International Journal of Future Generation Communication and Networking
Vol. 13, No. 4, (2020), pp. 136 –146

Lean based framework for implementing engineering curriculum to reduce educational waste and increase educational value

Sunny Nanade 1, Dr. Sachin Lal 2

Ph.D. Scholar 1, Associate Professor and. Head of the Department 2,
School of Engineering,
Sir Padampat Singhania University, Udaipur.

Abstract:

It is difficult to develop an education system, which represents and has a pace to match with the industrial practice. There is also a hearing about the software industry's skills shortage and the difference between what is taught in college and what is required in the "real world." This transcript shows how we developed a college program that reduces this gap, giving students the required skills for careers in software engineering for industries. We include explanations of the program's evolution and development, which focuses on the strategies, tools and problems that appear in a modern team's professional developer's daily life. Also, we illustrate how our aligning 4QS method of teaching with the lean principles of software delivery has allowed us to improve the learning curriculum by delivering high-quality, consistent learning experiences. The research's findings take the lessons learned form, and can be used as guidelines for those trying to build a teaching system on their own and strategies for effective curriculum learning to increase the quality of education.

Keywords- *Education, software engineering, curriculum design, 4QS model.*

1. Introduction:

Education faces more challenges than ever, owing, on the one hand, to the globalization of the market in goods, services and resources and, on the other, to the globalization of problems. By thinking about whole systems and eco-sustainable approaches, these problems need globalized approaches. In the past, one-sided solutions were commonly adopted by ignorance or ingenuity or just greed, such as putting the toxic residues from production or off-shore production back in the neighborhood (or even sending them to developed countries) to explore low wages or under-regulated working conditions.

The evaluation of teachers is another pressing problem facing educational systems. With the dramatic increase in education costs in post-World War II years, the public has started to demand transparency in education. Accountability, to most, means proven productivity. Research calls for evaluation by teachers. During a time when the public is seeking greater accountability in education, research shows that existing methods used in teacher assessment are surprising. National surveys (NBA, 1964, 1969) showed that only about half of this country's school systems implement standardized teacher assessment processes and those with formal programs still use ineffective procedures and methods [1].

The standard approach used in public schools to assess teachers is one in which the principal periodical fills out a checklist-type form showing the degree to which a teacher possesses the specified features and skills. Usually the form is completed by the principal after a visitation. For certain schools, the assessment is not accompanied by classroom observation, and a meeting between the principal and the teacher is not followed to address how the teacher might enhance teaching methods. Results from varied studies show that in many schools there tends to be an expectation that better performance is an inevitable product of increased age, experience and college credit. The diagram below illustrates the Education process system [2].

ISSN: 2233-7857 IJFGCN

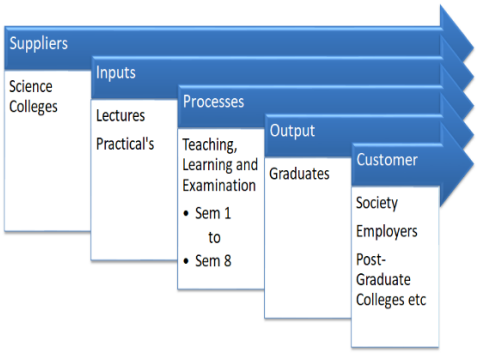

Figure 01: Process of Education system.

