

ARTIGO <https://doi.org/10.22481/praxisedu.v15i36.5956>**ADAPTATION OF LEAN PRODUCTION TOOLS TO EDUCATIONAL ACTIVITIES
OF UNIVERSITIES**ADAPTACIÓN DE HERRAMIENTAS DE PRODUCCIÓN AJUSTADA A LAS
ACTIVIDADES EDUCATIVAS DE LAS UNIVERSIDADESADAPTAÇÃO DE FERRAMENTAS DE PRODUÇÃO ENXUTA ÀS ATIVIDADES
EDUCACIONAIS DAS UNIVERSIDADES*Svetlana A. Kucheryavenko*

Belgorod State University – Russia

Irina V. Chistnikova

Belgorod State University – Russia

Boris A. Thorikov

Belgorod State University – Russia

Anastasia N. Nazarova

Belgorod State University – Russia

Abstract: The use of lean technologies can improve the quality of services and the efficiency of available resource spending, stimulate the development of the country economy and improve the living standards of the population. Authorities pay particular attention to the modernization of higher education. In this regard, it is advisable to introduce lean technologies in the educational process of higher educational institutions, which will allow us to identify and develop the ability of these structures to self-development not only due to the influx of information and external finances, but through the use of their internal sources. The introduction of lean production principles in the activities of universities can help increase the efficiency of the educational process and their competitiveness. Based on this, the article discusses the process of lean manufacturing tool introduction into educational activities. An attempt is made to analyze comparatively lean manufacturing tools and the possibility of their application in the educational activities of the university. The article emphasizes that the replication of existing experience of lean manufacturing tool implementation will ensure a steady growth of key performance indicators and will allow the formation of a sustainable lean model of population behavior based on the popularization of the culture of “thrift” among students.

Keywords: Lean manufacturing; Lean manufacturing tools; Lean thinking; Lean technology; 5S system.

Resumen: El uso de tecnologías lean puede mejorar la calidad de los servicios y la eficiencia del gasto en recursos disponibles, estimular el desarrollo de la economía del país y mejorar el nivel de vida de la población. Las autoridades prestan especial atención a la modernización de la educación superior. En este sentido, es aconsejable introducir tecnologías lean en el proceso educativo de las instituciones de educación superior, lo que nos permitirá identificar y desarrollar la capacidad de estas estructuras para el autodesarrollo no solo debido a la entrada de información y las finanzas externas, sino a través del uso de sus fuentes internas. La introducción de principios de producción ajustada en las actividades de las universidades puede ayudar a aumentar la eficiencia del proceso educativo y su competitividad. Basado en esto, el artículo discute el proceso de introducción de herramientas de manufactura esbelta en actividades educativas. Se intenta analizar herramientas de fabricación comparativamente esbeltas y la posibilidad de su aplicación en las actividades educativas de la universidad. El artículo enfatiza que la replicación de la experiencia existente en la implementación de herramientas de manufactura esbelta asegurará un crecimiento constante de los indicadores clave de desempeño y permitirá la formación de un modelo lean sostenible de comportamiento poblacional basado en la popularización de la cultura del "ahorro" entre los estudiantes.

Palabras clave: Manufactura esbelta; Herramientas de fabricación esbelta; Pensamiento esbelto; Tecnología esbelta; Sistema 5S.

Resumo: O uso de tecnologias enxutas pode melhorar a qualidade dos serviços e a eficiência dos gastos com recursos disponíveis, estimular o desenvolvimento da economia do país e melhorar o padrão de vida da população. As autoridades prestam especial atenção à modernização do ensino superior. Nesse sentido, é aconselhável introduzir tecnologias enxutas no processo educacional das instituições de ensino superior, o que nos permitirá identificar e desenvolver a capacidade dessas estruturas de auto-desenvolvimento, não apenas devido ao influxo de informações e finanças externas, mas através do uso de suas fontes internas. A introdução de princípios de produção enxuta nas atividades das universidades pode ajudar a aumentar a eficiência do processo educacional e sua competitividade. Com base nisso, o artigo discute o processo de introdução de ferramentas de manufatura enxuta nas atividades educacionais. É feita uma tentativa de analisar ferramentas de manufatura comparativamente enxutas e a possibilidade de sua aplicação nas atividades educacionais da universidade. O artigo enfatiza que a replicação da experiência existente na implementação de ferramentas de manufatura enxuta garantirá um crescimento constante dos principais indicadores de desempenho e permitirá a formação de um modelo enxuto sustentável de comportamento da população com base na popularização da cultura de economia entre os estudantes.

