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LEAN EDUCATION SYSTEM: A CASE STUDY

Abstract:

The number of students in the institutions of secondary education approaches 5.5 million in the Turkish education system. Such a big system should be managed very well in order to educate successful students. In successful managements, successful results are obtained by taking proper steps. The key to good management is examination of the current state and determination of correct strategies in agreement with the objectives. This system aims not only at maximum quality but also to minimize the cost. In this way, it will also enhance customer satisfaction and its preferability. Previously used only in the manufacturing systems, lean philosophy is also available in the service sectors today. In this study, the current system at private high schools – one of the most important parts of the education sector included in the service sector – was examined; the processes of the high school were defined and analyzed; and the waste was determined. Lean thinking and lean tools were utilized to eliminate waste and to enhance quality and customer satisfaction.

Keywords:

Lean; Lean Management; Process; Process Management; Lean Education System

JEL Classification: M29, L30, Z00

1. **Introduction**

In the business world where the competitive environment has increased, the institutions in the public sector, like the establishments operating in the private sector, have to make some arrangements in order to survive and to be preferred in the competitive environment. One of these practices is to prepare a strategic plan which consists of strategic goals, objectives, and activities in order to be able to attain their visions. Objectives are determined to reach the strategic goals included in the strategic plan. When determining the objectives, it is important to know the jobs done in an institution. The activities which turn inputs into useful outputs for its customer by creating value added for inputs are called a process. A process is a chain of procedures carried out to complete the jobs which constitute the goods or services that an institution offers to its customer. The fact that the processes in an institution have been defined well, openly, and clearly and that the areas which are open to improvement in the processes have been determined is one of the most important auxiliary elements to determine the objectives of an institution properly.

The importance of attaining the objectives and ensuring customer satisfaction should be known by all managers and employees. In order for an enterprise to attain its strategic goals, it is necessary that all employees have acquired the process perspective. To adopt this perspective, the processes should be determined, defined, put in order of importance, analyzed, and improved – that is to say, a transition to management through processes should be made.

The increasing of preferability by customers is as important as the realization of objectives. Enhancement of quality in both production and service sectors is quite important to ensure customer satisfaction, to surpass customer expectations, and hence to increase preferability. To enhance quality, it is necessary to improve the production or service processes. Lean Philosophy is a thought which aims to eliminate the waste determined in processes after the processes have been defined, to reduce the cost and therefore increase productivity, and ultimately to ensure customer satisfaction by enhancing quality. Since the non-value added activities in a product or a service will be eliminated with lean philosophy, the duration of a product or a service to reach the customer will be shortened as well.

In their book entitled “The Machine that Changed the World”, Womack, Jones and Roos defined lean as an alternative approach to the other types of production (Womack et al., 2007). Lean, an alternative approach, has some principles which distinguish it from the others. These principles are used to reduce the waste in processes, to make improvements in the current state, and to enhance quality.

The lean approach can be employed in the service sector, as it is employed in the manufacturing sector (Martin et al., 2012). Competition has also been rapidly increasing

in the service sector recently, which means that institutions should reduce their costs and enhance their quality in order to increase their competitiveness. Enhancement of the value added of the system by eliminating the waste in the processes will both reduce the cost and enhance quality. By realizing this reality, the service institutions also understand the importance of analyzing their processes and eliminating the non-value added activities/waste and perform their configuration in this line.

The education sector, which is part of the service sector, also has managerial objectives such as customer satisfaction, enhancement of quality, and reduction of waste. In the Turkish education system, it is of crucial importance to receive good university education. For good university education, it is necessary to receive good high school education and to get prepared for the university entrance examination very well. Therefore, high schools are like enterprises which compete with each other. They make studies to provide students with the most correct and highest quality education. Besides, they desire to keep the cost at the minimum point while enhancing quality. This approach overlaps lean philosophy.

First of all, process, process management, lean, lean management and lean techniques are defined in this study. The implementation of process management at a private high school in İstanbul is described in the third section. Within this scope, all processes of the high school are defined and the process flows are drawn. Details of the implementation of lean process management are provided in the fourth section. In this part, the areas which are open to improvement in the defined processes and the waste which badly affects the performance of the process are specified and the lean techniques used to eliminate the waste are elucidated. The results and “the lean education model” planned to be carried out in the future are mentioned in the last section.

2. Literature

The word ‘lean’ can be defined as the elimination of waste. That is, it is the thought of being able to do much more jobs with fewer resources by eliminating non-value added actions.

Lean thinking provides a way of defining the value, of putting value creating actions into order in such a way that will yield the best result, of implementing these activities uninterruptedly when someone demands them, and of performing them gradually more effectively. Lean thinking shows the way of gradually obtaining more with less, i.e. with less human effort, less equipment, less time, and less space (Womack and Jones, 2003). In this way, enterprises ensure customer satisfaction as well.

