Chapter 9 Design and implementation of a comprehensive program for innovation in training processes in an automotive company

Capítulo 9 Diseño e implementación de un programa integral para la innovación en los procesos de capacitación en una empresa automotriz

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Introduction

Abstract

The work presents the implementation of a comprehensive training project (PIC), for an automotive industry company (EAP), which was designed and developed by academic staff of the Industrial Processes and Operations (IPOI) of the Universidad Tecnológica de Huejotzingo (UTH). These results come from the implementation of the project executed during two years of work between company and University, the previous stages were: 1). Identification and development of labor competencies for the operating personnel of a CNC[11] and improvement of the individual work role, and 2). Evaluation of operational personnel through the design and application of evaluation instruments by competencies.

The study is qualitative, exploratory and descriptive, since in the third stage the case described for this work was developed; the results achieved were, courses designed and taught, trained personnel and the hours of training, which allowed to prepare the operators of the EAP according to their needs. The innovation in the UTH was directly reflected in the methodology designed by the participating academics in the project, who gained experience in the teaching-learning processes for the industry. For the EAP, the innovation was carried out for the training process with the implementation of the PIC, which once approved was given in two phases: in the first one, all the personnel who were working in the plant participated and in the second, the personnel in the process of being recruited, in such a way that approval is currently required to be part of the EAP.

Comprehensive Plan, Training, Labor Competencies

Problem

On the part of the UTH a working group of four IPOI career researchers was integrated, who were responsible for carrying out the visits to the company (on which the case study was made), to carry out the analysis of the Training needs, on the other hand, those responsible for the project on the part of the company expressed the importance of having technical staff with the level of competencies appropriate to each of their jobs, in addition to problem solving and decision making during the development of their work. The above has as its final objective that in the long term the company has technicians certified by labor competences in the operation of machines and management of the production process in its different areas.

However, to achieve this, in a first stage the job competencies of the jobs were identified, so a pilot study of the model change in a CNC grinding machine was carried out in Perez, De Ita, Velázquez and Fernández (2016), the results achieved are described and an approximation of the integral training plan was proposed. During stage 2, Perez, Merino, Ordaz and Tlapale (2017) described the results achieved with the proposal of the evaluation instruments developed and applied to technical personnel, taking into account the different levels of competence defined and validated by the company, as well as as the integral training plan endorsed during this stage. Derived from the results of the previous projects, the UTH developed the PIC, according to the needs of the specific labor competencies of the company. Case study.

It should be considered that the processes in each area are different, however the competencies that technicians must possess coincide in most of the jobs, which is why this project describes the process for the design, development and execution of a plan that integrates the training for technical personnel of the EAP.To carry out the development of the PIC, a General objective and four specific objectives were established, which were the areas on which the research.

General Objective

Design a PIC by means of the application of a diagnosis of needs to the different areas of the company, for innovation in the training processes in the EAP.

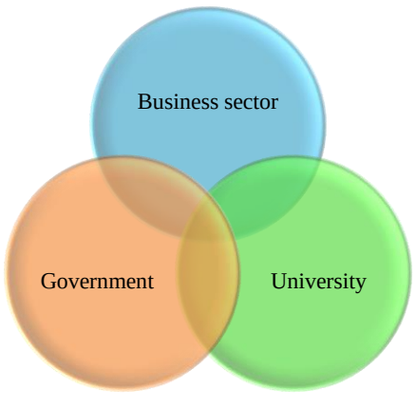
[11] CNC: computerized numeric control

Particular objectives

- Perform the diagnosis to detect training needs for technical personnel.
- Integra a team of work on the part of the UTH.
- Design the training courses that make up the training plan.
- Implement the training program.

The case study developed is important, because like all Technological Universities in the country, the UTH is based on the triple helix model, which implies the search of the link between disciplines and knowledge, where the university It has a strategic role and is the basis for generating relations between the company and government, as shown in Figure 9.1.

Figure 9.1 Triple helix model



Source: Own Development, from Etkowiz and Leydesforff, 2000

The triple helix model assumes that higher education has to respond appropriately to the nature of the work it does in the face of the new contexts presented by the globalization of markets, as well as the transfer of knowledge and technologies between countries (Etkowiz y Leydesforff, 2000).

Most universities are training professionals, although there is little interaction and linkage with the needs that the labor market requires; but in the particular case of the Technological Universities (UT's), these are born linked to the productive sector, therefore, one of its tasks is to seek the approach with the companies, where it is allowed to transfer the knowledge generated in the university to the practical field, through the development of projects that directly impact the company, but that in turn bring professional and economic benefits to the University.

Therefore, the training program that was worked for the EAP takes special relevance for the UTH, because it is presented as a case where tacitly meets the established by the model of the triple helix, but also with the mission and vision of the university, due to the fact that a close collaboration relationship arose between the company and institution where the University, can develop a scaffolding for the application of knowledge from the experience of teachers to transfer them to the company, and for its part, the company was involved in improving its processes as a form of innovation in the training programs for operating personnel, eliminating old practices in favor of continuous improvement.

Theoretical Framework

For the purposes of the research, a literature review was conducted that provided the theoretical basis for conceptualizing business innovation, labor competencies and methodologies for the development of business training programs, as well as tools to improve and control the process. What facilitated the direction in the design of the comprehensive training plan.

Innovation concept

Del Rey and Laviña (2008, p.23) from Oslo (2005), take up the concept of innovation of an organization as "the introduction of a new organizational method in the practices, the organization, the workplace or the company's external relations".

Coronado, Oropeza and Rico (2005), mention that in the theory of the solution of problems of inventiveness (TRIZ, for its acronym in Russian), five levels of innovation are defined:

- Level 1: Standard call, there is a simple solution to a conventional problem that anyone close to the situation can solve.
- Level 2: An existing systems and processes are improvements, for the solution to the problems apply known methods and principles within the industry, however the level of knowledge is more specialized than the previous level.
- Level 3: It is an invention by methods known outside the industry. Solutions are found more in science than in technology.
- Level 4. It is an innovation that requires a change of paradigm to create a system or technological process and the solution requires a new principle to perform the primary functions of the system.
- Level 5: These are scientific discoveries and pioneering inventions of a new system or process. The problem and solution are outside the limits of the science of the moment. Additionally it is about improvements in the practices of the organization.

For the case study of the EAP, the innovation focuses on level two, since it is an improvement to the process with a level of knowledge that is not of competence in the company and therefore required specialized knowledge in engineering issues, professional education and business training.