Evaluations by the building principal alone have clear drawbacks-unilateralism and subjectivity. Such procedures provide the teachers with little assistance, and are thus regarded with disadvantage by teachers in general. Therefore, one of the most daunting challenges facing public education today is the creation of programs for assessing teacher performance which the teaching profession would recognize as legitimate and useful. The use of assessment programs to take decisions relating to pay, employment, advancement or dismissal from work has given rise to a fundamental issue in education which has had the effect of alienating teachers to evaluation programs and, in turn, to school administrators. Therefore, the public-school administrator faces the challenge of testing teachers with evaluation systems that his teaching staff suspects. Numerous evaluator systems have been proposed as a potential solution to the issue of assessment by a single principal. These systems will provide a solution to the "one-sided" problem of assessment. Supporters of multiple evaluator systems point out that in order to ensure that an evaluation system is as equitable and objective as possible, the different "publics" with which the teacher associates should be involved should be. Students, peer teachers, and administrators are among these publics. It would seem then that having several separate "publics" assist in the teacher assessment process would be a prudent practice. The National Education Association 's Research Division acknowledged this potential strategy in its May 1972 division newsletter (NEA, 1972). This group claimed that the use of multiple evaluators would provide a solution to the "one-sided" assessment aspect. As a possible solution to the problem of subjectivity in teacher assessment, a committee of peers, subordinates, supervisors and students was recommended. The term resume has its origins from Latin. Originally it meant "racing chariot" and the verb it is derived from is currere, "to run."

Nowadays we think and theorize on how the education has greatly changed in the past years. The easiest way to define the word "curriculum" today are the topics that comprise a study course at colleges, schools or universities.

Obviously, there are differences in the course design — for example, a mathematics subject studied in one university may provide the same content, but the teacher may be able to teach it differently — but the development of the curriculum remains the same especially the core basics.

What are the models of curriculum development?

Then a successful and effective teacher performance evaluation program will be one with a variety of inputs. Developing such a program must be a joint activity that includes students, teachers and administrators. And to assess the teacher's success against the school's goals, the assessed aspects must meet the three requirements specified by Menne in order for the established framework. Developing such an assessment framework is currently a daunting challenge for local school districts to pursue due to the lack of a blueprint to implement. Developing such a model is the problem this study is directed toward.

Content of the Current models of curriculum can be broadly divided into two categories: process model and product model[3].

The product model is outcome driven. Prime target are the grades, with emphasis more on the final product rather than the process of learning. Nevertheless, more open-ended is the process model, and focuses on the evolution of learning over time. When it comes to program designing these two frameworks must be taken into consideration.

ISSN: 2233-7857 IJFGCN

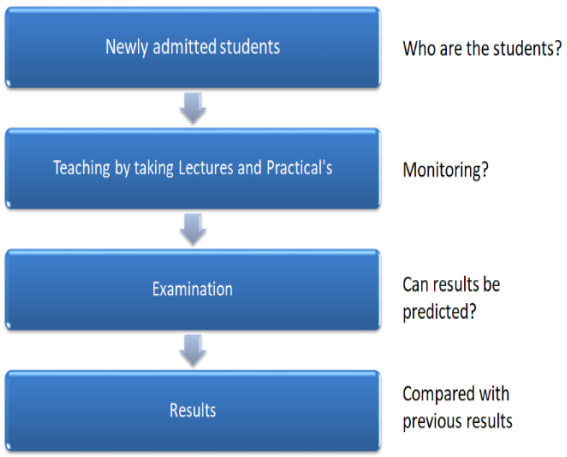

Figure 02: Traditional Approach for Educational Curriculum

Curriculum design

Curriculum design is a deliberate curriculum organization inside a course or classroom. As teachers plan their curriculum materials, they determine what's going to be done, when, and who's going to do it, and what is the purpose of the course. Clearly note that the program contains the skills and information required for a student to develop an experience in progressing to an advance level. Keeping in mind how structured their curriculum is, teachers ensure that all the available requirements are covered. With that, a discussion will begin on different approaches and teaching techniques that will help them fulfill their goals [3].

What are the types of curriculum design?

There are three basic types of Curriculum Design— problem-centered, learner-centered and subject-centered curriculum designs. The emphasis of the Subject-centered design is on a single subject or discipline, such as algebra, physics, or literature. This design style appears to concentrate less on the student and more on the subject. This is the prevalent form mostly of standardized curriculum used in the K-12 public schools.