In lean thinking, it is aimed to enable the actions of a process to add value to the process by analyzing the processes, determining the non-value added actions, and reducing

waste. Although lean thinking occurred together with lean manufacturing, lean philosophy finds quite many fields of use not only in production activities but also service activities. Likewise, recently the use of lean has been gradually increasing in such fields as lean management, lean accounting, lean transformation, lean supply chain, lean organization, lean leadership, and lean product development. Lean practices are gradually taking place more considerably in public administration, local government, finance services, human resources, health services, and education.

Implementing a lean business philosophy can transform an organization, bringing with it huge benefits in terms of reduced operating costs, decreased lead times, and increased customer satisfaction, along with a marked improvement in employee morale, customer loyalty, and quality of products and services. The lean business model – while originally developed within the US and Japanese automotive manufacturing industries – has proven its worth time and again in every field imaginable – from retail and manufacture to central government administration (Akdeniz, 2015).

The right management is crucial for lean companies. Lean is not just a set of tools that can be applied to any situation to reap rewards. Lean management involves taking a holistic approach to developing a specific culture throughout an organization – and a lean business culture can only be achieved if everyone buys in. A lean manager must guide, coach and inspire but beyond this they must be open and ready to learn on every step of their journey of continuous improvement (Akdeniz, 2015).

Lean management is a strong managerial approach which develops the operational performances by enterprises (Bortolotti et al., 2014). Lean management is a quality development philosophy which uses the tools and components of long-term goals for continuous development (Simons et al., 2014). The lean management philosophy proposes some principles for organizations and optimizes efficiency while they are creating value. These principles are keys for organizations and also affect the physical structure and running (Cochran, 2000).

Lean management should have sustainability in order to be successful at enterprises. Charron et al. (2015) give details about the critical components required for Sustainable Lean Management. Positioning Lean as a management operational philosophy far beyond the traditional set of improvement tools, Charron et al. (2015) explain how managers at all levels of the organization can integrate Lean into their daily management activities. They define the Lean Philosophy as well as the beliefs and behaviors required to develop a thriving Lean Company Culture. Mann (2015) describes the need for lean management and how to create the lean culture in an organization.

Liker (2004) shows managers in every industry how to improve business processes by eliminating wasted time and resources, building quality into workplace systems, finding low-cost but reliable alternatives to expensive new technology, producing in small quantities, and turning every employee into a quality control inspector.

Ballé and Ballé (2009) address a critical problem in order for companies to become lean: how can they advance beyond realizing isolated gains from deploying lean tools, to fundamentally changing how they operate, think, and learn? In other words, how can companies learn to go beyond lean turnaround to achieve lean transformation?

George et al. (2005) discuss lean and the Six Sigma tools in their study. Additionally, their study provides expert advice on how to select a tool for a "family" which desires to perform different purposes in the best way. Packed with detailed examples and step-by-step instructions, it's the ideal handy reference guide to help Green and Black Belts make the transition from the classroom to the field.

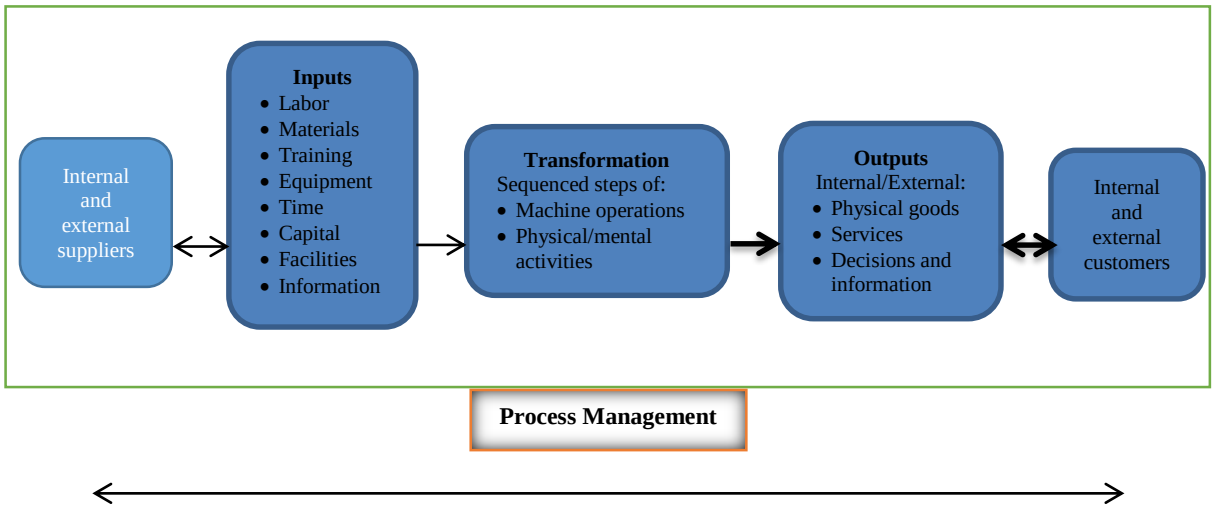
Such lean tools as the Process Approach, 5S, Workplace Organization, Just-in-Time (JIT), Value Stream Mapping (VSM), the Pull System, the use of Kanban cards, One Piece Flow, SMED, the Poka-Yoke Approach, Total Productive Maintenance (TPM), and Employee Participation should be used to become lean. For detailed information on lean tools, see Akdeniz (2015), Duggan (2013), and Taylor (2013).