Palavras-chave: Manufatura enxuta; Ferramentas de manufatura enxuta; Pensamento enxuto; Tecnologia enxuta; Sistema 5S.

Introduction

In modern realities, a course has been taken towards the development of a lean production system in Russia. This applies to such areas as public administration, education, medicine, public transport, the activities of service and industrial enterprises, etc. The use of lean technologies in these areas will improve the quality of the services provided and the

efficiency of available resource spending, stimulate the development of the country economy and improve the living standards of the population.

Authorities pay particular attention to the modernization of higher education. During the economic crisis, the main problem of its development is most sharply - the lack of funding. As a rule, the lack or absence of financial resources is the main reason for the shortage of qualified personnel, new educational technologies, and modern equipment of educational institutions. In this regard, it is considered advisable to introduce lean technologies in the educational process of higher education institutions, which will help to identify and develop the ability of these structures to self-development not only due to the influx of information and external finances, but through the use of their internal sources.

The lean manufacturing philosophy develops the university ability to continuous self-improvement and innovation, providing a systematic approach to university value increase for consumers, which are students, employees and external partners.

It should be noted that in modern conditions, "lean education" can become common with the effective implementation of lean manufacturing tools aimed at internal reserve determination, elimination and prevention of certain types of losses.

The active implementation of lean manufacturing concept, based on a constant desire to eliminate all types of losses, required changes to the lean process control system at the university.

Study methods and materials

The works in the field of lean manufacturing were used as the materials for the study as well as the experience of lean manufacturing tool use in the educational activities of universities, the "Lean University" project developed at the Belgorod State National Research University.

The comparative analysis method examined the possibility of lean manufacturing tool use in the educational activities of the university.

The ranking method was used to establish the level of compliance and adaptability of lean manufacturing tools to the education sector.

The tabular method is used to characterize lean manufacturing tools and the possibility of their use at a university, as well as to present the methodology for 5S system implementation at the department.

Study results

The achievement of quality goals is possible using certain tools. When you choose tools and lean manufacturing methods, you must be guided by the following principles:

- leadership development at each level of process management;
- the heads of the university structural units should develop long-term and short-term strategies, using the information received from the faculty and students;
- each leader is responsible for the results of their own projects.

It is important to note that the use of lean manufacturing tools is primarily aimed at education quality improvement. It should be evaluated at all levels, and the results obtained should be felt by all participants of the educational process.

The university must have clear guidelines and rules for each group of participants. At the same time, it is necessary to ensure their close interconnection and mutual assistance. Certain standards of key quality parameters should be developed to attract all university employees to the implementation of the concept.

In the framework of the concept of thrift, there is a lot of tools and methods that can be adapted to the field of education. In table 1, the authors attempted the comparative analysis of lean manufacturing tools and the possibility of their use in the educational activities of the university. The color highlights the tools, ranked by the level of compliance and adaptability to the field of education, based on the analysis of the studied sources (from largest to smallest).

The table shows and characterizes almost all the tools of lean manufacturing that are often used in production activities. At the same time, the authors indicated the possibility of one or another tool use at higher educational institutions. The level of adaptation was determined on the basis of its characteristics and the frequency of implementation in educational institutions and the materials of scientists published earlier.

The tools under consideration will contribute not only to the project goal achievement, but also, thanks to their synthesis, will allow to identify and eliminate imperfect areas in the educational process that were not noted during its development.

The use of lean manufacturing technologies in higher education is possible in the following areas:

- the development of a modern integrated concept of lean manufacturing in higher education;

- the development of educational infrastructure, and technologies to involve students in the educational process, regional training systems, retraining and advanced training of staff, as well as incentive systems for faculty during lean technology use;
- the development of a sustainable lean model of population behavior based on the popularization of “thrift” culture among students;
- the development of information educational space, the choice of parameters for educational process development based on the principles of thrift;
- a synergistic approach introduction to lean technology management using various tools and methods.