List of subjects are compiled by teachers and provide clear examples on ways to learn them. This technique is usually used in major university or college classrooms in higher education, in which the students concentrate on a specific discipline or topic.

The subject-based design of curriculum is not student-centric, and the model applies less to different learning styles than to other forms of curriculum design. It can contribute to student engagement and motivation problems, which can cause students who are not adjusting to this model to fall behind.

In contrast, the curriculum design of Learner-centric revolves around the wishes, desires and goals of the students. This acknowledges that students are not uniform but individuals, and so should not be subject to a structured curriculum in any event. This approach aims to encourage learners to make decisions that can affect their education.

Differentiated curricula offer the opportunity to pick assignments, opportunities for teaching and learning, or activities. It has been shown that this way of developing a program requires and empowers students. The downside to this curriculum design approach is that it will bring pressure to bear on the teacher to include unique learning materials for each student. This can be difficult because of time constraints at teaching. It could prove to be a challenging task to balance the individual students ' needs with the appropriate output of the institution [21].

This paper's contributions are in the lessons learned format, this could be seen as guidelines for those trying to establish their own teaching systems and strategies for improving the standard of education. These are, in simple terms:

ISSN: 2233-7857 IJFGCN

• Through this, students should understand, and principles of software engineering should be evaluated whenever possible in the form of practical experience, than through the regurgitation of material learned or extracted from textbook[4].

• Evaluation should be performed "small and often" Frequent, small tasks with the concepts of modern agile growth fit well. It also promotes continuous high-quality input. Setting multiple small goals would avoid high peaks of stress and commitment for both students and staff is agreed upon, and that will allow students to enhance their learning capacity at a reasonable pace than otherwise would.

• The evaluation burden is reduced with a good approach and instill good practice in the students' workflows. Therefore, the time invested on tooling and automation is well spent.

• It is critical that industry commit to software engineering teaching. Guest speakers and Instructors who are developers of software themselves are therefore in a much better place to educate practically on software engineering skills than purely academic based skills, and thus give a much better sense of context to the material being taught[22].

2. Literature Review:

Comparing to the actual production, a simulation has more advantages [3]. It takes less time to model and evaluate the production process in a simulation [9]. Simulation of a factory or a company gives the students a chance to understand the problems and the burden encountered by the managers when important decisions are made. It is more effective since the user has an important role in the decision process of the simulation. In the simulation, various components used for processing can be used effectively with high accuracy. These components may be physical components like the equipment and resources used in the industry or conceptual components like plans and schedules. The creation of the actual factory is difficult due to the cost constraints and hence, simulated factories are used to denote the real plants in the manufacturing process [10].

The structure of a simulated factory has been proposed in [11] and it has been studied and evaluated by using it as a manufacturing process. Discrete event analysis has been used in a simulation by [12] and it has been used to predict the progress in the work in a factory that fabricates wafers. The process of lean management and its implementation in the educational field has been discussed in [13]. It has also explained the options of implementing it in other industries like Medical, Administration and IT field. The usage of modelling using simulation to design and optimize the manufacturing process of PCB has been demonstrated by [14]. The need to improve the modelling and the need to estimate the production data has been suggested by [15] and a simulation of a factory for educational field has also designed with better modelling parameters and production data. Lean Education has been used across the world by various institutions. The LAI (Lean Aerospace Initiative) is a collaboration of various universities to develop and initiate a syllabus to teach the fundamentals of lean six sigma. It has been created at MIT in 2002 and the faculty have created a course with a duration of one week and has been delivered to various industries and government sectors. The course map of the topics and the techniques of assessment have been updated in the knowledge base [22]. The methodology of this LAI and its contribution to Lean Thinking has been studied in Enhancing Faculty Competency in Lean Thinking Bodies of Knowledge [4]. The results have shown that this method has effectively increased the ability to impart the Lean Education.