Since the process approach and Just-in-Time (JIT) will be used as lean tools in this study, Process, Process Management and Just-in-Time tools are described more elaborately.

A process is a series of value creating activities which transform the specific inputs obtained from the supplier into useful outputs for the customer by creating value added, which can be defined, which can be quantified, and which are interconnected. A process is a chain of procedures performed for the completion of the jobs which constitute the goods or services that an institution offers to its customer.

Notwithstanding the availability of many different definitions of process, the process elements are basically identical. These elements are shown in Figure 1 (Wisner and Stanley, 2008).

Figure 1. Generic process elements



Source: (Wisner and Stanley, 2008)

As shown in Figure 1, a process consists of a set of linked activities or elements designed and performed by internal and external customers. Collectively, these processes are the business and need to be managed. Process activities may be performed for instance by suppliers, employees, customers, manufacturing equipment, and computers. Processes may start small or large, formally or informally, and deliberately or naturally; and they can also be successful or unsuccessful. *Successful processes* ultimately keep employees, stockholders, and customer satisfied, creating value for the firm and its product. *Unsuccessful processes* can be harmful to businesses and are either changed, retired, or left to create long-term problems or distractions (Wisner and Stanley, 2008).

The first mission of that process office involved the need to detail each one of the several businesses in our organization to facilitate the comprehension and participation of all, maintaining alignment between the executions of daily work to the strategic plan of the corporation. In addition, there was the premise that the management was based on performance indicators that allowed fast and efficient decision taking (Palvarini and Quezado, 2013).

According to Tokcan (2011), a process which continues productively and efficiently should have such characteristics as identifiability, transformation, repeatability, consistency, measurability, controllability, and creation of value added.

The fact that the processes have been defined at an enterprise does not mean that the enterprise concerned is managed through processes. Process management covers the activities of defining and analyzing the processes (determination of the purpose, input, output, actions, supplier, customer, implementers, responsible person, and performance indicators of a process), developing a suitable system to control the processes, following their performance at specific intervals, determining the areas which are open to improvement, and improving them.

Process management is an organization which is based on the systems comprised of interrelated processes. Each singular process at an enterprise constitutes part of some comprehensive process management together with other processes (Benner and Tushman, 2003).

In their study, Wisner and Stanley (2008) define process and process management, elaborate on the processes at enterprises (New Product Development, Customer Relationship Management, Customer Service Management, Demand Management, Inventory Management, Purchasing and Supply Chain Management, etc.), and discuss lean tools in order to increase the process performance. Bruijn and Heuvelhof (2010) provide the definitions of process and process management and compare process management with the other relevant approaches (process management versus command and control, process management versus project management, etc.). In addition, in their study, Bruijn and Heuvelhof (2010) emphasize the risks of process approach and change-negotiation and examine the relationship between process management and decision-making. Boutros and Purdie (2014) mention the process improvement context, process maturity, and process-oriented architecture and give examples by describing the things to be done in order to form a process ecosystem, managing process improvements, and the process improvements organization. Madison (2005) describes the importance of process, process mapping, and key stakeholders' role and responsibility and elaborates on how to make process improvement and how to create improvement teams. Damij and Damij (2014) focus on the multi-disciplinary nature of process management by explaining its theoretical foundations in relation to other areas such as process analysis, knowledge management, and simulation in their books. Jeston and Nelis (2008) provide a clear and thorough exposition of the six key dimensions necessary for the creation of a process-focused organization: process governance, strategic alignment, methods (execution/implementation), people, culture, and technology in their study.