Table 1. Characteristics of lean manufacturing tools and the possibility of their use at a university *

Nº	Name	Characteristic	Possibility of application at a university
	5S system (proper organization of a workplace)	<p>5S - five Japanese words or 5 Steps. The interpretation of these steps is given below:</p> <ul style="list-style-type: none"> - Seiri “sorting” (necessary-unnecessary) - a clear separation of things into necessary and unnecessary and getting rid of the latter - Seiton “keeping order” (accuracy) - an ordered and accurate location and storage of necessary things, which allows you to find and use them quickly and easily. - Seiso “cleanliness” (cleaning) - maintenance of the workplace clean and tidy - Seiketsu "standardization" (the establishment of norms and rules) is a necessary condition for the implementation of the first three rules. - Sitsuke “improvement (literal translation - education)” (self-discipline) - the development of accurate fulfilling habit concerning established rules, procedures and technological operations. 	Possible, since 5S is a workplace improvement technique that will improve the quality of the workflow by unnecessary movement number reduction.
	Continuous Flow (elimination of losses in the process)	The development of production flows in an optimal way. The process, built correctly, does not imply filling the "buffer" and any	Possible. The greatest efficiency of this need implementation is achieved by organizing a continuous flow of teacher

		<p>long stops between the stages of production.</p> <p>Allows you to eliminate such losses as ill-conceived transportation, excessive stocks, and waste of time.</p>	<p>training. It is in the process of the initial "product" (learner) promotion. A certain value is added to it in the stream in the form of new knowledge and skill obtaining. The task of the educational process organizer is to ensure uniform and continuous flow movement.</p>
	<p>Gemba (battlefield - the involvement of a leader in the production process)</p>	<p>The development of understanding that all the most important happens during production, and not in the offices of management.</p> <p>The management is involved in the production process, which helps to strengthen discipline, reduce the reaction time to emerging problems and receive information from the source.</p>	<p>Possible. In managerial practice, Gemba is characterized by scrupulousness, well-thought-out actions, a clear focus on the goal. Each of its steps is regulated in detail, and in the case of strict adherence to instructions in the hands of the head, it turns into a guaranteed tool for entrusted unit activity improvement.</p>
	<p>Hoshin Kanri (Policy development - improvement of link between strategy and tactics)</p>	<p>Development of a link between "strategy" and "tactics": management objectives with the actions of production representatives.</p> <p>Management sets goals for each of the employees, they are moving in this direction.</p> <p>Adequate communication between management and workers can reduce losses.</p>	<p>Possible. The implementation of this tool allows you to plan, set and communicate the goals of the university to the performers and carry out an operational analysis of the tool, which ensures coordination of all actions aimed at correctly formulated strategic goal achievement.</p>
	<p>Kaizen (continuous improvement - synergistic effect from the combined efforts of all employees)</p>	<p>The use of kaizen tools is the combination of efforts of all employees in the direction of a special corporate culture development and the achievement of common goals.</p> <p>The synergistic effect of combining the efforts of employees aimed at cost reduction becomes, per se, the "perpetual motion machine" of lean production progression at an enterprise.</p>	<p>Possible. It involves the introduction during joint activities of the university leadership, faculty and students. The Kaizen philosophy carries the idea that our life as a whole (labor, social and personal) should be focused on continuous improvement. At the same time, educational activity itself should follow the path of improvement.</p>
	<p>JIT, Just in time</p>	<p>The production and delivery system are based on production of product volume necessary for a client at a given time. At the same time, projected demand is practically not taken into account. It requires such systems as Continuous Flow, Kanban, Takt time, and Heijunka.</p>	<p>Possible. In the context under consideration, the use of this tool means that when you plan the implementation of the educational program it is necessary to provide the conditions for students to enter universities from secondary vocational schools.</p>