The educational network has effectively increased the method of teaching as compared to other known approaches. A simulation that is based on the Kanban theory and a simulated game based on the lean architecture has been proposed [16]. The use of hypertext pre-processing and the usage of structured query language makes the game more interesting with tools that give knowledge. The findings have suggested that the most widely used games that are used for education do not communicate well with the users and hence innovative simulations are required with better GUI to improve the lean education. A VE Suite (Virtual Engineering) has been used to solve it in this work. Lean Education is a nice methodology to improve the student-centered learning since the student selects the way of learning thereby improving methods of learning [2].

This has been discussed in Lean Education for Applied Science Universities: A Proposal by Federal Institutes of Applied Sciences in Brazil [17] and the basis that has to be applied in the coming years has

ISSN: 2233-7857 IJFGCN

been studied. Hence, a project has been recommended for an institution and the following results have been concluded: Concentration on the problems faced by the students and companies while devising a plan for the course, Unity and uniform syllabus of students from different universities. The learning is centered on the students. Uniformity of syllabus among different streams of education. Improvement of the students' skill and their capabilities. The students are assessed based on their skill, not on what they have learnt from the text books Concentration of the learning process and not on the results of their examination. Less number of instructors are sufficient for the teaching process. Better relationship between the students, faculty and the company. This may improve the overall educational system and get better and effective results. The demand for engineers with a deep knowledge of the lean principles is increasing day by day in various industrial fields [21].

The present methodology for lean education utilizes training and simulation, but the simulation games that are available in the market are complex and cannot store the results. They also cannot be modelled. Hence, a virtual simulation platform that can make the students conduct different experiments by using lean principles have been created [18]. The proposed system solves these issues by using a simulation software called VE-Suite and contains user friendly boxes, machine's graphical model, measures the performance and its layout can also be edited. Various management principles have been used in the work like Little's law, EOQ and cycle time to apply the lean concepts. Initially, a conventional production line with push type mechanism has been used and this has been improved by the students using the lean technology. Future work of this paper will be to create a supply chain where the universities will act as a vendor and a complete virtual manufacturing procedure can be simulated. When a comprehensive algorithm has been applied to help to improve the performance of the lean implementation, there has been accomplishments like utilizing a wider technique [19]. The performance of the application of lean can also be improved by using special goals and taking movement towards these goals [20]. The scope of the lean education has been tried to be expanded to solve the problems of organizational and cultural issues. These issues have been tried to be solved [21] [22] by using an educational project that has been funded by the NSF (National Science Foundation) by improving the technical and professional skills of the student in lean education.

Most companies that only had manufacturing process as the main source of income previously are now shifting to both goods and services. This is possible due to the implementation of the lean principles and is known as sterilization or PSS (Product Service Systems). Lean has also been used in the service operations, but there is no knowledge among many people, when the lean education is implemented in PSS. Hence, two companies that use lean technologies and are recognized for both products and service has been utilized to evaluate the operation of PSS in the lean environment. Multiple case studies have been proposed to propose a framework to link the lean environment with the PSS [23]. The critical success factors have been identified by implementing lean education [24]. It has been implemented in SME (small and medium enterprises) and the case studies have been taken for a period of four years. It has been observed that the actual problem in making the lean process successful was not due to the problem with the management, but it was due to the knowledge gap since they have been ignorant of the process. Hence, this works considers the knowledge factor as a key parameter to implement the lean education successfully mainly in factories that has less resources. The knowledge in management and education is necessary for the people who work in the implementation of the simulation especially in SME due to the limitation in the resources. However, this paper has concentrated only on SME, thereby neglecting the large enterprises. There is hardly any research regarding the cultural aspects and organization philosophy in lean education. Hence, the lean implementation and its influence has been identified initially and then the aspects have been aggregated into themes [25]. The perception of the participants and the cultural position has been identified for manufacturing SMEs. The most effective lean tool has been used for addressing the need for organizational culture to simply the lean implementation and use its success in SMEs of Saudi Arabia. Since exploring culture is necessary for the topic, it is necessary to use the qualitative research. The implementation had been performed in 37 aspects from the questionnaires.

