



A Pilot Study on Continuous Improvement & Organizational Learning as Lean Tools in Higher Education

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Abstract: Continuous Improvement (CI) and Organizational Learning (OL) are two pillars of Lean philosophy, an approach to management which was first developed on the Toyota shop floor and since then has been adapted by other industries, including manufacturing, services, health care and increasingly education. This paper presents the results of a primary study conducted through surveys which explores the usage of CI and OL as Lean tools in the field of higher education by analyzing the perspectives of both students and faculty. Descriptive frequency analysis showed that the level of awareness of CI is relatively high in both categories (92% of students reported having at least a basic knowledge, 90% of teachers had the same level regarding Lean principles), but the practical use of Lean methods falls short of conceptual understanding — only 60% of teachers have ever used a Lean tool, although the general level of awareness is much higher. Project-based, practice-oriented learning is preferred by almost all respondents (83% and 72% of students and educators respectively). Both groups are united by such common barriers to implementation of CI as resistance to changes, limited resources and lack of practical experience. Teachers consider CI and Lean methodologies as effective means of achieving organizational success (70% reported them to be highly effective) and associate CI approach with the development of such skills in students as problem solving, adaptability, teamwork and employability.

Keywords: Continuous improvement, organizational learning, Lean, organizational success, teamwork, employability

1. Introduction

1.1 Background and Rationale

The Lean philosophy is based on the Toyota Production System and revolves around the idea of waste reduction, standardization of operations and continuous improvements [1]. The two concepts which are at the core of Lean philosophy are Continuous Improvement, also referred to as KAIZEN ("change for the better" in Japanese) and Organizational Learning, which is the ability of an organization to create, disseminate and utilize the information created in its daily operations [2]. Although these ideas originated from manufacturing environments, the essence of both, namely numerous small changes driven by feedback and undertaken by those who know the most about the process, easily translates into an educational environment.

There are increasing pressures on higher education institutions to make their students ready for a dynamic job market, to be responsive to student and industry input and to show measurable results of quality to accreditation authorities [3]. In view of the above, there is the need for a vocabulary that can be used by institutions to facilitate self-improvement. This is where Lean tools such as PDCA, 5S and Value Stream Mapping come into the picture. There is the need for organizational learning processes that will sustain the above efforts.

1.2 Lean Thinking and Continuous Improvement: A Conceptual Overview

The theoretical framework guiding this research is based on three key concepts. First, Continuous Improvement (CI) sees improvement as an ongoing process, rather than a project, often implemented using PDCA cycle [4].



Secondly, Organizational Learning (OL) defines a way how the organization develops its capacity through various practices, like training, information exchange sessions, mentoring and feedback to learn from experience gained in one area of operations for other purposes [5]. Thirdly, Lean tools, which include 5S, KAIZEN, value stream mapping and visualization, offer particular methods by which CI and OL are implemented. When applied to education, this means ongoing curriculum modification, structures for faculty and students' information exchange and specific process improvement methodologies, like structured feedback forms, mentoring programs and project-based learning [6].

1.3 Objectives of the Study

- To assess the level of awareness of Continuous Improvement and Lean principles among engineering students and faculty.
- To examine the extent to which CI initiatives (feedback mechanisms, project-based learning, digital tools) are currently used in the higher education institution.
- To evaluate the organizational-learning mechanisms (training, mentorship, industry collaboration, knowledge-sharing) in use, from the faculty perspective.
- To identify which specific Lean tools (KAIZEN, 5S, PDCA, Value Stream Mapping) are known and applied, and the perceived benefits of doing so.
- To identify the principal barriers perceived by students and faculty to deeper adoption of CI and Lean practices.
- To compare student and educator perspectives and draw practical recommendations for institutional improvement.

2. Literature Review

Continuous Improvement was originally based on the quality movement in the middle part of the twentieth century. W. Edwards Deming developed the plan-do-check-act model for continuous improvement through iterations and data-driven cycles, whereas the idea of "KAIZEN" by Masaaki Imai focused on making continuous improvement a regular process at the root level [7]. The concept of Lean Thinking developed by Womack & Jones was an attempt at synthesizing all the best ideas from the Toyota Production System into a broad framework of continuous improvement, characterized by the removal of wastage and value addition from a customer perspective [8]. Liker further developed the concept of "Toyota Way" which highlighted the fact that without a supportive organizational culture of respecting people, long-term vision and problem-solving at the front, lean tools were not going to yield the desired results [9].

In the case of organizational learning, as defined by Senge et al. the concept goes beyond improvement in processes on an individual basis to encompass the capacity of the organization to learn as a whole [10]. It involves systems thinking, shared vision, team learning and mental models. This concept is demonstrated in education through the feedback mechanism between students and lecturers, faculty development initiatives, mentorship models and industrial partnerships to keep the curriculum in step with changing demands [11].