Approaches to the concept of competences

In relation to Ramírez (2012, p.85), "competences are a set of knowledge, skills and attitudes that are in constant change that are transferable and developed based on experience and that allow the individual to react, manage and act with relevance in complex and contextualized situations". However, this concept is quite general when you want to land in other fields as it happens when you must make your transfer to the workplace, because in relation to the skills that a person must have in a specific professional field whatever it may be; industrial, commercial or service there are many demands on different aspects, both individually and personally as well as socially and professionally, so it is very important to identify the specific competences of the area that is going to be addressed. For the particular case that concerns us, the competences should be studied from what is required in the workplace, in this sense in Mexico, both the Mexican Institute of competitiveness (IMCO), and the National Council for Standardization and Certification (CONOCER)), refer to the competencies that individuals must possess for the development of specific activities.

The CONOCER (2009) defines a competence as the productive capacity of an individual, who is defined and measured in terms of performance in a specific work context, not only knowledge, skills, abilities and attitudes; these are necessary but not sufficient by themselves for effective performance. The standard of competence: are the knowledge, skills, skills and attitudes required for a person to perform any productive, social or government activity, with a high performance level, defined by the sectors themselves.

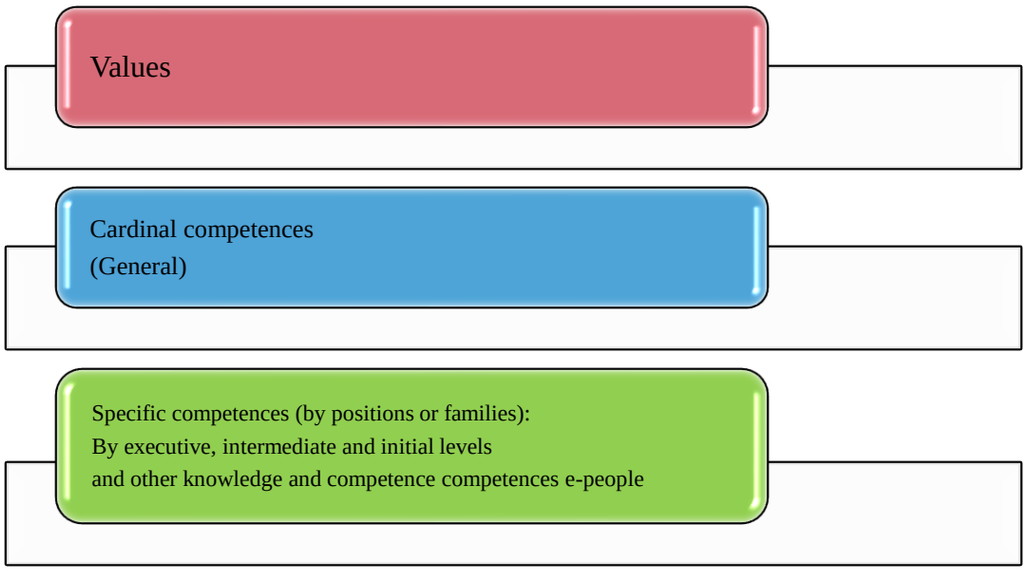
In the Mexican model, the competence issue is recent, in other latitudes, the term has a history of several decades, mainly in countries such as England, the United States, Germany, and Australia, the competences appear related in the first instance to the productive processes in companies, particularly in the technological field where the development of knowledge has been very accelerated, therefore the need to train personnel on a continuous basis, regardless of previous degree, diploma or work experience, was presented. (Huerta, Pérez y Castellanos, 2000, en Rodríguez, 2006).

The professional competences according to Flores (2007, in Echeverría, 2002), mention that they are the sum of four components; the subjects know (technical competence), know how to do (methodological competence), know how to be (personal competence) and know how to be (participative competence).

For the International Labor Office on the development of human resources and training, competences include: knowledge, professional skills and technical expertise that are applied and mastered in a given context (Vargas, 2004).

But, at present, it is necessary to develop specific competences in any area of knowledge, considering the specific function as it happens in the case of technical competences, see figure 9.2.

Figure 9.2 Specific competences



Source: Adapted from Alles, 2005

Therefore according to Alles (2005, p.161) "each company according to its reality and considering its own mission and vision can describe their competences and their respective levels, in the way that best represents the feeling and the needs of that particular organization". For purposes of the EAP in which the project was developed once the diagnosis was concluded, the specific technical competences were defined as follows:

The Generic Competence is defined as "Managing the online production of CNC grinding, ensuring the quality of the process and the product in the set-up and operation to contribute to the competitiveness of the company" (Pérez, et al 2016, p.), likewise, two learning units were defined:

1. Execute the change of model based on the technical specifications of the process and product, to reduce the variation in production, as well as comply with the production plan.
2. Conduct series production according to the production plan to meet customer's volume and specifications.[12]

In order to develop competences, it is important that companies provide personnel with the necessary means and information to achieve this, so one way to carry it out is through training. Which, viewed from different authors, can be defined as: "One of the key functions of the management and development of personnel in organizations, and therefore must operate in an integrated manner with the rest of the functions of this system. The above means both disciplines must be understood as a whole, in which the different functions -including training- interact to improve the performance of people and the efficiency of the organization" (Guglielmetti, p. 9 en Hidalgo y Jara, 1998).

[12] The process to carry out the development of the specific technical competences in the EAP of the case that is presented, is described in its entirety in the research entitled "Study of the change of machine model (Diskus) of the pilot project of certification in competences to the technicians of an autoparts company, "published in the ECORFAN Journal of Technology and Innovation, Bolivia, March 2016. Vol III. No.6 P. 46-59.

Another author mentions that "It consists of a planned activity based on real needs of a company or organization and oriented towards a change in the knowledge, skills and attitudes of the collaborator" (Silíceo, 2004, p.25). For Dessler (2001, p.49), "Training refers to the methods used to provide new and current employees with the skills they need to perform their job"

The Secretariat of Labor and Social Welfare (STPS), in Mexico, defines training as the detailed description of a set of instruction-learning activities structured in such a way that they lead to reaching a series of previously defined objectives (STPS, 2008). In relation to the provisions of the STPS, for the design of training courses should be considered: the writing of objectives, structuring of content, instructional activities, selection of teaching resources and evaluation. From the theoretical review of training concepts, you get the guidelines that companies must follow to implement a training program.

Business training: According to the concepts reviewed, the ones that most closely approximate the work carried out in the EAP are those proposed by Alles (2005) and Dessler (2001), from which the adaptation was made to carry out the design of the project. PIC for the EAP. Dessler (2001), proposes five steps in the process of training and development. Figure 9.3 summarizes the execution process for the development of the PIC for the study company, which was taken as a reference by the academics participating in the project.