Just-in-time (JIT) production was developed as manufacturing quality management under the name 'The Toyota Production System' after the midst of the 20th century by Japanese managers (Amasaka, 2014). It refers to the production of only required parts in required amounts, in required places, and at required times (Ozdemir and Tekoğlu, 2011). Just-in-time production is based on designing the products for economic production, organizing a workplace in order to facilitate the manufacturing flow, drawing up programs to provide employee participation, making studies to obtain the accurate data, reducing the paperwork, reducing the rate of production wastage, reducing inventories, and ensuring continuous development in all fields (Ünal, 2007). The practice of just-in-time production increases productivity and the quality of processes, while it reduces the total cost (Alcaraz et al., 2014).

In the service sector, JIT production provides such advantages as the improvement of communication, reduction or elimination of depots, an increase in the performance of

suppliers, making prophetic estimations, improvement of quality, improvement of the service, faster settlement of problems, reduction of transportation costs, improvement of stationery procedures, and development of the team spirit (Ozdemir and Tekoğlu, 2011).

School leaders are interested in expanding their abilities to leverage more effectiveness, efficiency and relevance with approaches that extended beyond the traditional budgeting processes, including program and personnel reductions. Educators want to learn how to work smarter and how to enable employees to do so as well so that mission is realized and operationalized to maximum levels of excellence. Lean is a new frontier in improvement technologies for education (Flumerfelt and Soma, 2012).

In order to have a lean educational institution, managers and employees must not only develop strong strategies and manage the classes more effectively but also do practices to show this. The lean practices likely to be done in educational institutions are explained in many sources. In his study, Emiliani (2013) discusses how teachers will become better teachers by using lean techniques, what kind of improvements will be made in the teaching process, and making improvements by evaluating the outputs appropriately.

There is a need to implement lean education not only at the primary or secondary education level but also, and indeed as a greater requirement, in higher education. In an environment of diminishing resources, growing enrollment, and increasing expectations of accountability, Balzer (2010) explains the understanding and the tools required to return education to the consumers it was designed to serve—the students. It supplies a unifying framework for implementing and sustaining a Lean Higher Education (LHE) transformation at any institution, regardless of size or mission.

Waterbury (2011) provides practitioners with a seminal perspective of Educational Lean, introduces a research-based Lean improvement model referred to as the Educational Lean Improvement Model (ELIM), provides rationale for the language translation, illustrates four case studies, and presents the perspective of several leadership positions that have experienced the phenomenon of Educational Lean.

Flumerfelt (2012) offers a foundational introduction to the application of lean for school administrators. In her study, five lean essentials, paired combinations of lean tools and concepts, are described in detail within the context of typical leadership practice. Her study deals with familiar problems in schools today, such as with handling instructional remediation, aligning instructional delivery to mission, conducting special education budget reductions, evaluating administrators, and standardizing instructional best practice in reading. Regardless of the problems faced by school leaders, Flummerfelt (2012) highlights how lean concepts and tools are particularly helpful in engaging employees, achieving outstanding results and sustaining continuous improvement.

For detailed information on lean education and its feasibility, see Ziskovsky and Ziskovsky (2011) and Emiliani (2004).

3. Implementation

3.1. Introduction of the School

The educational institution where the implementation will be carried out is a private school which was founded in 2002 and which serves as an Anatolian High School in İstanbul. The institution has 24-person private classes, applied courses, private classrooms, a library, science laboratories (physics, chemistry, and biology), indoor and outdoor sports halls, a conference hall, a cafeteria, a dining hall, and the accommodation service. It also has achievements in academic and cultural branches as well as in the branches of arts and sports.

3.2. Definition of the processes

The processes in the educational institution, the subject of the implementation, were collected under 3 main headings and defined as in Table 1. They are academic processes, administrative processes, and supervisory processes. These main processes consist of sub-processes as shown in Table 1.

Table 1: Processes of the Educational Institution

A. Academic Processes	B. Administrative Processes	C. Supervisory Processes
a.Étude determination process b.Student following process c.Process of doing test exams d.Curriculum determination process e.Attendance process f.Guidance and counseling process g.Schedule determination process h.Atelier and laboratory process i.Process of using materials j.Foreign language	a.Process of getting permission b.Cleaning process c.The refectory process d.The Ministry of National Education process e.Press and Public relations process f.Budget and accounting process g.Personnel actions(HR) process h.Student affairs process i.IT and technical maintenance process j.Library and documentation process k.Process of health, culture, housing, sports, and businesses l.Building works and technical maintenance process	a.Performance monitoring process b.Internal auditing process c.Strategic planning process

process k.In-service training process l..Candidate training process m.Project and research process	m.Quality improvement process n.Purchase process o.Security services process	

All processes shown in Table 1 were examined, analyzed, and defined (their relevant processes, responsible person of the processes, and their implementers, inputs/outputs, suppliers/customers, actions, and performance indicators were determined); their flow diagrams were drawn; their areas, which were open to improvement, were determined; improvements were made by using the process approach and just-in-time production philosophy out of the lean tools in order to form the lean educational institution; and the waste was reduced.