Several studies have been carried out regarding the adaptation of the Lean concept to higher education, sometimes called "Lean Higher Education" or "Lean in Academia." These studies include practical applications ranging from the process optimization of administrative procedures to course development and quality assurance in academia. One of the issues that can be seen in almost all of these studies is the discrepancy between the theoretical understanding of Lean/CI by academics and their practical application in academia [12]. It seems that there is more awareness about KAIZEN and PDCA than there is use of Lean methods on campus. This issue motivates our research.

3. Research Methodology

3.1 Research Design

This research makes use of descriptive, cross-sectional survey design in order to obtain a snap-shot of awareness, implementation and perceptions regarding CI, OL, and Lean tools. The research made use of two similar but purposefully designed survey instruments - one for students and another for faculty members / educators.

3.2 Sample and Sampling Technique

Responses were collected through a convenience sample of undergraduate engineering students as well as faculty members at the same institution, using a self-administered online (Google Forms) questionnaire.

The sample of students consists of undergraduate students from various branches of engineering. The faculty members' / educators' samples consist of experienced academicians with 80% of them having more than 10 years of experience.

3.3 Research Instrument

Each of the questionnaires was broken down into three main thematic areas. The student questionnaire covered: (1) knowledge about CI and Lean concepts and the implementation thereof; (2) learning enhancement through feedback and teaching methods preferred and (3) process improvement activity participation, obstacles to involvement and knowledge of CI benefits.

The educator questionnaire covered: (1) knowledge about Lean and CI concepts and the implementation of CI and any problems encountered in that process; (2) organizational learning strategies and frequency of feedback-driven curriculum decisions and (3) knowledge about and usage of Lean tools, benefits derived from them and the influence of CI/Lean on organizational performance and skills acquisition of students. Multiple choice formats for answering questions included "single-select" (Yes /Somewhat /No; frequency scales) and multiple select (choose all that apply).

4. Data Analysis and Findings

4.1 Findings from the Student Survey

4.1.1 Awareness of Continuous Improvement and Lean Principles

It is observed from the data that the majority of students have a basic level of awareness regarding Continuous Improvement in the educational process: 75% expressed awareness, while 17% partially understood Continuous Improvement and 8% had no idea about it. On the other hand, knowledge regarding the concept of Lean, including waste minimization, efficiency of processes and KAIZEN, is comparatively low and scattered, as 50% responded in the affirmative, 28% partially aware, and 22% not aware.

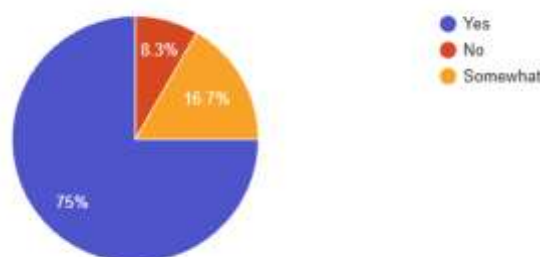


Figure 1: Awareness of Students about Continuous Improvement in Education

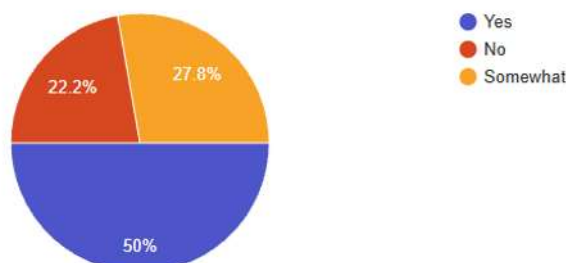


Figure 2: Familiarity of Students with Lean Principles

4.1.2 Continuous Improvement Initiatives Observed

According to the survey responses related to CI activities observed or participated in by the students, the most common CI activities were project-based learning for gaining practical knowledge (83%) and feedback systems for course improvement (75%). The other CI activities mentioned were the use of technology to improve the effectiveness of learning (56%) and interactive/engaging teaching (39%). The results imply that project-based learning is the leading example of CI among students.