Figure 9.3 Training process

Source: Adapted from Dessler, (2001)

Based on the theoretical review, the purposes of the research, the characteristics of the company, and of course with the participation of the professors of the IPOI career, the courses were developed adhering to topics such as: teamwork, general knowledge of the product and process, as well as those focused on the management of technical documentation, so it is important to make a theoretical review of them, it is important to highlight that the definition of the courses[13] arise from the results presented in Pérez, et al., (2016) and Pérez et al., (2017).

[13] The development of the courses is a work that was published in its entirety in the article entitled "Desing of evaluation instruments by competences for operative personnel of an autparts Company" published in Journals-Marcoenomics and Monetary economy, ECORFAN, Taiwan, July-December 2017 Vol I. No.6, P. 10-17., And in the article "Study of the change of model of machine (Diskus) of the pilot project of certification in competitions to the technicians of a company of autopartes", published in the Journal of technology and innovation ECORFAN, Bolivia, March 2016. Vol III. No.6 P. 46-59.

Theoretical support of product knowledge and process

To understand the type of courses focused on knowledge of the product and process, part of the concept of productivity is defined as "the ability to generate results using certain resources. It is increased by maximizing results and / or optimizing resources "(Gutiérrez and De La Vara, 2009, p.7). Therefore, it is important to know the critical and variable characteristics of the product and process to be controlled, as well as the causes of variation, which, according to Besterfield (2009), mentions that variation is present in every process due to the combination of factors such as equipment, material, work method, environment, as well as by the operator; who carries out quality inspections and their criteria may vary slightly from one to the other despite having quality standards.

Therefore, it is important to know the critical and variable characteristics of the product and process to be controlled, as well as the causes of variation, which, according to Besterfield (2009), mentions that variation is present in every process due to the combination of factors such as equipment, material, work method, environment, as well as by the operator; who carries out quality inspections and their criteria may vary slightly from one to the other despite having quality standards. The above is related to a good administration of operations and according to Krajewski (2008), two principles must be considered: The first refers to the fact that each of the areas of an organization, including the design and operations of the processes, are part of the value chain and problems of quality, technology and personnel must be solved. The second principle considers that each part of an organization has its own identity; which must be connected with the operations.

Theoretical support for the handling of technical documentation

For purposes of the second group of courses that is aimed at the management of technical documentation, based on the principles proposed by Krajewski (2008), some of the Core Tools were considered, such as the AMEF (Analysis of the mode and effect of process failure).), which allows to find the potential failure modes of the product and the process before they are produced and avoid economic losses (Alcalaide, Diego and Artacho, 2006).

Another important tool that must be understood to ensure compliance with the required quality specifications is the management of the control plans that can be applied to a group of products, which allows a dimensional description, measurement methods, materials, and tests of the function that must occur during the construction of the prototype and production process (Thisse, 2014). Having described the above, it is important that technicians identify the tolerances of the product to be manufactured, which, according to Gieseck and Frederick (2006), is defined as the total amount that a specific dimension can vary, since greater precision implies a high cost, it is advisable to define the most adequate tolerance that allows the satisfactory functioning of the part to be produced, assigning the one in which two corresponding parts can be adjusted to each other.

This allows to control the flow of production, through the management of technical documentation in the company, allowing to ensure the continuous flow of materials to produce products in its different variants: model, color, size, own specifications of each client, so that it is important to exercise control in batches as they go through the different processes (Riggs, 2010). Regarding the inventory management Villaseñor and Galindo (2007), explain that the identification of raw material inventory allows to reduce their levels and facilitates the management thereof, so the efficient handling of travel cards is of utmost importance, Platas and Valencia (2014), consider the traveling card as an instruction label also called Kanban according to the Japanese word, it contains information that serves as a work order, allows information to be given to the production area about what is going to be produced , in what quantity and the handling of materials to be mobilized. For the efficient management of the technical documentation of companies, they use information systems such as SAP and ERP, which allows the management of information and processes concentrated in different modules (Regalado, 2016).

Theoretical support for social competences

Finally, for the development of social competences, the analysis of theories of teamwork, high performance teams (HPT) and emotional intelligence is made. Katzenbach and Smith (2006) consider that an HPT is one in which a small group of members who are highly committed to each other, with well-defined functions, possess characteristics and skills necessary to achieve objectives.

Therefore, it is important to develop teaching-learning methods that allow reaching the social competences of the personnel involved. Additionally, the commitment and participation of senior executives is necessary, since it contributes to EARs achieving the goals defined by the organization. For Blanchard, Randolph and Grazier (2006), these teams must develop high levels of trust between them, clarify limits to create freedom of action responsibly and develop self-management skills for decision making. Regarding emotional intelligence from the point of view of Goleman (2008), highlights the self-control, enthusiasm, empathy, perseverance and self-motivation as part of a genetic baggage that can be part of the person, but other times can be molded and modified during life. Evidence supported by abundant research shows that emotional skills are susceptible to be learned and perfected throughout life if they use the appropriate methods. Bradberry and Greaves (2012), emphasize that emotional intelligence requires effective communication between the rational and emotional brain, is something that is in each of us, is intangible and influences the way we manage our behavior, as well as overcome complexities social and make decisions that allow positive results.

Methodology

The study presented is considered qualitative according to Denzin and Lincoln:

> *"Qualitative research is an activity that locates the observer in the world. It consists of a set of interpretative practices that make the world visible. These practices transform the world, turn it into a series of representations, which include field notes, interviews, conversations, photographs, registers and memories. At this level, qualitative research implies an interpretative and naturalistic approach to the world. This means that qualitative researchers study things in their natural context, trying to make sense or interpret phenomena according to the meanings that people give them." (Denzin y Lincoln, 2005, p.3).*

The study is considered exploratory and descriptive because it was carried out through a diagnosis of the needs of the EAP, through semi-structured interviews, as well as competency assessments designed and applied to the technical staff during stage 2 of the project and whose results were presented in Pérez et al., (2017). This allowed the identification and description of the needs for the development of specific competences by knowledge areas and the identification of courses to be carried out. However, in stage 3 and with the previous results of the projects presented in Pérez et al., (2016) and Pérez et al., (2017), the company managers approved the types of courses to be carried out with the priority themes , the hours required in each of them, where the EPIO academics presented the final proposal, classifying them as administrative and technical within the PIC, so for purposes of this case study in table 9.1 the categories defined are shown.

