.

Simons, N. (2013). The business case for Lean Six Sigma in higher education. *ASQ Higher Education Brief*, 6(3), 1-6.

Womack, J. P., Jones, D. T., Roos, D. (2007). *The machine that changed the world*. New York, NY: Free Press.



Karen L. Pedersen

Karen L. Pedersen, Ph.D., recently stepped into the role as chief knowledge officer for the Online Learning Consortium (OLC – formerly Sloan-C). Prior to joining OLC, Pedersen served as the associate vice president for extended campuses at Northern Arizona University, the vice president for professional studies at Southwestern College (Kansas), and in academic associate and dean roles at Upper Iowa University's extended university. Prior to starting her administrative career, Pedersen served as a faculty member at the University of Nebraska at Kearney. She can be reached via email at karen.pedersen@onlinelearning-c.org.



Melissa J. Ziegler

Melissa J. Ziegler, M.A., is a Ph.D. candidate in educational psychology at The Pennsylvania State University and the program director for Washington State for the American Honors programs at Pierce College and Community Colleges of Spokane. She worked as a graduate assistant for Penn State Academic Outreach's operations unit where she worked on process improvement and operations projects. Ziegler's research interests include the measurement and evaluation of undergraduate learning outcomes and continuous process improvement. She can be reached via email at melisa@psu.edu.



Lacy D. Holt

Lacy D. Holt, M.A., is the coordinator of training and development at Northern Arizona University, Flagstaff, AZ. She has more than 15 years of experience in public K-12 and higher education with a focus on student services, employee development, and process improvement. Her research interests are in the areas of training and employee engagement. Holt can be reached via email at lacy.holt@nau.edu.