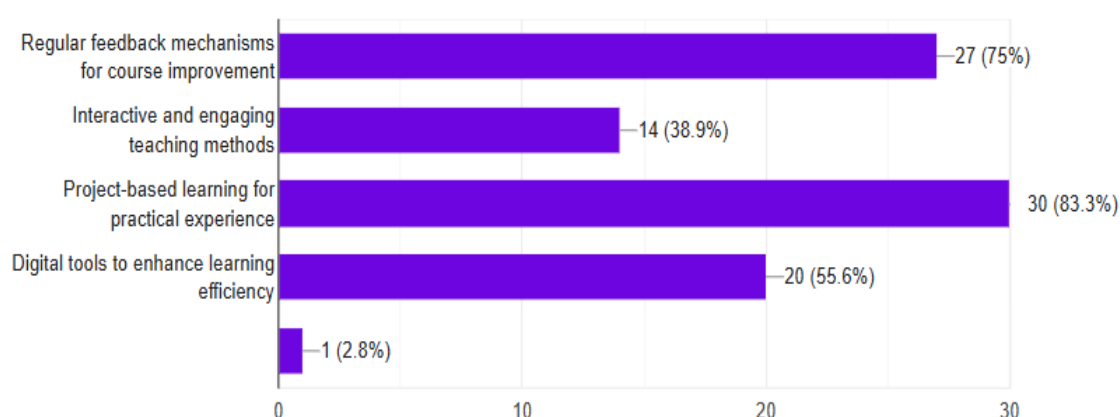


Figure 3: CI Initiatives Observed / Participated by Students

4.1.3 Feedback Driven Learning Improvement

Student feedback has been found to have an institutionally responsive environment, with 64% of students stating that feedback-induced changes are "frequent," 31% claiming that changes happen "occasionally" and 6% reporting that such changes are "rare." The methods used by the institution to collect feedback include end-of-semester surveys (75%), feedback-induced changes to the structure of the course (53%), mentor-mentee interaction sessions (47%), while student-led discussions about improvement of learning account for 33%.

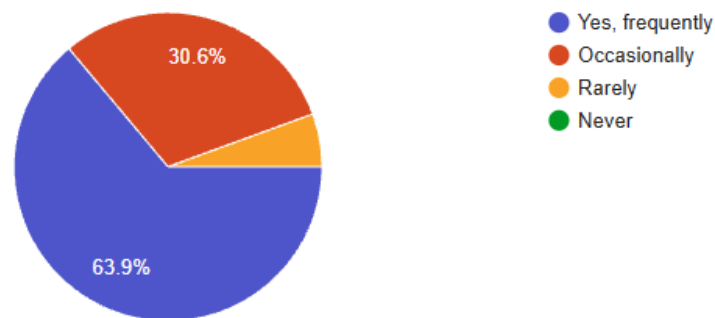


Figure 4: Frequency with which institution acts on feedback-driven learning improvements

With regards to the effectiveness of current teaching-learning methods in preparing learners for practical application in the field, the most common answer is “Moderately Effective” (53%), followed by “Highly Effective” (33%) and “Slightly Effective” (14%).

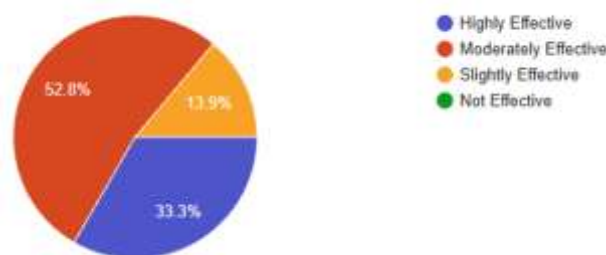


Figure 5: Perceived effectiveness of current teaching-learning approach for real-world readiness

4.1.4 Preferred Learning Methods

The students have shown a marked inclination towards experiential and applied learning formats, which include hands-on projects and case studies (83%), as well as industry-related learning (72%). The fourth most preferred learning method is gamification or interactive sessions (53%), followed by self-paced courses (47%). The preference hierarchy is quite in line with the lean learning concept of “learning through doing” and the significance that project-based learning holds.

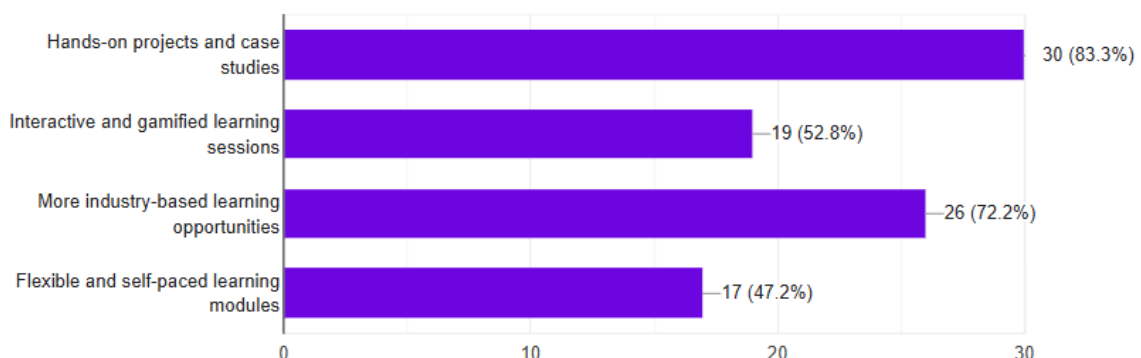


Figure 6: Learning methods preferred by students for better engagement and understanding

4.1.5 Participation in Process-Improvement Activities

A substantial 81% of students report having participated in process-improvement activities such as student clubs, project-based learning or academic-enhancement programmes. Among those who elaborated on the type of initiative, Project-Based Learning approaches (58%) and student-driven problem-solving challenges together with research-based learning projects (47% each) were most common, followed by academic clubs focused on innovation (44%).

4.1.6 Perceived Obstacles to Improving Learning Methods

The traditional teaching methods that fail to incorporate innovation and the inadequate exposure to the problem faced in the real world is highlighted as a significant barrier by 67% of the learners, while inadequate interactions are cited as another barrier similar to the above-mentioned one (61%). Lack of feedback and implementation is mentioned by 31%. These barriers are a manifestation of the gap that CI and Lean aim to fill.