Table 9.1 Definition of training categories

Objective of study	Training categories	Description	Classification
Design a comprehensive training program through a needs assessment that allows innovation to this key process for the EAP.	Course definition	Grouping of knowledge according to the competences that technicians must possess.	− Type of courses − Average hour per course
	Course design	It refers to the specialist in the area that intervened in the development of each course.	− Number of IPOI teachers who participated. − Average hours for the design and development of the course.
	Administrative courses	It is related to the courses designed to achieve the specific social competences established by the company	− Number. of administrative courses
	Operative courses	It refers to technical competences in the management of production processes	− Number of technical documentation management courses − Number of general knowledge courses

Source: Self Made, 2018

Regarding the development of the case study, the techniques used for the collection of information were:

- Direct observation: for the identification of the production processes in the areas of columns, machining and pressing, since observation was necessary to verify the execution of the tasks.
- Unstructured interview with technicians, heads of area and the head of human resources in the EAP.
- Evaluations to the technical personnel of the machining area; which allowed to evaluate the level of competence through the evaluation instruments by competences.

The instruments used in the case of observation were: field notes, video recording and technical documentation provided by the company. For the unstructured interview, direct questions were asked to the technical and managerial staff. For the evaluation of competences, the instruments used were: checklists, rubrics, technical knowledge exams, observation guides. Table 9.2 summarizes the techniques and instruments used.

Table 9.2 Techniques and instruments of the study

Technique	Instruments	Participating	personnel Purpose
Direct observation	Field notes, video recording Technical documentation of the company	Technical staff	Identify and validate the execution of the production process.
Unstructured interview	Direct questions	Technical staff, heads of area, head of Human Resources.	Collect information on the management of technical documentation on the floor.
Staff evaluations	Checklists, rubrics, technical knowledge exams and observation guides.	Technical staff	To identify the level of competence in the execution and management of the production process.

Source: Self Made from Palella and Martins 2006

Population and sample

To determine the training needs of the study population; all the technicians of the EAP were considered, for purposes of presenting this case study the sample includes only the courses designed and applied by teachers in the area of Engineering in Processes and Industrial Operations (EPIO).

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Materials: technical documentation, videos, recordings of the interviews.

Development of the study case

This section describes the stages that were carried out for the PIC.

Stages of the process for the design of the comprehensive training program

Based on the diagnosis made with the techniques and instruments used in Pérez et al., (2017), as well as those applied in table 9.2, they allowed to set the pattern for the design of the PIC. Table 9.3 summarizes the stages developed by the UTH for the execution of the project based on Dessler's proposal (2001).

Table 9.3 Process for the design of the comprehensive training plan

Stages of the process of a training program (Dessler)	Stages of the training program process by UTH	Description
1. Analysis of training needs	a. Diagnosis and analysis of training needs	It was made from the following instruments: • Competency matrix defined in CNC grinding machine. • Evaluation of the competencies to develop measurable knowledge and performance objectives. • Presentation and approval of the proposal of the training plan before the company.
2. Construction design	b. Recruitment by UTH to design courses by area of expertise: (EPIO Mechanics (MEC) and Project Management (GP))	Approved comprehensive training plan Identify the specialist areas of UTH personnel for course design.
	c. Course design	Attending specifications of the company and the STPS.
3. Approval	d. Feedback and approval	Carried out by those responsible for the project in the company, and according to the needs by production area.
4. Apply training program	f. Programming courses during the authorized training period (dates, level, teachers)	Execution of the training program in 2016-2017
5. Evaluation and follow-up	h. Evaluation of each course, instructors and service provided	For each completed course the evaluation of the services to the client was carried out

Source: Self Made, 2018

Process for the design, development and application of the PIC: specific case of EPIO

The following describes the process for the design of the PIC, in which the teachers and researchers of the UTH EPIO race participated specifically.

1. Analysis of training needs

From the results in Pérez et. al., (2016) of the matrix of technical competences for the execution and release of the CNC grinding machine production process, the process for designing the technical competence matrix was explained, it was possible to identify the training needs. With the results of stage 1, evaluation tools were designed and applied for technical knowledge, management of technical documentation for the preparation and / or execution of the production process, release of the product, among others; these results were explained extensively in Pérez et al., (2017). Based on the knowledge that the technicians of the EAP had to possess and once the training needs were identified, knowledge and performance objectives were set to begin with the design corresponding to the training courses.

Derived from the training proposal corresponding to stage 2 in which 18 courses were presented, a review was made that allowed the managers of the different areas of production of the AEP to make the decision of the courses that would be developed and taught. by teachers, as well as the hours needed for training and the depth of the topics, with at the end being 13 courses for the PIC, summarized in table 9.4. However, due to confidentiality issues, the contents of each of these are not emphasized.

Table 9.4 Definition of courses and hours

No.	Course	Training hours per course	No.	Course	Training hours per course
1	Product knowledge	3	8	Measurement systems	10
2	Civil liability and critical characteristics	4	9	Problem solving	8
3	Control of nonconforming product	3	10	Management of quality systems TS 16949	8
4	Technical documentation	4	11	Industrial Security	12
5	Material handling	6	12	Interpretation of plans	
6	Statistical control of the process	10	13	High performance teams 1 and 2	12
7	Interpretation of plans	8			

Source: Self Made, 2018

2. Construction design

Recruitment by UTH to design courses by area of expertise: At this stage it was identified personnel UTH different careers: Industrial Processes and Operations (EPIO), Mechanical, Project Management and Administration, whose expertise and knowledge would contribute to the development of each course. Therefore, a matrix of instructors was integrated, indicating: names and area of the personnel to develop each course, the topic, the hours of duration of the course and the number of groups that would be trained in the first stage. Course design: The work methodology was very similar for the design of all the courses. So in this stage it was necessary that the company provide each responsible for the technical documentation of the processes. Table 9.5 summarizes the content considered general of the courses designed by the EPIO career.

Table 9.5 Content of training courses

Elements of the integral plan training courses	**Development of training program**	**Activities carried out by UTH**	**Example**
	Analysis of the course for specific design by area of knowledge.	The information was collected through unstructured interviews with the operating personnel, heads of areas, use of data recording formats, photography and videos of the process.	*Material tracking: handling of travel cards, contingency actions, data recording in the SAP system, among others.*
	Objective	Definidos por cada curso en colaboración con el personal de la EAP	Identify process materials for identification and control in inventory differences
	Content structuring	According to the skills and attitudes to acquire per course.	Traceability Contingency actions among others
	Instructional activities	Realized by the instructor and participants: dialogue-discussion, expository, role play.	Playful activities that allowed to identify the importance of the correct identification of materials.
	Selection of resources	According to the course, videos, practical activities, role plays are presented.	Design of the training manual, instructor's guide, Power point of each course.
	Performance tests per course	For all the courses designed a knowledge evaluation (Questionnaire) and in some cases observation guide.	Evaluation questionnaire with topics of each topic developed during the course.
	References	The necessary for each course by area of knowledge.	The necessary for each course by area of knowledge.

