THE LEAN TRANSFORMATION MODEL FOR THE EDUCATION SYSTEM

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Abstract: Lean thinking not only changes the way of manufacturing, but also can be the way to improve any kind of organizations. Educational system is one of these organizations that consider using lean principles to improve the current system. The goal of this study is to develop a model, which shows how the lean principles can be used to transform the university system to a lean organization. This model has the following objectives:

- To identify the ultimate customer
- To use the mapping value stream to remove waste from the system
- To create flows for the value
- To pull each element when needed
- To pursue perfection

Key words: Lean organization, lean model, educational system, and lean principles.

0 INTRODUCTION

Lean Manufacturing reduces costs of manufacturing by improving labor utilization, decreasing inventories, reducing manufacturing cycle times, and increasing capacities without capital expenditures. *Lean thinking* not only changes the way of manufacturing, but also can be the way to improve any kind of organizations as service and construction. Educational system is one of these organizations that consider using lean principles to improve the organizational system.

In global competition, customers are more demanding. Therefore, they have to react faster for delivering goods and services to the customer at improved quality and lower prices. In this sense, lean thinking becomes hot new trend that many business leaders try to adapt the concepts to use in their organization (Howell, 1999).

1 BACKGROUND

This study is the implementation of lean thinking concepts, tools, and processes in the College of Engineering at University of Tennessee at Chattanooga. The College of Engineering is the organizational unit of the University, which is responsible for engineering, engineering management, and industrial technology management programs. The programs are accredited by the Engineering Accrediting Commission/Accreditation Board of Engineering and Technology. Programs and administrative heads run the college with the involvement of faculty in existing committees. The engineering curriculum provides a four-year program with emphasis on engineering fundamentals, design, projects and team experience, mathematics, laboratory sciences, communication, humanities and social sciences. Engineering students take a common core of courses the first two years, followed by specialization courses the third and fourth years. The master programs are also offered with concentrations in chemical, civil, electrical, industrial, mechanical engineering, and engineering management.

2 LEAN THINKING

Fundamental to lean thinking is the conversion of waste into customer-defined value (Womack, 1992). The college of engineering serves three functions: teaching, research, and service. Teaching is the most important function by the concern of the college of engineering and the policy of the university. Students, who enroll in courses in the college of engineering, are consumers of knowledge. Therefore, the study of lean thinking concepts, tools, and processes concentrate on delivery values to students (Womack, 1996).

The value can be defined as an engineering knowledge that students use in their future work and personal life. The ultimate value that students look for can be divided into two parts: value to career and value to personal interest. The value that students can receive from the college of engineering depends primarily on two factors. One factor can be described as what students lean, which depends on courses structured under the programs provides by the college, and the details of knowledge under each courses. The second factor is how students learn. Because both factors depend on the college, the college is responsible for structuring programs to provide the student with a broad background in the engineering sciences and in-depth focused in areas of engineering and transferring the knowledge to students in the most effective ways.

There are two significant parts in delivering value to students: what students learn and how they learn it. There is only one process that adds value to students in the college of engineering and it is the process of transferring knowledge, which combines two parts to deliver value to students. Two important processes to deliver value to students are: process of transferring knowledge to students and process of assessing students for knowledge they receive. Transferring knowledge to students should include the objectives of each course and what they will learn. The "assessing students" step should be able to evaluate the students' performance to determine if they learned the material.

3 PROCESS OF TRANSFERRING KNOWLEDGE TO STUDENTS

- *Course Objectives*
  The objectives of each class should be stated precisely. Students are entitled to know what teachers expect from them to learn. The whole course should be in place before semester begins. The objectives should specify the performance measurement method that can be used by students and teachers.

- *Course Nature*
  The main objective of the college is to have students achieve the full understanding of the courses. The college cannot expect all students to master the courses at the same time, but the personalized lessons for each student should be implemented to effectively deliver value to students. The smaller amounts of material are more digestible than larger amounts and students will learn better if they are given frequent and immediate rewards.

- *Course Delivery*
  Because the whole programs are in place before students enroll, the teacher responsibility for each course will be different from the traditional one. The program will be changed from faculty-centered to student-centered.

- *Modules*

Two main characteristic found in engineering courses in the college of engineering are content of knowledge and application of knowledge. The instructional types of content-based knowledge must be self-contained and students should be able to repeat these instructions without trouble. The application-based knowledge can be transferred to students by type of instructions that let students practice to use the knowledge. The examples of these instructions are lab studying, work project, workshop, group discussion, problem solving and evaluation.

- *Support Systems*
  In order to keep changes move smoothly, the support system is created to help students in the changed environment of the course. The support system includes creating on-line course communicate group, and making information available to everybody.

4 PROCESS OF ASSESSING STUDENTS FOR KNOWLEDGE THEY RECEIVE

- *Assignment*
  Homework is important in the aspect of practicing students to use what they have learned from lectures. The personalized assignment should be the cross-discipline assignment. It will also benefit students that they have to use variety of knowledge like in real world to try to solve problems.

- *Test*
  Students should be examined to see if they achieved the stated objectives. The tests should provide immediate feedback to students so students would have chance to go back to materials and achieve the objectives in the next attempt. Professors should talk with students who need help.

- *Grading*
  The grading system is divided into two parts. The study units and tests. There will be no marks for homework assignment or class attendance. In the unit test part, students can take the test as many time as needed to pass it.