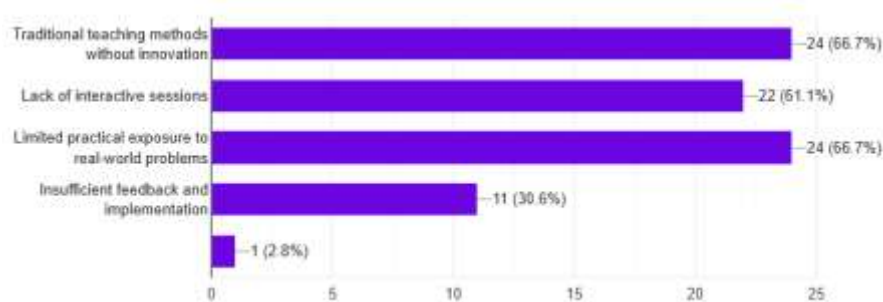


Figure 7: Perceived obstacles to improving learning methods, as reported by students

4.1.7 Belief in the Value of Continuous Improvement

The level of belief about the usefulness of CI is relatively high; 61 percent of students hold the view that the CI approaches can "substantially" increase their learning process, while 39 percent of the students argue that CI approaches can "increase" their learning process to some extent.

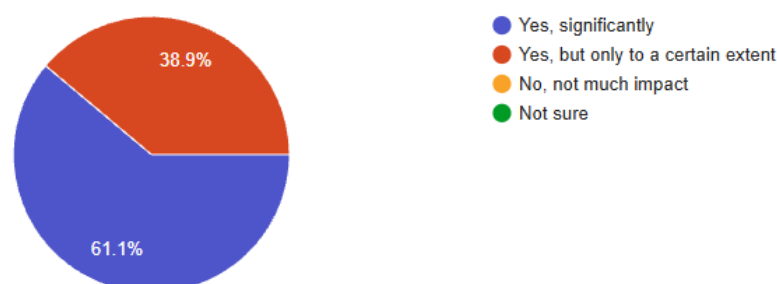


Figure 8: Student belief that CI strategies can enhance their learning experience

4.2 Findings from the Educator Survey

4.2.1 Awareness and Application of Lean/CI Principles

Awareness of Lean principles is high among faculty: 75% report being aware and a further 15% "somewhat" aware, with only 10% unaware. This is corroborated by a near-identical distribution for a separately worded item

on familiarity with Lean principles (waste reduction, efficiency improvement, KAIZEN, Six Sigma), again 75% "Yes". A large majority (90%) report having implemented or observed CI strategies in their institution.

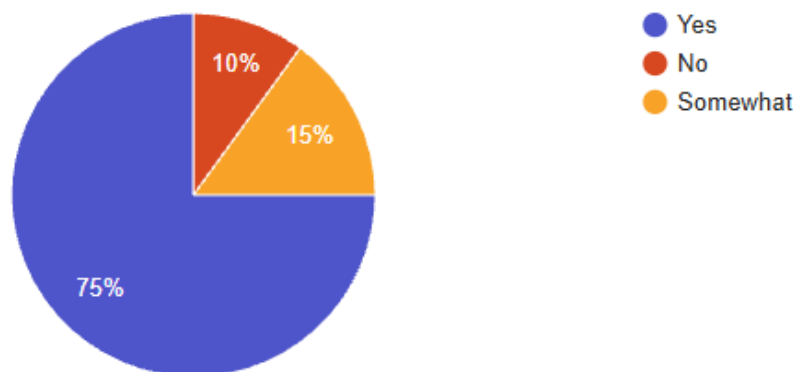


Figure 9: Educator awareness of Lean principles in education

Among those who elaborated on how CI has been applied, training and skills enhancement (75%) and quality improvement (65%) initiatives have been identified as the most common mechanisms, while feedback mechanisms (60%) and process improvement (40%) follow close behind.