Source: Self Made. 2018

3. Feedback and approval

During the development of each of the courses, feedback meetings were held with the heads of the areas responsible for production of the EAP, who approved the topics addressed in each course and provided information on each of the processes involved, in such a way that the training allowed to cover their specific needs to the production areas. Apply the PIC: Since the validation of the comprehensive training plan in June 2016, the implementation of the plan began in August for all the technical staff of the EAP, which was carried out in stages:

- Stage 1: Called refresh or feedback to consolidate the knowledge of active technical staff. Approximately 340 people.
- Stage 2: This process is known as Onboarding, and staff were included in the selection process, who once they approved all the courses could end up with the hiring.

4. Evaluation

In each of the training services provided to the EAP, the UTH conducted a customer satisfaction survey that was conducted by the course participants. Table 9.6 shows the criteria used for the evaluation at the end of each of the services provided.

Table 9.6 Criteria evaluation of the satisfaction survey

Instructor	**Content of the course and activity dynamics**
Met the established schedule	The content of the participant's manual corresponds to the objectives of the course.
Clarified the objectives of the course from the beginning	
The order of the subjects provided in the manual followed	The participant manual facilitated the understanding of the topics
Demonstrated mastery of the issues	
Adequately used audiovisual resources.	The facilitator did exercise to fix and review concepts during the activity
Demonstrated ability to help me understand the issues	
He kept my interest and my desire to learn	Audiovisual resources facilitated the understanding of the themes
He answered my doubts with clarity and precision	
Demonstrated courtesy, impartiality and respect	
Generated participation and commitment	
He used practical examples related to the Company.	
Application	**Logistics and services**
This course helped me improve the knowledge required in my job	The arrangement of the room was comfortable for the activity
This course helped me improve the skills required in my job (If applicable)	Audiovisual resources worked correctly
I feel able to apply what I learned in my job	The coffee service and / or refreshments and / or lunch arrived in appropriate time and quality
I would recommend this course to other people	He received sufficient and timely information before attending the activity (time, place, topic, etc.)
Opinions and suggestions	
Evaluation level: 1 = Nothing, 2 = Little, 3 = Partially, 4 = Completely, 5 = Exceeded expectations	

Source: UTH. 2016

The results of the evaluations to the courses are shown in the results section in graphs 9.6 and 9.7. The follow-up actions to the PIC have not yet been evaluated, since at the date these results are presented, it is still applied for the new staff to the EAP.

Results

The results of the diagnosis of training needs was published in Pérez et. al., (2016 and 2017), both articles describe the competencies to be developed and the first approaches to the PIC for the EAP. What is shown for purposes of this final work are:

a. The integration of the work team part of the career of EPIO
b. The courses designed
c. The evaluation of the service provided with the implementation of the PIC.

Table 1 previously described that the grouping of the courses was classified as administrative and operational, finally approving a total of thirteen for their design, which account for 92 hours of training that each of the EAP technicians must receive and distributed on average between six and twelve hours per designed course and that are part of the PIC.

Table 9.7 Classification and total of courses designed by the UTH races

Classification of courses	Central topics	Number of courses designed	Career responsable	No. of courses
Administrative	Teamwork.	2	EPIO	1
			Psychopedagogical area	1
Operative	Decision making.	5	EPIO	4
			Metal Mechanics (MEC)	1
	General knowledge of the product and process	6	EPIO	4
			IPA (Engineering in Food Processes)	1
			Metal Mechanics (MEC)	1
Total courses				13

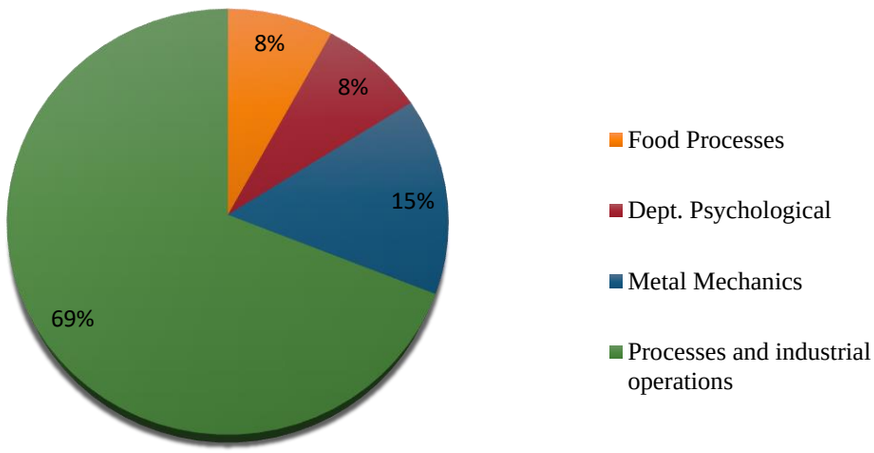
Source: Self Made, 2018

Table 9.7 summarizes the classification of the type of courses designed in total, of which 9 corresponds to the work done by the teachers of the EPIO career from the detection of needs, the career was responsible for designing an administrative course and 8 operations, corresponding to the handling of the technical documentation of the processes and general knowledge.

Design of the construction of the PIC

For this stage, the competences that the UTH researchers had to participate in the design of the PIC courses were considered. Regarding the career of EPIO, the selected personnel has experience in the industry, with the competences that the EPIO race demands, as well as those of teamwork, problem solving, responsibility, activity, among others. This was because it required working in the field to collect information to facilitate work for the development of the PIC. With reference to table 9.5, Graph 9.1 shows the percentage of courses designed by the participating UTH races.