To make a process manageable, its basic elements should be defined. The basic elements of the process to be used in practice are described below:

- **The Main Process:** It is the process which is at the first level when the processes are considered hierarchically.
- **The Sub-Process:** It is the elaborated state of the main process.
- **Person responsible for the Process:** He/she is the person who knows, manages, and conducts the process and who will make the process improvements and the necessary arrangements. It is absolutely necessary to know the person responsible for the processes. Assignment of the responsibility for the process to a single person will prevent the complications in the running of the process.
- **Inputs of the Process:** They are resources such as the person, machine, material, capital, and information provided by the suppliers of the process and stimulating the process.
- **Outputs of the Process:** They are the goods and services whereby the inputs provided by the suppliers are transformed by creating value added in such a way that will meet the needs and expectations of the customers.
- **Suppliers of the Process:** They are the people or establishments that provide the inputs of the process. They may be from either within or outside the organization.
- **Customers of the Process:** They are the users of the outputs of the process. The customers of some processes may be in-house people or departments (the internal customer), whereas the customers of some processes may be people or institutions outside the establishment (the external customer). When carrying out the processes, the satisfaction and expectations of all customers should be taken as the basis without discriminating between internal customers and external customers.

- **Actions of the Process:** They are the activities which are performed during the transformation of the inputs into outputs and which create value added.
- **Process Performance Indicators:** They indicate the level at which the process meets the customer expectations/needs. Determination of measurable indicators (e.g. duration of responding, the number of items, and the rate of scrap) facilitates understanding whether the process has really worked or not while measuring.

Of the processes examined according to the process approach, "the étude determination process" will be shown as an example. **The process identification card** where the relevant processes of the étude determination process, the responsible person of the process and its implementers, inputs/outputs, suppliers/customers, actions, and performance indicators are described is shown in Table 2.

Table 2: The Process Identification Card of the Étude Determination Process

Name of the Process: Étude Determination Process
Main Process: Academic Processes
Person responsible for the Process: Relevant Vice-Principal
Implementer of the process: Relevant Teachers and Relevant Vice-Principal
Purpose and Brief Summary of the Process: The étude system is a system for the completion and consolidation of the subjects about which the students have deficient knowledge. Students complete their deficient knowledge about the subject matter to achieve the targets and better consolidation of the issues is the purpose of the system.
Inputs of the Process: Classes, previous course reports, exam results, and course materials
Actions:

1. Determination of the classes to which an étude will be implemented
2. Determination of the subjects to be taught in études
3. Determination and procurement of the materials to be provided in études
4. Determination of étude times
5. Determination of the classes in which the études will be taught
6. Implementation of études
7. Subjecting the students to a test at the end of an étude
8. Quantifying the efficiency of an étude as a result of the test
9. Reporting those who attended the étude, the test results, and the teacher who taught the étude

Its Outputs: Efficiency results, test results, and relevant teacher reports
Performance Indicator: The efficiency of études, student satisfaction, and exam results in the future
Its Customers: Students
Its Suppliers: Relevant Teachers and Relevant Vice-Principal
Other Relevant Processes: Student following process as well as Guidance and counseling process

Frequency of Revision and Report: 1 year

"The identification card for the étude determination process" shown in Table 2 contains the actions to be performed in case of étude determination in the educational institution when necessary, the responsible person of this process, its input/output, its supplier/customer, the other processes to which it is relevant, the performance indicators of the process, and its frequency of revision.

The flow diagram of the étude determination process is demonstrated in Figure 2.

Figure 2: A Flow Diagram of the Étude Determination Process

Responsible People	**Workflow**
Relevant Teachers	Determination of the classes to which an étude will be implemented
Relevant Teachers	Determination of the subjects to be taught in études
Relevant Teachers	Determination and procurement of the materials to be provided in études
Relevant Teachers and Relevant Vice-Principals	Determination of étude times
Relevant Vice-Principals	Determination of the classes in which the études will be taught
Relevant Teachers	Implementation of études
Relevant Teachers	Subjecting the students to a test at the end of an étude
Relevant Teachers	Quantifying the efficiency of an étude as a result of the test
Relevant Teachers	Reporting those who attended the étude, the test results, and the teacher who taught the étude

The flow diagram of the étude determination process shown in Figure 2 consists of two columns. The actions of the process are shown in the form of a flow diagram in the second column, whereas the people responsible for that action of the process (or those who will implement the action) are shown in the first column.

4. Lean Education System

4.1. Shortcomings of the étude determination process

In summary, the étude system is an essential system for a student to complete and consolidate the subjects about which he/she has deficient knowledge. Nevertheless, this system may have shortcomings too. The shortcomings which occurred when the étude system in the educational institution was examined can be listed as follows:

- The students do not fully know the subjects about which they have deficient knowledge.
- The teachers do not know about which subjects the students have deficient knowledge and how deficient students' knowledge is.
- The return, i.e. utility, of études cannot be fully quantified.