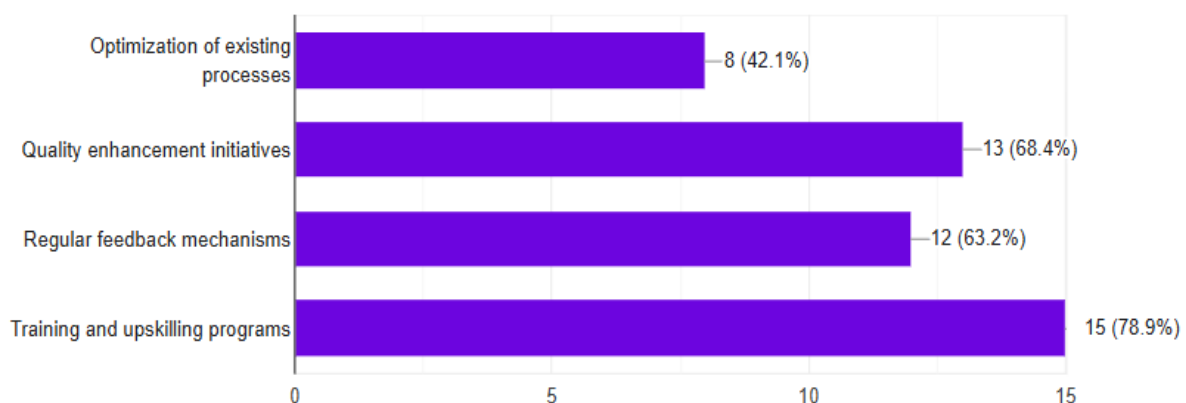


Figure 10 Ways in which CI practices have been applied, as reported by educators

4.2.2 Challenges in Implementing Continuous Improvement

The resistance to change comes across as the most common barrier, with 65% of participants mentioning it, whereas the lack of awareness/training follows with 60%, and limited resources in terms of time, budget, or technology come third with 55%. The inability to measure the impact was mentioned by 35%. The high relevance of the "resistance to change" barrier, which is a classic barrier for Lean implementation in any firm, suggests that the limitation for CI is not only technological or resource-related but behavioral and cultural as well.

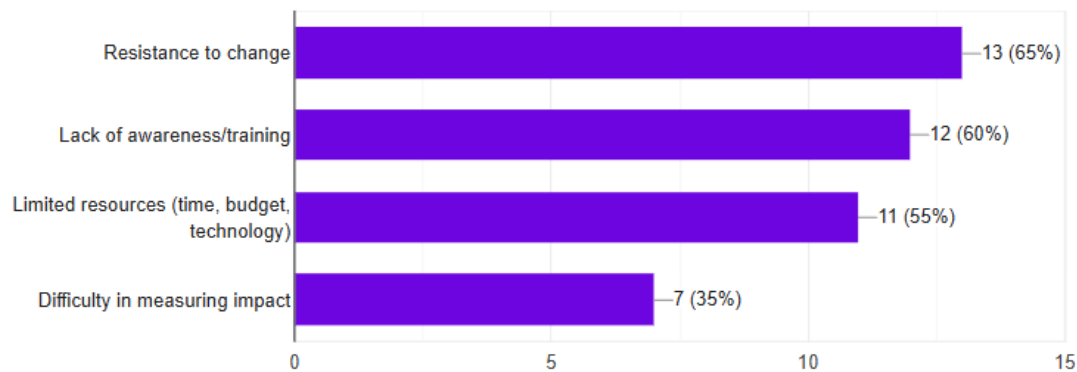


Figure 11 Major challenges in implementing Continuous Improvement, as reported by educators

4.2.3 Organizational Learning Mechanisms

Learning structures that are feedback-based and allow for organizational learning have been said to be fully developed by 70% of teachers, while the remaining 30% state that these structures exist partially, with none stating there is nothing like organizational learning mechanisms. Workshops and training are the primary means of organizational learning at 85%, then industrial-academic collaborations at 70%, knowledge exchange meetings at 60%, and mentorship schemes at 50%.

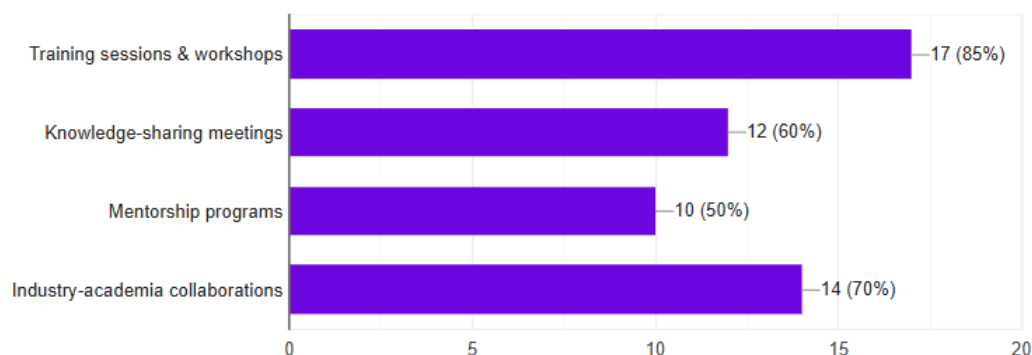


Figure 12 Methods used for organizational learning, as reported by educators

Curriculum and teaching methods are modified on the basis of feedback received from students every semester for 70% of respondents, once a year for 20%, and infrequently for 10%, reflecting a rather rapid response to feedback for the majority of the sample of faculty members. Faculty Development Programmes come out as the most popular form of knowledge sharing between faculty and students (95%), followed by student-led research projects and modification of teaching methods (75% each), and industry-academia collaboration (70%).

4.2.4 Familiarity with and Use of Specific Lean Tools

While there is extensive knowledge regarding Lean philosophy as per Section 4.2.1, 60% of the teachers have used the Lean tools while 40% haven't had any firsthand experience. This is the most obvious example from the dataset of the disconnect between theoretical knowledge and practical application. Those who use the tools use PDCA at 45%, 5S Workplace organization at 45%, KAIZEN at 40% and Value Stream Mapping at 30%.