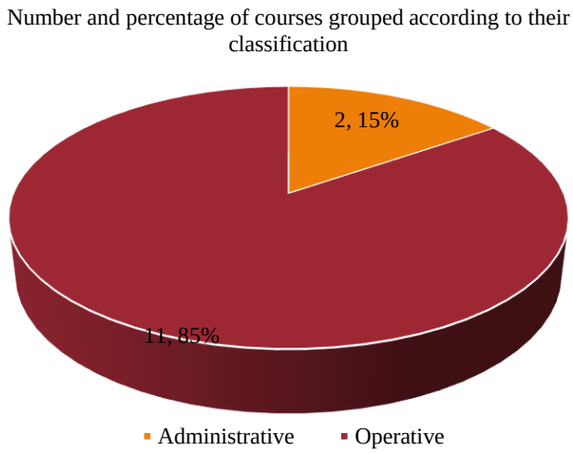
Graphic 9.1 Percentage of courses designed by career



Source: Self Made. 2018

With regard to the grouping of courses; 2 administrative offices were designed, corresponding to 15% of the total and 11 operatives for the management of technical documentation and general knowledge, representing 85%. The above confirms the importance of the proper management of documents for the management of the production process and that must be understood by all company personnel.

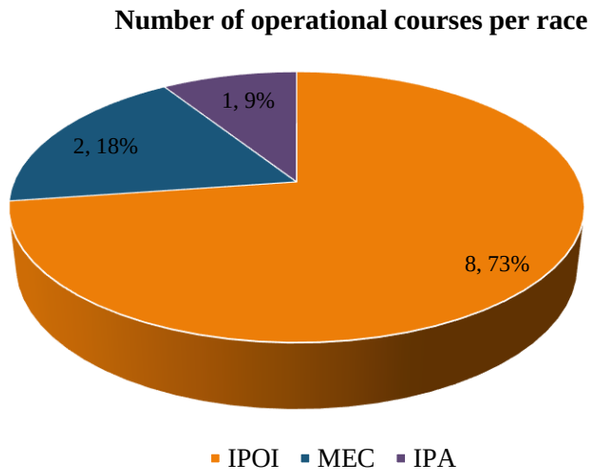
Graphic 9.2 Number and percentage of courses designed grouped by classification



Source: Self Made, 2018

With regard to the career of EPIO in Graphic 9.3, there is a higher percentage of participation for the design of the operational courses, with 8 courses designed, which represents 73% of the total participation with respect to Food process careers and Metal Mechanics. This is due to the fact that the EPIO teachers who collaborated in the project have professional training in the areas of Industrial Engineering, Industrial Mechanics, Electronics and Electricity. So their areas of knowledge are directly related to the production processes in the EAP.

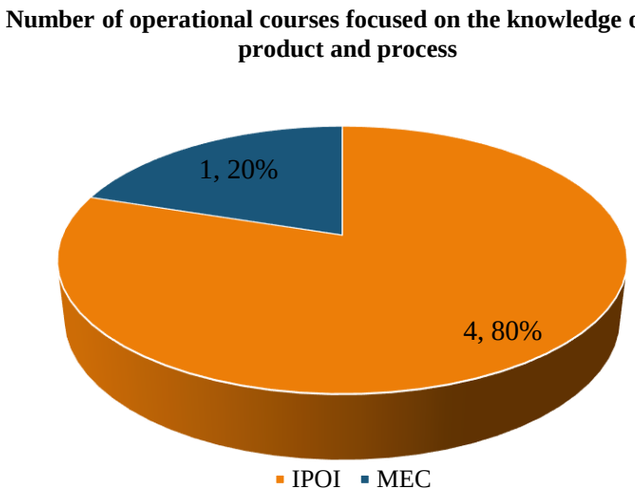
Graphic 9.3 Percentage of operational courses



Source: Self Made, 2018.

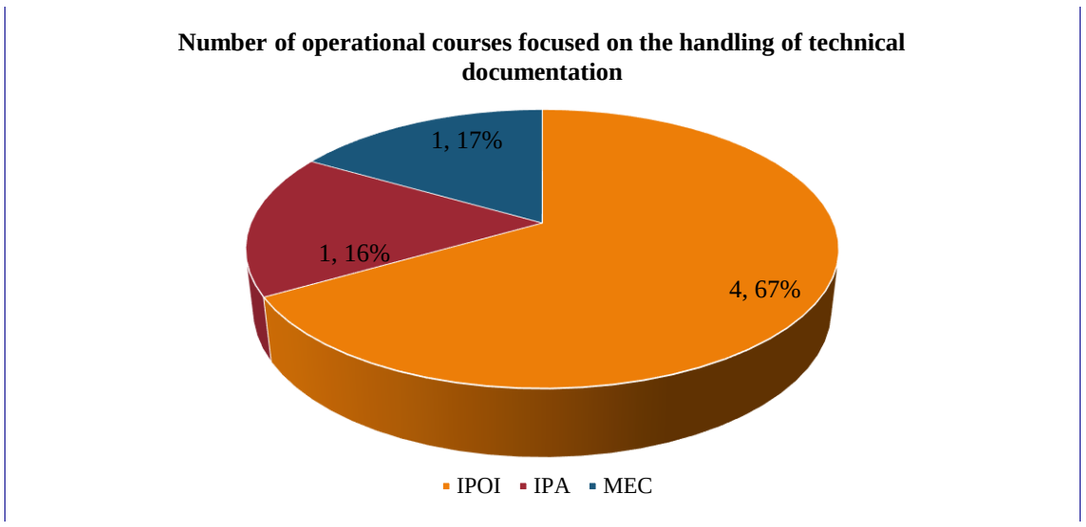
Finally, graphs 9.4 and 9.5 represent the number of operational courses for the management of technical documentation and general knowledge. Figure 9.4 again identifies that the participation of the EPIO career is 80% with 4 courses designed for the knowledge of the product and the process. Of the 6 courses designed for the management of the technical documentation of the company, the researchers of the career of EPIO carried out 4, which represents 67% of participation. It should be noted that for the design it was necessary to carry out field work in the company, since it was necessary to know the entire production process, as well as the management of technical documents of the EAP, and that are necessary to ensure that the products comply with the quality specifications, allowing the courses to be effective for the technical personnel participating in each of the trainings that would take place.

Graphic 9.4 Operational courses on product and process knowledge



Source: Self Made 2018

Graphic 9.5 Number of operational courses for handling technical documentation



Source: self made. 2018

Finally, for each of the courses designed for each of the races, the corresponding final products were delivered: Training manual, presentation in Power point of the course, instructor's guide, list of materials for the execution of the course; as it is the case of armored games, board games, instruction sheets of the activities to be developed by the participants, theoretical evaluations of the course, among other resources necessary to develop the PIC in a practical and effective way.