There is hardly any research regarding the cultural aspects and organization philosophy in lean education. Hence, the lean implementation and its influence has been identified initially and then the aspects

ISSN: 2233-7857 IJFGCN

have been aggregated into themes [25]. The perception of the participants and the cultural position has been identified for manufacturing SMEs. The most effective lean tool has been used for addressing the need for organizational culture to simply the lean implementation and use its success in SMEs of Saudi Arabia. Since exploring culture is necessary for the topic, it is necessary to use the qualitative research. The implementation had been performed in 37 aspects from the questionnaires [3].

3. Problem Statement:

Curriculum design based on problems (problem-based curriculum) teaches students a method to look at a problem and devise solutions for the same. Considered an authentic form of learning as students are exposed to real-life problems, this model is structured to help students acquire skills that can be applied to the real world. It has been shown that the problem-centric curriculum design increases the performance of the curriculum and encourages creativity, innovation and teamwork in the classroom. The downside to that approach is that the various learning styles are not always taken into account.

The problem is developing a model teacher evaluation system that can be used by districts of the school / colleges / university. The model will include the procedures to be followed in developing criteria items that are valid for the district in question. Even the model must meet the following criteria:

1. Validity
2. Observability
3. Variability
4. Brevity
5. Useful for use by trained appraisers

Purpose of Proposed Method:

- To help the teachers know the learning levels of a student.
- To correctly define the learning outcomes based on the students learning levels
- To develop a model to estimate the gap in HSC results and actual learning level of students.

4. Proposed work:

From the literature review on various lean educational system and the simulation process, it has been seen that the researchers have focused mainly on the organizational and the management side of the lean system. The study of lean process in the field of education is very rare and simulations have also not been done effectively.

From these aspects, the objectives of the proposed research work are as follows:

1. Implement the 4QS model
2. Map the 4QS model with Cognitive Levels
3. To assess the educational value of the lean based developed system

into the framework. From the literature review, various gaps have been found and they have been given in the objectives as the steps for this project.

In order to make the study helpful, the Model Syllabus as proposed by AICTE for Engineering will be studied.

Steps 1 and 2 mentioned above can be by taking the 4QS test [1] and mapping the test results as shown in the figure 03:

ISSN: 2233-7857 IJFGCN

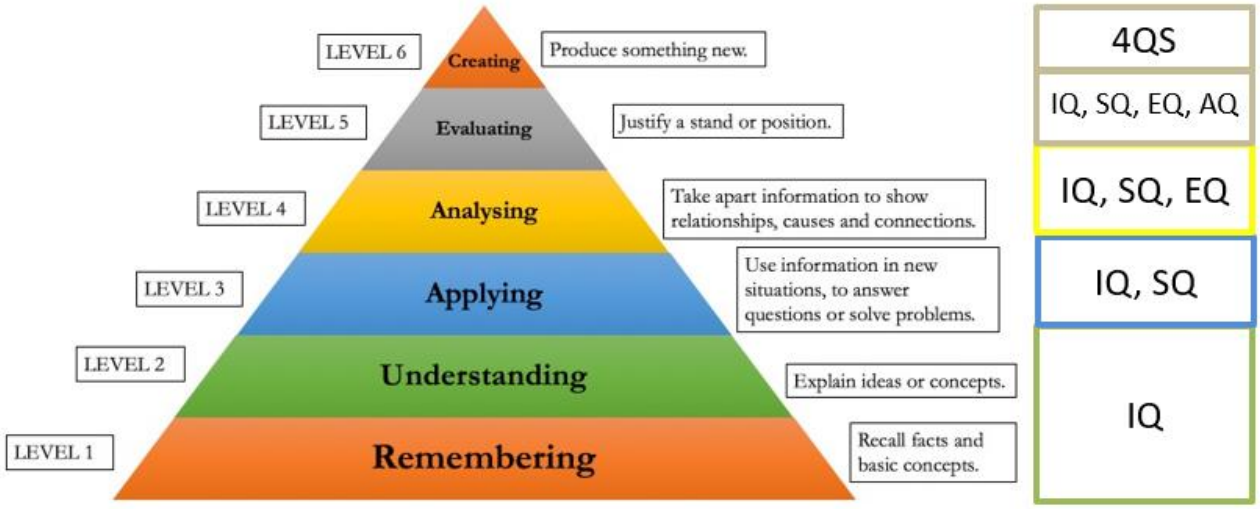

Figure 03: Mapping of 4QS test with the cognitive domain.

Test result of 4QS test is mapped with the respective learning level and the same is tabulated for the entire class. Class wise data for each test is again broken down into 3 categories say High (H), Medium (M) and Low (L). The instructor can now design the respective CO's based on the level of understanding of the class.

5. Result & Discussion:

The 4QS test indicating the level of understanding is tabulated as follows:

Table 01: Tabulated 4QS data

Roll No	AQ	IQ	EQ	SQ	Stress	Comment Indicating the area of concern
##	H	H	M	H	L	
##	H	M	H	H	L	
##	M	M	M	L	M	Low Spiritual Quotient
##	M	H	H	H	M	
##	H	L	L	M	H	Low Intelligence Quotient, Low Emotional Quotient, High Stress

The findings from the test can be summarized as:

- Stress was mostly Medium and High in the F.E. students
- Students with Medium and High Adversity Quotient had less stress
- High Emotional students showed Medium-High Stress
- HSC Marks Intelligence Quotient did not match
- High Spiritual students showed less stress

ISSN: 2233-7857 IJFGCN

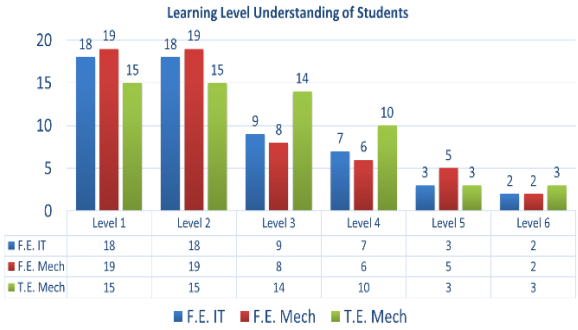

Figure 04: Number of students with respective learning levels

The 4QD test data was tabulated for each student. Mapping of each test result with the corresponding cognitive level was obtained.

Table 02: 4QS and Cognitive Level Mapping

Roll No	Remembering IQ	Understanding IQ	Applying IQ,SQ	Analysing IQ, SQ, EQ	Evaluating IQ, SQ, EQ, AQ	Creating 4QS
##	H	H	M	M	M	M
##	H	H	H	H	M	H
##	H	H	H	M	M	M
##	M	M	M	M	M	L
##	L	L	M	L	L	L

For continuous monitoring during the semester and to have proper assessment of the students, the assessment pattern was also mapped with the cognitive level and weightage of marks were put accordingly.

Cognitive Levels	Internal Examination (20 marks)				Semester End Examination (50 marks)
	Continuous Assessment Tests (15 marks)			FEA Programming Assignment (5 marks)	
	1	2	3		
Remember	0	0	0	0	0
Understand	20	10	10	0	10
Apply	80	50	40	0	70
Analyse	0	30	50	0	20
Evaluate	0	0	0	100	0
Create	0	0	0	0	0

Figure 05: Assessment Pattern (Cognitive Domain)

Based on the results obtained, the course outcomes for the next semester were suggested. Assuming the next class will have the same level of learning. This can be fine-tuned after 3 or more semesters results are obtained.