4.2. The waste in the étude determination process

When the shortcomings in the étude system are also considered, the predetermined waste in "the Étude determination process" can be given as follows:

- *Waste of time:* The students who know the subject listen to the same subject once more during the études implemented, which is a waste of time for both the students and the teacher.
- *Waste of documents & materials:* Since the tests, and books given in études are not provided according to a specific system, the documents and materials provided to the students who do not need them are a waste.
- *Waste of energy:* Listening to the subject about which they have no deficient knowledge once more and solving questions about the subject are a waste of energy for students. Teaching the subject again to the students who know the subject and bringing tests and handing them out to these students are unnecessary actions, unnecessary transportation, and a waste of energy for teachers.

4.3. Improvement

Of the lean tools, just-in-time production was utilized to eliminate the waste in the étude determination process. By using the principles of just-in-time production, the waste was eliminated and the value added in the processes was enhanced.

Person-orientedness: With the principle of person-orientedness in just-in-time production, it is aimed to eliminate the waste of time in études. In this way, it is planned to carry out the études in a student-based, but not class-based, fashion. By analyzing the results of the tests and exams performed concerning the subjects, which students have deficient knowledge about which subjects and how deficient their knowledge is are determined. "The étude requirement determination form" shown in Table 3 was drawn up for this determination procedure.

Table 3: The Étude Requirement Determination Form

Name of the Class	**Exam I**			**Exam II**			**Homework**	
Name of the Lesson / *Student ID*	Subject 1	Subject 2	Subject 3	Subject 4	Subject 5	Subject 6	Subject 7	Subject 8
Student 1	X					X		X
Student 2			X		X		X	
Student 3		X			X			X
Student 4	X			X				X
Student 5	X				X			X
Student …								

“The Étude Requirement Determination Form” demonstrated in Table 3 will be individually filled in for each class and for each lesson of the classes.

The names of the class and the lesson concerned are written on the Étude Requirement Determination Form. The names of the subjects within the scope of the first exam, the second exam, and the homework pertaining to that lesson are written in the line containing the name of the lesson. The subject columns can be multiplied depending on the circumstance. The numbers of all students who attend the relevant lesson are listed in ascending order in the class whose name is written in the first column which contains students’ numbers. The line of each student in the column which contains students’ numbers gives information on the deficient knowledge of that student about the subjects regarding the exams and the homework pertaining to that lesson. “X” indicates the deficient knowledge of the student in the same line about the subject in the same column. When determining the étude requirements, an étude class is created only for the students who have deficient knowledge about the relevant subject (who are marked with ‘X’).

An Étude Requirement Determination Form can be applied for every lesson and for every class. The person responsible for this form is the branch teacher of that lesson. He/she will mark the shortcoming of every student in the exams and homework regarding the lesson for which he/she is responsible. In this way, the students with

deficient knowledge on the same subject will be subjected to an étude about that subject. The student with no deficient knowledge on the subject will not need to attend that étude. As a result of this, there will be no waste of time for the student who has understood the subject (since he/she will not attend that étude) or for the relevant teacher (since he/she will teach the subject only to the students who need it). Furthermore, because the student who has understood the subject will not be provided with any documents like tests regarding that subject, the waste of materials/documents will disappear too. The waste of energy due to the unnecessary transportation and the unnecessary action resulting from the fact that the relevant teacher teaches a lesson to the student who has understood the subject and brings documents to him/her will be eliminated as well.

The Pull System: The documents provided in études like tests are stored in one area. At the beginning of the academic year, specific numbers of documents about every subject are bought and kept waiting in this area. This procedure leads to a waste of space, for it creates inventories. The steps below will be followed in order to eliminate this waste of inventories in the educational institution.

- Determination of the subject to be taught in the étude
- Determination of the number of students to attend the étude
- Placing of orders to the publishing house before the date of the étude
- Collection of the deliveries before the étude hour on the day of the étude

When the above-mentioned steps are followed, the pull system will be implemented as required by the philosophy of just-in-time production. In this way, the waste of inventories will disappear.

Customer satisfaction: One of the most important principles of lean philosophy is customer satisfaction. “The Student Satisfaction Questionnaire” provided in Table 4 will be used to quantify the productivity of études.