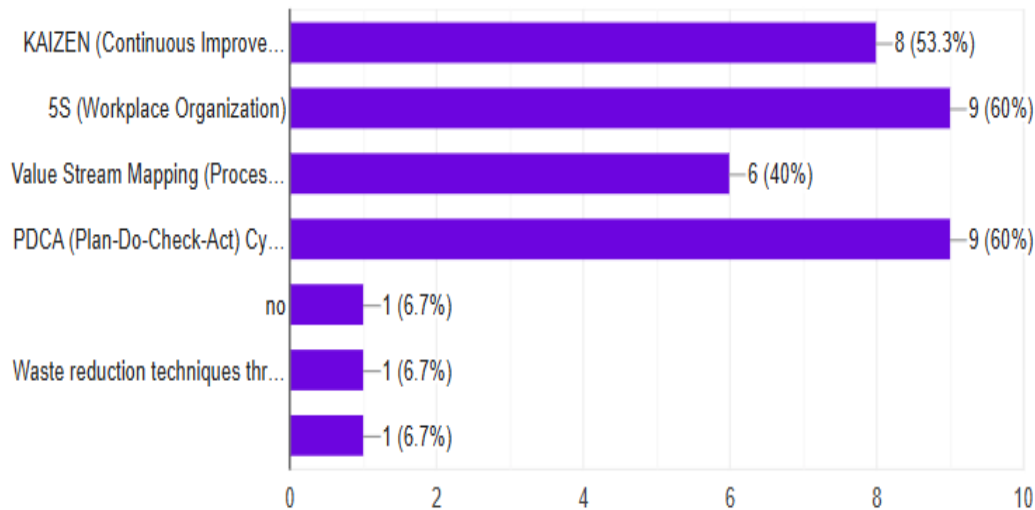


Figure 13 Specific Lean tools used in practice, as reported by educators

The most common benefits that educators recognize in implementing lean practices are improvements in the quality of work and education (90%), efficiency, and productivity (85%). The other benefits include savings in costs and resource optimization (70%) and engagement with stakeholders (55%).

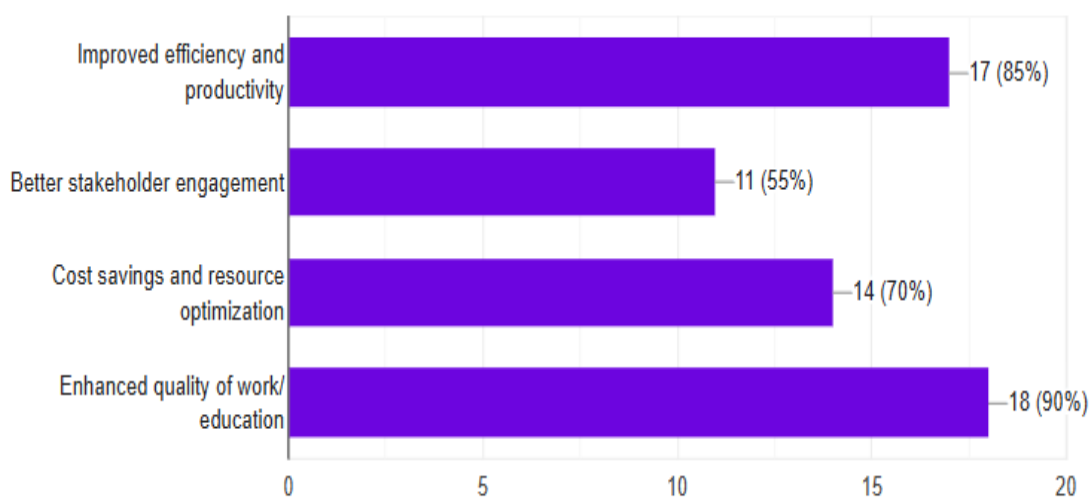


Figure 14 Key benefits of applying Lean principles in education, as reported by educators

4.2.5 Overall Effectiveness and Student Skill Outcomes

A staggering seventy percent of educators regard CI and Lean as “Highly Effective” in achieving success in organizations, whereas the remaining thirty percent consider them “Moderately Effective.” No teacher considers them ineffective. In the case of asking what skills of students are most developed through techniques like project-based learning and CI, problem solving and critical thinking top the list (90%), followed by industry readiness and employability skills (70%), teamwork and collaboration (65%), and adaptability and learning agility (60%).