Proposed CO's based on the level of understanding were as follows.

CO Number	Course Outcome Statement	Weightage In %
CO1	Solve the physical problem using functional approximation method like weighted residual method & Variational methods.	10
CO2	Explain the fundamental concepts of theory of Elasticity.	10
CO3	Solve for one dimensional structural and thermal problems using FEM.	20

ISSN: 2233-7857 IJFGCN

CO4	Solve the two dimensional structural and thermal problems using FEM.	20
CO5	Formulate the shape function and stiffness matrix for two dimensional Iso Parametric and Higher Order Elements	10
CO6	Perform computer Simulation for Linear, Nonlinear static Structural, Modal, Steady state, Transient Thermal analysis using FEA Software.	30

6. Discussion:

- 4 quotients with Stress to assess student's potential during course enrollment have been incorporated into the lean model.
- Report based on 4QS and Cognitive Level indicating areas of improvement will help student improve his/her performance.
- Teacher will be able to know the potential of student before commencement of semester.
- In curriculum planning, the Course Outcome can now be placed exactly with the cognitive level of students.
- Assessment pattern can now be mapped with the cognitive level for proper level of teaching and learning.

7. Conclusion

Starting with a detailed analysis of the literature on lean principles and using lean philosophy in an academic environment, this paper addressed the case of an Education system in which lean principles were applied. Efficient application of lean principles contributed to the identification of the obsolete procedures and elements of the unused curriculum. A new streamlined solution based on the pull-system was introduced. Lean will create a win-win situation in higher education institutions for curriculum growth for students, teachers, employers and administrators by continuously concentrating on can-non-value - added initiatives. Furthermore, when applied correctly to core academic processes, the lean theory can contribute to the reduction or elimination of issues that lead to customer dissatisfaction. Applying lean methods would help create better services for both students and college / university as academic institutions are working to establish online classes. The knowledge and tools contained in this paper would enable teachers and instructional administrators to see how lean concepts can be implemented to enhance the quality of the program and standardize current processes.

References:

1. Sunny Nanade, Sachin Lal, Dr. Shubham Goswami, Dr. Arvind Sharma, "4QS model to assess the student learning capabilities", International Journal of Advanced Science and Technology (IJAST) 2227-2244. Retrieved from http://sersc.org/journals/index.php/IJAST/article/view/24405-2020.
2. Sunny Nanade, Sachin Lal, "Applying Lean for Effective Implementation and Governance of Education in Future Cities", International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-8, Issue-7S, May 2019.