Table 4: The Student Satisfaction Questionnaire

Name of the Lesson					
Name of the Subject					
Name of the Teacher					
EVALUATIONS	***1***	***2***	***3***	***4***	***5***
The teacher comes to the lesson in prepared state					
An adequate number of documents are provided					
Quality of the documents					

Use of a comprehensible language while teaching the lesson					
The ability of the teacher to teach the subject					
The degree of the étude to eliminate the deficient knowledge about the subject					
Recommendations					

"The Student Satisfaction Questionnaire" shown in Table 4 is used to quantify the satisfaction of students with the étude performed. Information about the performance of a teacher in the étude lesson is also obtained upon the evaluation of the questionnaire. The names of the lesson, the subject and the teacher pertaining to the étude performed are written in the first 3 lines of Table 4. The student is expected to give points regarding the six evaluation subjects contained in the part of evaluations. "1" represents the minimum point, whereas "5" represents the maximum point. With the evaluation of the student satisfaction questionnaire, satisfaction is quantified and improvements are made concerning the deficient aspects.

5. Conclusion and Future Work

The lean education system performed for a private Anatolian High School in İstanbul is discussed in this study. The studies to make the educational institution lean and the implementation of the lean tools of Process Improvement and Just-in-Time Production performed to be a beginning for "the Lean Education Model" to be created are also elaborated. Within this scope, the waste in the process was revealed by analyzing "the Étude Determination Process". The principles of Just-in-Time Production – part of Lean Thinking – were used to eliminate the waste. In addition, also by using the principles of customer-orientedness and customer satisfaction in lean thinking, the non-value added activities were eliminated, thereby enhancing quality.

As a result of the improvement made, it will be ensured that the information on the deficient lessons and subjects of all students, the current states of students and their development can be followed better, that the opinions of students about études and the teacher will be obtained, that the étude performance of teachers will be evaluated, that the unnecessary inventories resulting from the unplanned use of documents like tests will be eliminated, and that quality and hence success will be increased.

References

TOKCAN, T.(2011). "*Süreç yönetimi ve süreç iyileştirme teknikleri gıda işletmesinde bir uygulama",* Unpublished Master's Thesis, Dokuz Eylül University Graduate School of Social Sciences Department of Business Administration Production Management Program, İzmir.

WISNER J.D., STANLEY L.L., (2008), "Process Management: Creating Value Along the Supply Chain;

Text&Cases", Thomson – South-Western, printed in USA, ISBN-10: 0324291574, ISBN-13: 978-0324291575

PALVARINI B., QUEZADO C., (2013), "Process Management: A ResultOriented Approach", Vertsys, 1st Edition, Brasil

BRUIJN H.D., HEUVELHOF E.T., (2010), "Process Management: Why Project Management Fails in Complex Decision Making Processes", Springer Berlin Heidelberg

BOUTROS T., PURDIE T., (2014), "The Process Improvement Handbook, A Blueprint for Managing Change and Increasing Organizational Performance", McGraw Hill Education, printed in USA, ISBN-10: 0071817662, ISBN-13: 978-0071817660

MADISON D., (2005), "Process Mapping, Process Improvement and Process Management: A Practical Guide to Enhancing Work and Information Flow", Paton Press LLC, printed in USA, ISBN-10: 1932828044, ISBN-13: 978-1932828047

DAMIJ N., DAMIJ T., (2014), "Process Management: A Multi-disciplinary Guide to Theory, Modeling, and Methodology", Springer-Verlag Berlin Heidelberg,

JESTON J., NELIS J., (2008), "Management by Process: A roadmap to sustainable Business Process Management", Elsevier (Butterworth-Heinemann), printed and bound in Hungary, Print ISBN-10: 0750687614, Print ISBN-13: 978-0750687614

WOMACK J. P., JONES D.T., (2012), "Yalın Düşünce", Yalın Enstitü, Optimist Yayınları, İstanbul, in Turkish (2003 orjinal baskının 2012 çevrimi)

AKDENIZ C., (2015), "Lean Management Explained", Best Business Books, printed in Germany, ISBN-10: 1505866928, ISBN-13: 978-1505866926

BORTOLOTTI, T., STEFANIA, B., PAMELA, D. (2014). "Successful lean implementation: organizational culture and soft lean practices", *Int. J. Production Economics pp. 182-208.*

SIMONS, P. A. M., HOUBEN, R., VLAYEN, A., HELLINGS, J., PIJLS-JOHANNESMA, M., MARNEFFE, W., VANDIJCK, D. (2014). Does lean management improve patient safety culture? An extensive evaluation of safety culture in a radiotherapy institute, *European Journal of Oncology Nursing pp.29-37.*

COCHRAN D., EVERSHEIM W., and CUBIN G., "The Application of axiomatic design and Lean Management Principles in the Scope of Production System", Int J Prod. Res. Journal.,vol.38 no.6,pp.1376-1396 2000.