Approval

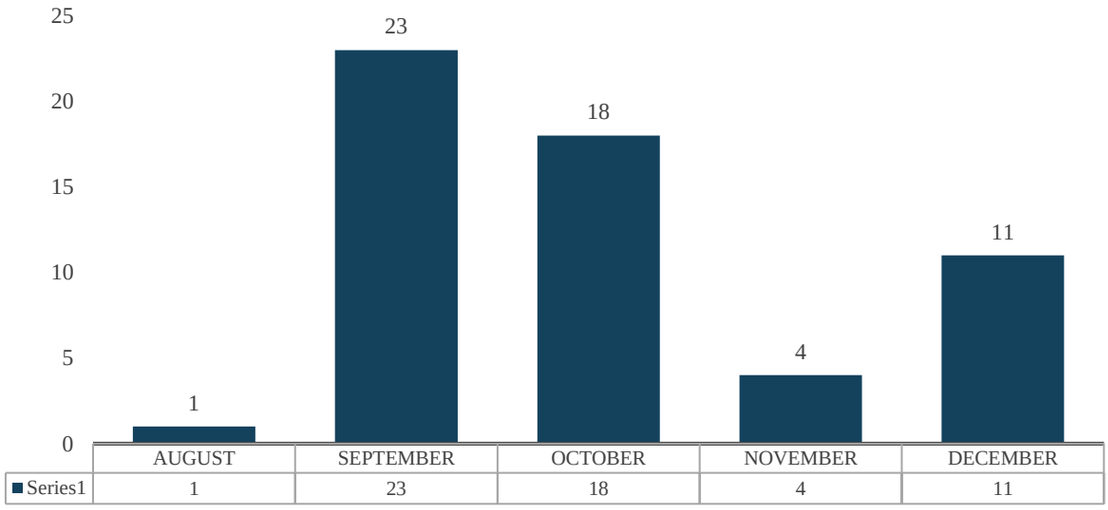
For the release of the content of each of the courses that make up the PIC, the teachers invested between 8 and 12 total hours for the project managers in the EAP to endorse them. The process consisted of scheduling visits to the EAP with the heads of the production areas involved so that the UTH researchers could explain the methodology of the courses, the thematic content, the teaching resources and the technical documents of the EAP to be managed in the training sessions, as well as the evaluation instruments were congruent with the objectives set for each of the courses.

The feedback sessions made it possible to clarify and share the necessary information among UTH researchers and those responsible in the company to strengthen the contents of each of the PIC courses to meet specific needs by production area. Once each PIC course was approved, the corresponding steps were taken between the Company and the University to carry out administrative procedures such as: confidentiality agreements, training scheduling, as well as payments to the University and when the agreements were concluded, the implementation of the PIC.

Application of the comprehensive training plan

The final stage began as of August 2016. Graphs 9.6 and 9.7 summarize the number of courses that were taught by the EPIO course, the number of services provided with the courses designed was 57 and during In 2017, 52 were taught, generating a total of 109 training courses given to operational personnel during the years 2016 and 2017 according to the needs of the company.

Graphic 9.6 Number of courses taught by EPIO in 2016

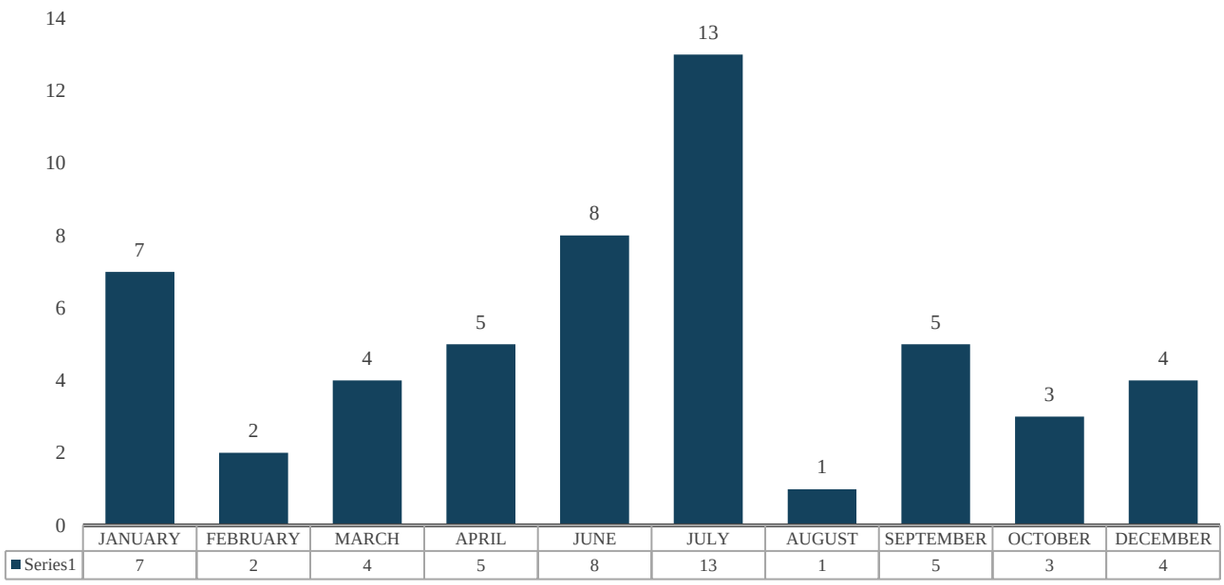


Source: Self Made. 2018

According to Graphic 9.7, the largest number of courses was given in September to cover the needs of the company according to the topics of the operational and administrative courses.

Graphic 9.7 shows the courses given by the EPIO race for 2017, corresponding to a total of 52. It should be mentioned that in the delivery of the training did not necessarily participate all the teachers who designed the course. So it was of great importance the design of the instructor's guide, whose objective was that regardless of who made it, another instructor could take charge of the delivery of the course.