		This method is most effective when it is necessary to reduce the number of manufactured products, the stocks of raw materials and the size of the production room. It contributes to the optimization of financial flows.	Here the thing is about the need for development of coordinated curricula of secondary vocational education and higher professional education in the same areas of training.
	Kanban (Extraction System)	It regulates the flows of manufactured products and raw materials inside and outside production. The need for components or finished products is determined by signal cards. The amount of losses and surplus stocks is reduced. It makes a positive effect on the results of inventory in a warehouse.	Possible. In the process of training, this tool means training the right number of experts demanded by an employer. The reverse action leads to unnecessary budget spending.
	KPI (Key Performance Indicators)	The metric system is used to analyze priority segments of the company. It is a powerful growth promoter for employees. Key indicators that employees can change make it possible to identify potential losses and risks timely and achieve the strategic goals set for the company.	Possible. The KPI system is designed to improve the quality of business processes, increase the efficiency of staff regardless of their position and profession, and to increase job payment satisfaction due to the remuneration system. The effectiveness of this system depends on the competent development, implementation and subsequent debugging of these indicators.
	Muda (Losses - getting rid of everything that is not valuable to a client)	Getting rid of everything that does not represent value for the customer (consumer). Having learned all the possible types of losses, they should be detected and minimized in a timely manner, improving the quality of work of personnel, equipment and the organization as a whole.	Possible. Identification of areas that cause losses in the field of education and their competent and timely elimination will contribute to education quality improvement at a university.
	PDCA (Plan-Do-Check-Act - allows you to find a systematic approach to problem solution, implement improvements and conduct experiments)	Iterative method that allows you to implement all sorts of improvements and/or make changes: - Plan (create a detailed plan) - Do (plan implementation) - Check (achievement control) - Act (review of actions taken in terms of effectiveness, the development of more productive actions if necessary). PDA allows you to find a systematic approach to problem	Possible. It is proved that the use of this tool, which is the technology for continuous improvement of processes, a universal method for problem solution, can be applied in any field of activity, including higher education.

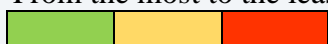
		<p>solution, implement improvements and conduct experiments:</p> <ul style="list-style-type: none"> - Plan (putting forward of hypothesis) - Do (putting hypotheses into practice) - Check (assessment of action effectiveness) - Act (introduction of changes, new attempt). 	
	Poka-Yoke (Error protection, Fool protection - creating the methods to prevent errors in the process)	<p>Creation of the methods which prevent errors in the production process. The main goal is to achieve "0% of defectiveness". The costs associated with the prevention of errors are significantly lower than those incurred by a company during regular inspections, and even more so when you correct a defect revealed after a long time.</p>	<p>Possible. The "Bye Yoke" tool (avoiding mistakes) allows you to achieve the required level of knowledge assimilation. The essence of the "error protection" for a student is the assimilation of the necessary minimum amount of content to continue learning. In practice, the implementation of this tool consists of mandatory intermediate and final testing by the basic basic disciplines of the educational program.</p>
	Analysis of problem root causes	<p>Identification of negative factors is carried out on the principle of "five why". That is, you need to ask the question "Why?" at least 5 times in relation to each factor that negatively affects production.</p>	<p>Possible. The use of the tool in educational activities will eliminate the main causes of problems and avoid similar situations in the future.</p>
	Visual Factory (Visualization of processes - each employee understands the current situation, relying on information system data (color, sound and other signals))	<p>Simple indicators are used. With their help, information is exchanged. Each employee understands the current situation, relying on information system data (color, sound and other signals).</p>	<p>Possible. The visualization tool allows you to structure the learning process optimally. Graphic planning procedures (graphs, tables, drawings, etc.) help to present any process (including educational) in a comprehensive manner.</p>
	Standardized work - the instructions for a particular operation performance close to perfect	<p>Instructions for a certain operation execution close to perfect. This document is constantly reviewed and updated. If a company has the same equipment, it should work according to a single standardized method (optimal). Maximum efficiency is achieved by using interactive documents, which can be quickly modified and supplemented. It helps to reduce losses (due to the application of only the best</p>	<p>Possible. The main goal of standardization in training is to create the conditions which ensure the effectiveness and efficiency of training, control over the formation of general and professional competencies among students.</p>