ISSN: 2233-7857 IJFGCN

3. Sunny Nanade, Sachin Lal, "Developing Engineering Curriculum: The Lean Way", International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-8 Issue-8S3, June 2019.
4. Alves, A. C., Flumerfelt, S., & Kahlen, F. J. (2017). Lean Education: An Overview of Current Issues. Switzerland: Springer International Publishing.
5. Alves, A. C., Kahlen, F. J., Flumerfelt, S., & Siriban-Manalang, A. B. (2013). Lean Engineering Education: bridging-the-gap between academy and industry. Retrieved from https://repositorium.sdum.uminho.pt/bitstream/1822/30297/1/ShortVersionPaper_CISPEE.p df
6. Antony, J. (2014). Readiness factors for the Lean Six Sigma journey in the higher education sector. International Journal of Productivity and Performance Management, 63(2), 257-264.
7. Antony, J., Krishan, N., Cullen, D., & Kumar, M. (2012). Lean Six Sigma for higher education institutions (HEIs): challenges, barriers, success factors, tools/techniques. International Journal of Productivity and Performance Management, 6(8), 940-948.
8. Badawy, M. (2006). Preparing engineers for management. Engineers Australia, 7, 64-66.
9. Baillie, C., & Fitzgerald, G. (2000). Motivation and attrition in engineering students. European Journal of Engineering Education, 25(2), 145-155.
10. Balaji, K. V., & Somashekar, P. (2009). A Comparative Study of Soft Skills among Engineers. IUP Journal of Soft Skills, 3(3-4), 50-57.
11. Balzer, W., Brodke, M., & Kizhakethalackal, E. T. (2015). Lean higher education: successes, challenges, and realizing potential. International Journal of Quality & Reliability Management, 32(9), 924-933.
12. Balzer, W. (2010). Lean Higher Education: Increasing the Value and Performance of University Processes. Boca Raton: CRC Press.
13. Barling, J. (2014). The Science of Leadership. New York: Oxford University Press.
14. Berdanier, C., Branch, S., London, J., Ahn, B., & Farmer, M. (2014). Survey Analysis of Engineering Graduate Students' Perceptions of the Skills Necessary for Career Success in Industry and Academia, 121st ASEE Annual Conference and Exposition, June 15-18, Indianapolis.
15. Bishop, J. H. (1995). Expertise and Excellence, (CAHRS Working Paper #95-13), Ithaca, NY: Cornell University, School of Industrial and Labor Relations, Center for Advanced Human Resource Studies, Retrieved from http://digitalcommons.ilr.cornell.edu/cgi/viewcontent.cgi ?article=1202&context=cahrswp.
16. Bol, L. A. (2010). Knowledge, Skills, and Abilities Necessary for Success in the Manufacturing Industry. WI: University of Wisconsin-Stout Menomonie.
17. Byrne, A. (2013). Lean Turnaround: How Business Leaders Use Lean Principles to Create Value and Transform Their Company. Ohio: McGraw-Hill.
18. Carvalho, C. V., Lopes, M. P., António, G., Ávila, P., Bastos, J., & Fonseca, L. (2013). Lean learning academy: an innovative framework for lean manufacturing training, 1 st International Conference of the Portuguese Society for Engineering Education (CISPEE), October 31 - November 1, Porto.
19. CBI (2016). The right combination/Pearson education and skills survey 2016. Retrieved from http://www.cbi.org.uk/cbi-prod/assets/File/pdf/cbi-education-and-skills-survey2016.pdf.
20. M. Kropp and A. Meier, "New sustainable teaching approaches in software engineering education," in 2014 IEEE Global Engineering Education Conference (EDUCON). IEEE, 2014, pp. 1019–1022.
21. Atul B Kathole, Dr.Dinesh N.Chaudhari, "Pros & Cons of Machine learning and Security Methods ", 2019.http://gujaratresearchsociety.in/index.php/ JGRS, ISSN: 0374-8588 ,Volume 21 Issue 4
22. Atul B Kathole, Dr.Prasad S Halgaonkar, Ashvini Nikhade, " Machine Learning & its Classification Techniques ",International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-8 Issue-9S3, July 2019.
23. C. Anslow and F. Maurer, "An experience report at teaching a group based agile software development project course," in Proceedings of the 46th ACM Technical Symposium on Computer Science Education. ACM, 2015, pp. 500–505.

ISSN: 2233-7857 IJFGCN

24. E. Papatheocharous and A. S. Andreou, “Empirical evidence and state of practice of software agile teams,” Journal of Software: Evolution and Process, vol. 26, no. 9.
25. Association of Computing Machinery, “Computer science curricula 2013,” online, 2013. [Online]. Available: https://www.acm.org/education/CS2013-final-report.pdf.
26. K. Beck, Extreme Programming Explained: Embrace Change, ser. An Alan R. Apt Book Series. Addison-Wesley, 2000. [Online]. Available: https://books.google.co.uk/books?id=G8EL4H4vf7UC.
27. D. Anderson, Kanban: Successful Evolutionary Change for Your Technology Business. Blue Hole Press, 2010. [Online]. Available: https://books.google.es/books?id=RJ0VUkfUWZkC.

ISSN: 2233-7857 IJFGCN