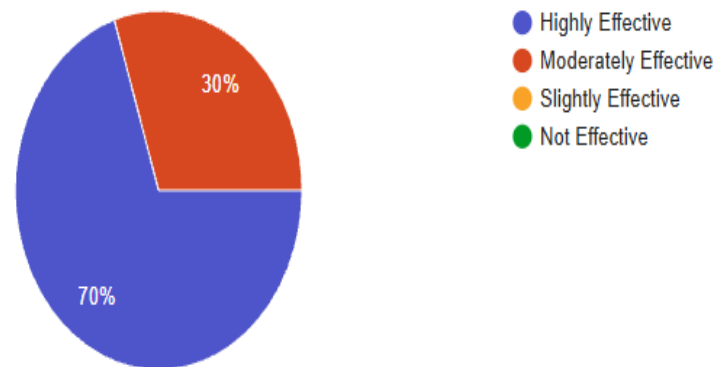


Figure 15 Educator-rated effectiveness of CI and Lean approaches in driving organizational success

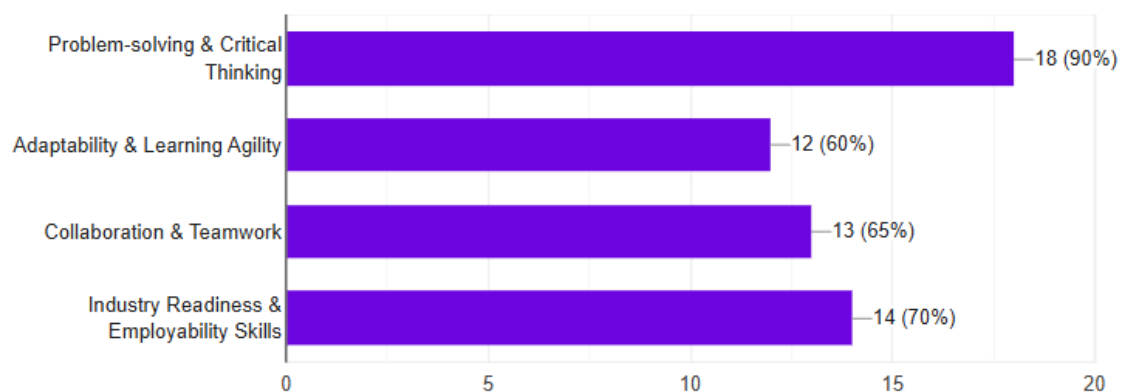


Figure 16 Student skills perceived by educators to be enhanced through CI/project-based learning practices

5. Cross-Stakeholder Discussion

Thus, the combination of student and educator data forms a consistent institutional story. Both groups demonstrate high levels of awareness concerning the concept of Continuous Improvement (CI): the term itself and its meaning are diffused extensively. However, the main drop occurs once the issue changes from general awareness to the actual application of formal Lean tools. In the case of students, awareness of “Lean principles” is notably lower (50% yes) than the awareness of CI (75% yes). In the case of educators, only 60% indicate the implementation of any named Lean tool, while 75-90% claim general awareness of Lean/CI.

Both cohorts also agree on the effective practices and barriers to implementation. Both students and educators appreciate hands-on learning, project-based learning and industry-oriented learning: students prefer hands-on projects (83%) and industry-based learning (72%), while educators name project-based learning as one of the major CI initiatives implemented at the institution and link it to increased problem-solving skills among 90% of the respondents. In terms of barriers, both students and educators identify traditional, non-interactive teaching and lack of practical experience (67% each) as the major hindrances. Educators also emphasize resistance to change (65%) and lack of resources (55%). These barriers are connected to the same foundational issue: moving from occasional CI initiatives to a systematic, tool-based Lean culture involves behavioral and resource investments that have been addressed only partially by the institution.



One more point of convergence is the strong, almost universal appreciation of CI: no student shows any doubts about the benefits of CI, and no educator rates CI/Lean approaches as ineffective. Thus, the primary opportunity for the institution seems to be not the construction of a case for change (which has already been successfully made), but the implementation of this consensus in the form of certain mechanisms: PDCA cycles for curriculum improvement, implementation of 5S approach to organization in laboratories and processes, and increased feedback usage (end-of-semester surveys, mentor-mentee meetings).

6. Summary of Key Findings

1. High conceptual awareness of CI among both students (92%) and educators (90% aware or somewhat aware of Lean).
2. Awareness to practice gap is clearly visible – 60% of educators have adopted at least one of the Lean tools (PDCA, 5S, KAIZEN, Value Stream Mapping) even though the level of awareness is much higher.
3. Project based learning, hands-on learning, and industry focused learning are the top three CI initiatives among both groups – they are favored by the students and are seen being implemented by the educators in relation to skill development.
4. Feedback loops are in place and utilized fairly often (64% of students report frequent feedback driven changes; 70% of educators report semester-wise feedback driven curriculum decisions). However, the end-of-semester survey is still the most popular and passive form of feedback.
5. Barriers mentioned by both groups include resistance to change, lack of resources, and lack of practical or real world exposure.
6. Both groups believe in the value of CI/Lean practices very strongly (practically unanimously), indicating that culture and beliefs are not the constraining factors; implementation is.
7. Problem solving and critical thinking, industry readiness, and collaboration are the areas where the educators see the most benefits of CI/PBL practices.

7. Recommendations

7.1 Bridging the Awareness-to-Practice Gap

Develop practical, hands-on faculty development workshops that go beyond simple awareness of KAIZEN, PDCA, and 5S towards applying these methodologies in practice. In other words, perform one PDCA cycle per semester in each department on an identified process (e.g., scheduling of labs, project assessment, feedback turnaround) and demonstrate tangible differences before and after implementation.