		experience), the risks of low-quality product development are reduced.	
	SMART (Smart Goals)	<p>This abbreviation contains the following words: Specific, Measurable, Attainable, Relevant, and Time-Specific. In the Russian version, it sounds like this: the goal is specific, measurable, achievable, relevant, defined in time.</p> <p>With poorly thought out communication or an erroneous understanding of tasks, losses will occur inevitably. The correct goal will allow to eliminate this problem correctly.</p>	Possible. The use of SMART goals in education allows not only to formulate the expected learning outcomes, but also to identify in detail the means of their control and assessment by searching for the answers to questions for each goal.
	Andon (timely troubleshooting)	<p>The system that immediately informs of a problem that arose during the production process and allows you to stop the process until the detected defect has become widespread.</p> <p>It eliminates problems in a timely manner and prevents future waste of resources on elimination the consequences of errors in a global scale.</p>	Possible. With the existence of an effective system for education quality monitoring and the involvement of artificial intelligence, it is possible to use the tool.
	Heijunka (planning without unnecessary stocks, without unnecessary actions)	<p>The ability to plan orders in a special way. Customer orders are divided into several small batches, which are arranged in a certain order. There is an opportunity to produce different products as quickly as possible and reduce the likelihood of production process disruption risks at different stages and the failure of a finished product transfer terms to a customer.</p> <p>This lean tool leads to the fact that the need to have a stock of materials and production time is reduced. It allows you to reduce losses due to the fact that each type of product is manufactured more often, and stocks (in other words, frozen assets) are reduced to the necessary minimum.</p> <p>When the line is forced to stop, an enterprise has all the products necessary for a client.</p>	Possible, however, the mechanism of this tool use will differ significantly from that used in the educational process of enterprises.
	TPM (General service of	The lean manufacturing method, the essence of which is to attract	It is possible not directly in the educational process, but in the

equipment (processes) - to involve each employee in the maintenance of equipment (processes)	every employee of a company to the equipment maintenance, and not just technicians. The goal of TRM is to increase the life of equipment and its effectiveness.	areas where it is necessary to reduce the number of downtime, the errors of working with equipment, accidents, and to increase the sense of responsibility for each employee.
<p>SMED (Fast process readjustment)</p>	<p>The set of tools manufacturing, based on the principles of lean manufacturing, allowing the debugging of equipment much faster (up to 10 minutes). The readjustment is carried out on the basis of two actions: internal and external. Internal actions involve stopping the equipment, while external actions can be performed while the device is running. The SMED technique involves the conversion of actions from internal to external.</p> <p>It is becoming easier to produce small batches of products, the useful life of the equipment is increased.</p>	<p>It is possible not directly in the educational process, but in the areas where standardization of university employee actions is necessary, which ensures the reduction of re-adjustment, transshipment, and equipment reconfiguration time.</p>
<p>Bottleneck analysis, improvement of the weakest elements</p>	<p>Finding a "narrow" place of production ("bottleneck"), which does not allow you to create more products in less time. The expansion of the "bottleneck" improves productivity and the output of production facilities.</p>	<p>Possible. The increase of shortcoming complexity and scale in the development of the education system and their untimely elimination leads to the accumulation of bottlenecks and their transformation into problem situations, and then into the problems that can be resolved only on the basis of innovative solutions and new technologies. Using the tool will allow to detect bottlenecks and prevent problems in time.</p>
<p>Jidoka (autonomy of equipment (processes) - there is a possibility not to stop all processes in case of failure</p>	<p>The equipment is subject to partial automation. The search for the problem occurs automatically. It is possible to stop production when an error is detected. One employee can control the operation of several devices at once. This leads to lower production costs, and also minimizes the cost of error elimination (compared with the situation if they were not detected immediately, but only at the end of the production cycle).</p>	<p>Possible. Using the tool will reduce the cost of educational and methodological activity provision and improve the quality and effectiveness of this area.</p>

	<p>OEE (Overall Equipment Effectiveness, Total Efficiency - allows you to track three types of losses: quality, availability, performance)</p>	<p>It allows you to track three types of losses related to the operation of equipment: quality, availability, performance. Allows you to understand the level of equipment operation efficiency. This is a balanced indicator that allows you to increase the profitability of production and improve its manufacturability. If OEE reaches 100%, it means that the company produces a product without defects, as quickly as possible, taking into account the available technologies, avoiding downtime.</p>	<p>It is possible not directly in the educational process, but in the areas where it is necessary to identify losses and causes of equipment inefficiency.</p>
	<p>VSM (Value Stream Mapping, a map of the stream for value development - a tool that allows you to separate the processes that add value, from those which not add it visually)</p>	<p>The Lin tool, which allows you to clearly distinguish between the processes that add value, from those that do not add value. This tool is a convenient solution for planning changes that are planned later.</p>	<p>Possible. Mapping the value stream is a fairly simple and intuitive graphic diagram depicting the material and information flows necessary to provide a product or a service (educational service) to the end consumer (a student). The value development stream flow chart allows you to see the bottlenecks of the stream immediately and, based on its analysis, identify all unproductive costs and processes, develop an improvement plan.</p>

* From the most to the least adapted lean manufacturing tool



The use of lean manufacturing tools in the design and implementation of the educational process can prevent the occurrence of many losses and open up reserves to increase the efficiency of educational activities (Davydova, 2015). Identified losses in educational activities are shown on Figure 1.