5 THE LEAN EDUCATION FLOWCHART

The below figure shows the lean process in the college of engineering. By using this flowchart teacher can monitor students and give respond to the actions quickly. Furthermore, this information can be used as an improvement opportunity. Teacher is able to see if which units majority of students are having problem with. So he/she can make necessary changes to reduce problems and improve quality. By using information from unit tests, questions from students, and discussion with students and colleagues, improvement opportunities are endless.

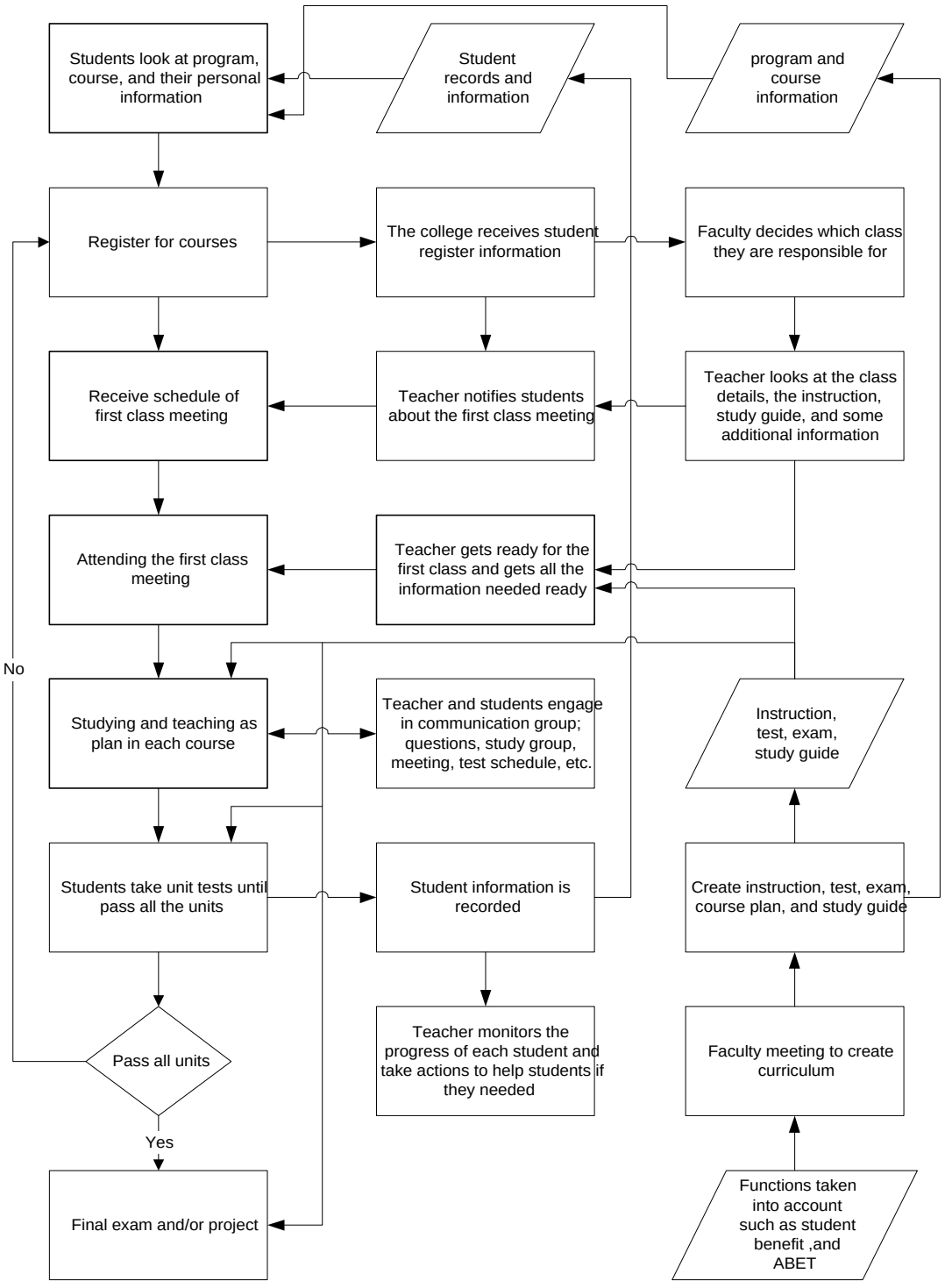

Figure XXX The process flowchart in college of engineering after applying lean

6 CONCLUSIONS

The expected results of the lean education and the comparison of the lean education with the traditional education are shown in the following table:

Table 1. The Comparison of Lean Education with Traditional Education

BEFORE APPLYING LEAN CONCEPTS	**AFTER APPLYING LEAN CONCEPTS**
Faculty has control on course contents and instructional styles	Student benefits are the first to concern in creating instructions
Students might not know what they will learn	The objectives are stated clearly to students so they know what to expect
Boundary of content is not clear and might be different with different teacher	The whole course is planned out before, sol there is a standard in each course
Knowledge is pushed to students	Students study at their own pace
Only courses that have enough students are opened	Every course is opened every semester
Students might finish the course with poor understanding	Students have better understanding with unit-perfection requirement for advance
Faculty and students rarely have relationship outside classroom	Closer relationship between students and faculty is created
Students have to get advisor signature for class registration	The information is available for students to decide what class they want to take
Programs and courses are hard to find	The information is available online and easy to access
Overload of assignment without an objective	Cross-disciplined and personalized assignment is created

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