7.2 Making the Feedback Cycle Transparent

Since end-of-semester surveys are the primary means of soliciting feedback while channels for student discussions are not utilized enough, institutions should combine a passive feedback survey collection with a more proactive communication approach “you said, we did.” That will allow students to see how particular pieces of feedback have been implemented, thereby addressing 31% of students' complaints about “insufficient feedback and implementation.”

7.3 Increasing Project-based and Industry-oriented Learning

Given that hands-on projects (83%) and industry-based learning (72%) are the preferred modes of learning and those types of learning associated with the best skill development, institutions should focus on expanding their capacity of offering project-based learning and developing industry–academia interface instead of developing self-paced modules.



7.4 Addressing Resistance to Change

Since change resistance is considered by educators the number-one obstacle to implementation of new practices, change management tools—early faculty engagement in the development of continuous improvement initiatives, positive reinforcement through recognition of improvement efforts, and incremental instead of mandatory rollout—are much more likely to help than technical training alone without regard for implementation issues.

7.5 Institutionalizing Lean Tools Beyond Pilots

Since PDCA and 5S have been implemented by some fraction of educators (45% each), these tools seem to be ready for further institutionalization in the form of standardized practices (e.g., organizing laboratories and common facilities according to 5S methodology, PDCA-driven curriculum review on annual basis).

8. Limitations of the Study

1. The sample (with 36 students and 20 teachers in it) was taken from one institution by means of convenience sampling, restricting the statistical generalizability of the results to other institutions or educational environments.
2. All data are subjective self-reports and cannot be checked independently for accuracy; thus, they may be prone to social desirability and recall bias.
3. Cross-sectional design captures a static moment in time and cannot show causation between CI/Lean practices and outcomes like better student skills.
4. Several multi-answer questions had several incomplete responses (e.g., write-ins), which were not included in the percentages calculations for the particular questions.

9. Conclusion

The aim of the research was to evaluate the interpretation and implementation of Continuous Improvement (CI) and Organizational Learning, which are Lean instruments, within a higher education setting, through the use of two complementary perspectives of the students and faculty members. The results show that this institution possesses high conceptual support for CI and Lean, characterized by high awareness, universal recognition of its importance and already existing, albeit developing, systems of feedback and organizational learning. The main way to improve the situation is not in convincing the stakeholders about the importance of CI since it is already recognized, but in the discrepancy between the conceptual understanding and the practical application, which consists in institutionalization of PDCA and 5S, closing of feedback loops and development of project-based industry-related learning, which was identified by both groups as the best and most valued type of CI in existence at this institution. Effective dealing with resistance to changes and limited resources instead of raising awareness is the key to overcoming the problem of going from Lean awareness to Lean practice.

References

- [1] A. Chiarini, *Lean organization: from the tools of the Toyota Production System to lean office*. Springer Science & Business Media, 2012.
- [2] W. R. King, "Knowledge management and organizational learning," in *Knowledge management and organizational learning*, Springer, 2009, pp. 3–13.
- [3] P. Kumar, B. Shukla, and D. Passey, "Impact of accreditation on quality and excellence of higher education institutions," *Investig. Operacional*, vol. 41, no. 2, pp. 151–167, 2020.
- [4] J. Singh and H. Singh, "Continuous improvement approach: state-of-art review and future implications," *Int. J. Lean Six Sigma*, vol. 3, no. 2, pp. 88–111, 2012.



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- [5] D. Basten and T. Haamann, "Approaches for organizational learning: A literature review," Sage Open, vol. 8, no. 3, p. 2158244018794224, 2018.
 - [6] F. Naseer, R. Tariq, H. M. Alshahrani, N. Alruwais, and F. N. Al-Wesabi, "Project based learning framework integrating industry collaboration to enhance student future readiness in higher education," Sci. Rep., vol. 15, no. 1, p. 24985
 - [7] S. D. Morgan and A. C. Stewart, "Continuous improvement of team Assignments: using a web-based tool and the plan-do-check-act cycle in design and redesign," Decis. Sci. J. Innov. Educ., vol. 15, no. 3, pp. 303–324, 2017.
 - [8] J. K. Liker and J. M. Morgan, "The Toyota way in services: the case of lean product development," Acad. Manag. Perspect., vol. 20, no. 2, pp. 5–20, 2006.
 - [9] S. Gao and S. P. Low, "The Toyota Way," in Lean Construction Management: The Toyota Way, Springer, 2014, pp. 49–100.
 - [10] D. H. Kim, "A framework and methodology for linking individual and organizational learning: Applications in TQM and product development," Massachusetts Institute of Technology, 1993.
 - [11] P. S. Aithal and A. K. Maiya, "Innovations in higher education industry--Shaping the future," Int. J. Case Stud. Business, IT, Educ., vol. 7, no. 4, pp. 283–311, 2023.
 - [12] S. Yorkstone, Global lean for higher education: A themed anthology of case studies, approaches, and tools. CRC Press, 2019.