Лишние движения - Unnecessary movements / Избыточные запасы - Excess stocks / Ожидание - Expectation / Дефекты - Defects / Потери творческого потенциала - Loss of creativity potential / Перепроизводство - Overproduction / Чрезмерная обработка - Excessive processing / Закупка избыточного количества учебной литературы, компьютеров, затраты на аудиторный фонд - The purchase of excess teaching materials, computers, the cost of the classroom fund / Недостаточная материально-техническая база, необходимость аренды зданий и помещений для практических и лабораторных занятий - Insufficient material and technical base, the need to rent buildings and premises for practical and laboratory studies / Снижение качества подготовки специалистов из-за несовершенной системы контроля сформированности компетенций - Decrease expert training quality due to an imperfect control system for the formation of competencies / Виды потерь и источники их возникновения в образовательной деятельности - Types of losses and the sources of their occurrence in educational activities / Нерациональное составление расписания занятий, невозможность замены преподавателя по причине его болезни - Irrational scheduling of classes, the inability to replace a teacher due to his illness / Излишняя загруженность ППС различными видами работ - Excessive workload of teaching staff with various types of work / Обучение невостребованного работодателем специалиста - An unclaimed expert training / Наличие в учебном плане дисциплин, которые не формируют необходимых компетенций - The presence of disciplines in a curriculum that do not form the necessary competencies.

Fig. 1. Losses in educational activity

The losses shown on the figure are typical for the activities of almost every educational institution in the Russian Federation. Their presence indicates an insufficient level of efficiency of the entire national education system.

To reduce the risk of loss in question, it is advisable for educational institutions to perform lean training. “Lean learning” is such an organization of the educational process, during which the losses that affect the effectiveness of training in education are eliminated.

Ideally, to optimize the education system, it is necessary to eliminate all types of losses. The introduction of the abovementioned lean manufacturing tools adapted to the higher education system can help.

The use of tools at the level of a separate structural unit (an institute) can become successful only with the full involvement of all its employees, especially the faculty of the departments. Understanding the problems of lean manufacturing tool introduction associated with a certain institutional “trap” expressed in inertia within the educational environment, tired of the permanent reforms of higher education, and as a result, meeting any changes with passive aggression, they developed 5S system implementation methodology. This technique is presented in table 2.

The important procedures are the preparatory phase, scanning the department, sorting and removing unnecessary, rational location and determination of boundaries, cleaning with simultaneous verification, standardization and exchange of information, and the maintenance and improvement of the progress.

Table 2. The methodology of “5S” system implementation at the department (B.A. Thorikov, V.M. Zakharov, 2019)

Step	Performed measures	Implementation terms	Persons in charge
1	2	3	4
1. Preparation			
1.1. Determination of a project leader for the implementation of 5S system	The leader of the project for the implementation of the 5S system is the head of the department.	3 - 5 days	Head of Department
1.2. Determination of Target Zones	It is necessary to identify individual areas within the department, requiring change. After identifying all the individual zones and determining their main functions, it is necessary to prioritize the implementation of elements of the 5S system.	During one week	Office areas for the implementation of the 5S system are determined by the head of the department
1.3. Implementation team development	The main implementation team is the project leader and responsible staff of the department. They are responsible	No more than one week	Head of Department