CHARRON R., HARRINGTON H.J., VOEHL F., WIGGIN H., (2015), "The Lean Management Systems Handbook", CRC Press, Taylor&Francis Group,

LIKER J.K., (2004), "The Toyota Way: 14 Management Principles from the World's Greatest Manufacturer", McGraw-Hill, printed in USA, ISBN-10: 0071392319 ISBN-13: 978-0071392310

MANN D., (2015), "Creating A Lean Culture: Tools to Sustain Lean Conversions", CRC Press, Taylor & Francis Group, Third Edition, Boca Raton, ISBN-13:978-1-4822-4323-9

BALLÉ M., BALLÉ F., (2009), "The Lean Manager: A Novel of Lean Transformation", Lean Enterprise Institute Inc., Cambridge, ISBN: 978-1-934109-31-1

GEORGE M.L., ROWLANDS D., PRICE M., MAXEY J, (2005), “The Lean Six Sigma Pocket Toolbook: A Quick Reference Guide to Nearly 100 Tools for improving Process Quality, Speed, and Complexity”, George Group, The McGraw-Hill Companies, ISBN: 978-0-07-150573-4

AMASAKA, K. (2014). New JIT, new management technology principle: surpassing JIT, *CENTERIS 2014, ProjMAN 2014, HCIST 2014 Procedia Technology 16, pp.1135-1145.*

FLUMERFELT S., SOMA P., (2012), “Lean Essential for Schools: Transforming the way we do business”, Charactership Lean Publishing Inc., Destin, FL, ISBN/10: 0988244500, ISBN-13: 978-0-9882445-0-4

EMILIANI B., (2013), “The Lean Professor: Become a Better Teacher Using Lean Principles and Practices”, The CLBM, LLC, second edition, printed in Westerfield/Connecticut/USA, ISBN-13: 978-0-9845400-8-2

MARTIN, S., GARNER, W., AROKIAM, I., WILSON, I.(2012). Coventry University Business Improvement Training(CUBIT) The application of lean thinking within the UK university sector, Coventry, http://www.stuni.com/training.html (availability, March 2015)

BENNER, M.J., TUSHMAN, M.L.(2003). Exploitation, exploration, and process management: the productivity dilemma revisited, *The Academy of Management Review, vol.28, no.2, pp.238-256.*

MARTINEZ-JURADO, P. J., MOYANO-FUENTES, J. (2013). Lean management, supply chain management and sustainability: a literature review, *Journal of Cleaner Production, pp. 134-150.*

OZDEMIR, A. I., TEKOĞLU, K. (2011). “Yalın üretimin hizmet sektöründe uygulanabilirliğinin incelenmesi: dershanecilikte yalın etüt sistemi model önerisi”, *XI. Üretim Araştırmaları Sempozyumu,* Istanbul.

UNAL, S. (2007). “*Tam zamanında üretim”,* Unpublished Master’s Thesis T.C. Istanbul Commerce University Social Science Department, İstanbul.

ALCARAZ, J. L. G., MALDONADO, A. A., INIESTA, A. A., ROBLES, G. C., HERNANDEZ, G. A.(2014). A systematic review/survey for JIT implementation: Mexican maquiladoras as case study, *Computers in Industry 65, pp.761-773.*

DUGGAN K.J., (2013), “Creating Mixed Model Value Streams: Practical Lean Techniques for Building to Demand”, CRC Press, Taylor & Francis Group, Second Edition, printed in USA, ISBN-10: 1439868433 ISBN-13: 978-1439868430

TAYLOR R., (2013), “5S: Workplace Organization and Process Design Using Lean 5S (Management Training Brief)”, ASIN: B00CO9G3O2.

ZISKOVSKY B., ZISKOVSKY J., (2011), “Optimizing Student Learning: A Lean Systems Approach to Improving K-12 Education”, American Society for Quality, Quality Press, Milwaukee, printed in USA, ISBN-10: 0873897994 ISBN-13: 978-0873897990

BALZER W. K., (2010), “Lean Higher Education: Increasing the Value and Performance of University Processes”, CRC Press, Taylor & Francis Group, printed in USA, ISBN-10: 1439814651 ISBN-13: 978-1439814659

WATERBURY T., (2011), “Educational Lean for Higher Education: theory and practice”, lulu.com, printed in USA, ISBN-10: 1257074636 ISBN-13: 978-1257074631

FLUMMERFELT S. R., (2012), “Lean Essentials For School Leaders”, Charactership Lean Publishing Inc., ISBN-10: 0988244519 ISBN-13: 978-0988244511

EMILIANI M.L., (2004), “Improving Business School Courses by Applying Lean Principles and Practices”, Quality Assurance in Education, Volume 12, Number 4, pp:175-187 http://ideaedu.org/sites/default/files/Emiliani%5B1%5D.pdf (availability in March 2015)