	for implementing the 5S system up to the stage of “Progress maintenance and improvement”.		
1.4. Training of employees responsible for the implementation of the 5S system	The goal of the step is to provide the department staff with knowledge, skills and the right approach for the successful implementation of the 5S system The main tasks for the implementation of the step: - Create a training deployment plan; - Introduction of a training plan; Newly hired employees must undergo individual training.	1 day	Head of Department
2. Department scanning			
2.1. Collection of initial data. Photo report of current conditions	The photo report should contain the pictures of open drawers, cabinets, etc. Recorded views should be above and below, this will allow you to see something new. Photographing should be carried out in several iterations to show how the situation is changing in the areas of the department with the gradual introduction of the 5S system, and updated pictures should be posted on the stand.	1 day	Core implementation on team
2.2. Filling in a checklist for office scanning	Carrying out the diagnostics of conditions at the department with filling out a checklist. It is necessary to implement this in each target zone and calculate the results. To see the improvements, you need to re-diagnose.	1 day	Core implementation on team
2.3. Creation of information stand project	An information stand must be created after the actual implementation of the previous steps. The stand should visually display the description, concept, process or implementation plan of a project. In a logical sequence, it represents all the actions that have already been taken, and which still need to be implemented to achieve the goal. The stand displays the results of the "5S" system implementation.	Within one day after the implementation of the previous steps of steps 2.1 and 2.2	Core implementation on team
3. Sorting and deletion of unnecessary			
3.1 Definition of criteria for sorting	Definition of guidelines and standards by which sorting will be carried out. The main tasks for the implementation of the step: - Development of a standard operating procedure for sorting; - Development of a sort control sheet form	1-7 days, depending on the size of a target area	Core implementation on team
3.2. Preparation of the temporary storage area	Provision of division employees with sorting standards. Temporary storage areas are the places for temporary storage of unnecessary items in the target zone until they are identified where they are needed or disposed of. When a need arises, such items are returned to their place. A temporary storage zone is created for each target zone. If a unit is large, you can organize a central temporary storage area for the entire department. The presence of such zones allows the sorting in “5S”.	During one week	Core implementation on team, together with all employees of the target zone
3.3. Sorting	Sorting is carried out in accordance with the developed sorting standard, in which they recommend to include the following sections (reporting forms): - “A list of tasks to be solved by sorting”; - “Checklist for the further use of items”; - “Red Labels” (identification of items that most likely do not require storage at the department	In two weeks	The main implementation on team, together with all employees of the target zone

4. Rational location and definition of boundaries			
4.1. Creation of a current state map for a target zone	<p>Interviewing unit employees and sketching a map to get a complete picture of space use.</p> <p>The main activities at this step:</p> <ul style="list-style-type: none"> - It is necessary to determine which part of the department to map; - Draw the contours of the target area; - It is necessary to display the contours of the entire room of the department (doors, walkways, show the sectors of door opening by dashed lines) - Mark large items. On an approximate scale it is necessary to map large elements of furniture and equipment. First, it is better to depict the outer borders of each element and identify it; - Mark small items; - Mark working areas; - Depict the flows of movement of employees, documents. Arrows must show the direction of movement of employees and objects. If possible, specify the distance and means of transportation. At the same time, it is necessary to determine the distance of transitions and movements in the target zone; - Mark all the important elements (tables, equipment, bookshelves, etc.); - Note important problems and facts with yellow cards. <p>Using map data, bottlenecks can be detected for further improvements.</p>	In one day	Core implementation on team
4.2. Development of a rational layout plan	<p>The main tasks for the step implementation:</p> <ol style="list-style-type: none"> 1. Consideration of possible rational arrangement tools. All rational location tools are aimed at ensuring the following principles: to find the best place for every thing in the department, to provide easy search, use, an easy way to return to the place. 2. Select problems or problem areas for improvement. 3. Define criteria and principles for further guidance. 4. Prepare a map of the future state (plan). The map of the future state shows the target zone after the implementation of the improvements made at the rationalization stage. 	During one day together with the previous step.	Core implementation on team
4.3. Rational arrangement performance	<p>At this step they perform:</p> <ol style="list-style-type: none"> 1. Verification of the rational location plan, where a map of the future state and the rational location plan is considered 2. Move items to the place where they belong, incl. documents. 3. To make the position of objects in selected places obvious. 	No more than three weeks	Core implementation on team, together with the employees of the target zone
5. Cleaning while checking			
5.1. Cleaning criterion definition	<p>Starting cleaning, the team should determine the main areas of work. In the process of cleaning, sorting and rational arrangement are carried out simultaneously.</p> <p>The main activities at this step:</p> <ul style="list-style-type: none"> - Development of a standard operating procedure. This step considers initial cleaning and inspection; - Development of a checklist with criteria. 	No more than three days	Core implementation on team, together with the staff of the department

5.2. Development and implementation of a cleaning plan	The task of the unit employees, together with the implementation team, is to clean the target area based on the developed plan. During the initial cleaning, everything is cleaned and, as far as possible, approaches the initial state of the target area.	No more than one week	Core implementation team, together with the staff of the department
6. Standardization and data exchange			
6.1. Development and implementation of standards for the implementation of each element of the 5S system, ensuring perfect condition	<p>Performed activities:</p> <ol style="list-style-type: none"> 1. Preparation of a map of the target zone final state. A map is created in order to show the standard, the correct position of the main elements in the target area. The department map must be placed in a conspicuous place inside the room to determine the correct location of objects. 2. Distribution of responsibilities according to the first three steps of the 5S system. All employees must know and fulfill their responsibilities to maintain the first three steps of the 5S system at the department. It is necessary to distribute these responsibilities among the employees of the target zone. It is necessary to develop and use the form as a checklist to verify the fulfillment of these responsibilities. 3. Integration of the first three steps of the 5S system into daily activities. 4. Introduction of offline service. 5. Implementation of other standards. 	During four weeks	Core implementation team, together with the staff of the department
6.2. Introduce visual management (Visual control is the ability to control “at a glance” or through “visualization”)	<p>The main activities at this step:</p> <ol style="list-style-type: none"> 1. Identify control points where control is applied. Dots are associated with standards, making it easy to identify them. If you have standards, you can create standard categories that apply to the target area. 2. Introduce visual display means. 	Within one month	Core implementation team, together with the employees of the target zone
7. Progress maintenance and improvement			
7.1. Make 5S system a habit	<p>The main activities at this step:</p> <ol style="list-style-type: none"> 1. To make the “5S” system a part of daily activity, which is not an additional load, but an integral part of the work of each employee. 2. Arrange management inspections. 3. Conduct the audits of the 5S system on a schedule or on a regular basis by the heads of departments. 4. To support the exchange of experience during implementation and improvement of 5S system between departments. 	Full time	All employees of the department
7.2. Continuation of improvements	<p>Activities for the implementation of the step:</p> <ol style="list-style-type: none"> 1. Leadership support provision, which consists in full participation of university leadership at all stages of 5S system implementation. 2. Application of a systematic approach to improvement. If similar problems repeatedly occur while improving the implementation process of the 5S system, it is necessary to study them more carefully and develop a unified approach to eliminate them. 	Full time	All participants of “5S” system implementation process

	<p>The application of a systematic approach implies a systematic improvement process, which includes six tasks:</p> <ol style="list-style-type: none"> 1. Identify and select a problem; 2. Analyze a problem; prepare possible solutions; 3. Select the necessary solutions and plan their implementation; 4. Implement decisions; 5. Assess the implementation of decisions and standardize the progress; 6. To reward and acknowledge the merits of employees for participation in the development of 5S system at the department. 		
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The introduction of this methodology will improve the quality of the workflow of employees by reducing the number of unnecessary movements.

Conclusions

Duplication of existing experience and the introduction of the concept of thrift in the educational process will help to achieve even greater effectiveness of educational activities. This will require the solution of specific problems, such as the value creation stream optimization in the educational process, standardizing and visualizing the educational process, improving the material and technical base, organizing workplaces for professors and teaching staff according to the 5S methodology and, of course, creating a culture of lean thinking among students, teachers, employees and experts in educational and methodical work.

Summary

The use of lean manufacturing tools in the educational activities of universities will create the conditions for ensuring the effectiveness of training, monitoring the formation of general and professional competencies, as well as for optimizing the educational process, and eliminating possible risks.

We hope that the material presented will contribute to the development and formation of “lean thinking,” both at our institute and will be useful for replicating experience at other universities.

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SOBRE OS AUTORES:**Svetlana A. Kucheryavenko**

Belgorod State University, Russia, Pobedy Street, Belgorod, 308000, Russia. Email: kucheryavenko_s@bsu.edu.ru

 <http://orcid.org/0000-0002-7954-8970>

Irina V. Chistnikova

Belgorod State University, Russia, Pobedy Street, Belgorod, 308000, Russia. Email: chistnikova@bsu.edu.ru

 <http://orcid.org/0000-0002-2233-3231>

Boris A. Thorikov

Belgorod State University, Russia, Pobedy Street, Belgorod, 308000, Russia. Email: info@ores.su

 <http://orcid.org/0000-0002-0899-8990>

Anastasia N. Nazarova

Belgorod State University, Russia, Pobedy Street, Belgorod, 308000, Russia. Email: nazarova_a@bsu.edu.ru

 <http://orcid.org/0000-0003-4455-8631>

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