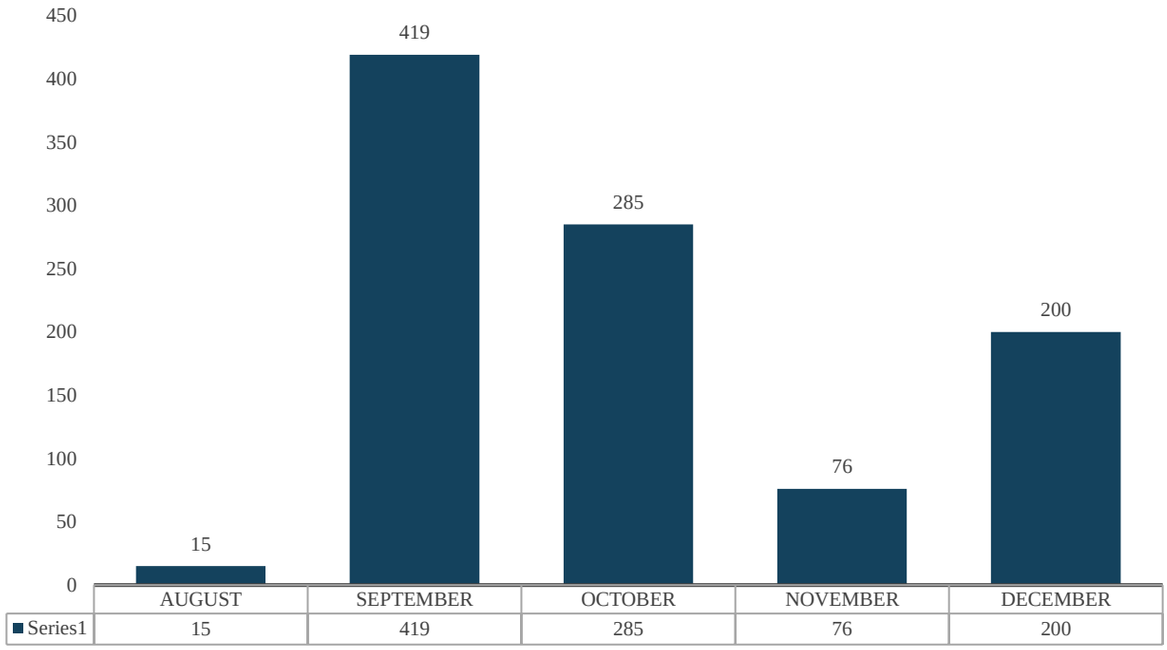
Graphic 9.7 Number of courses taught by EPIO in 2017



Source: Self Made. 2018

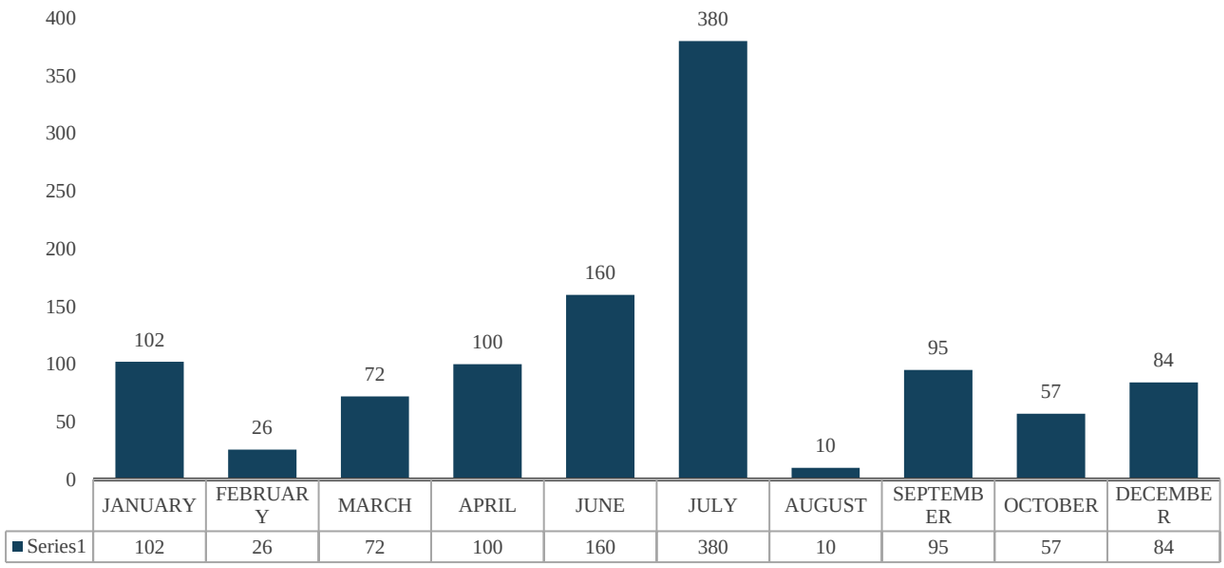
Figures 9.8 and 9.9 identify the number of participants trained for the EPIO race during 2016, totaling 995 participants and in 2017 1086 participants. It should be clarified that within these values in the same technician took different courses, however the topics treated were different.

Graphic 9.8 Number of participants trained in the various courses in 2016



Source: Self Made. 2018

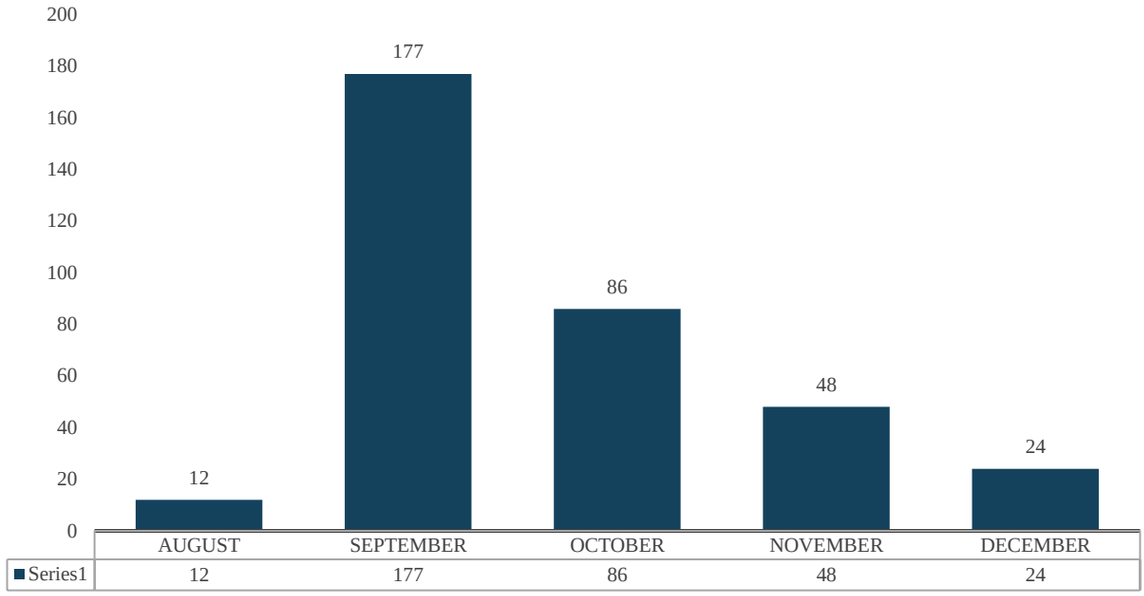
Graphic 9.9 Number of participants trained in the various courses in 2017



Source: Self Made. 2018

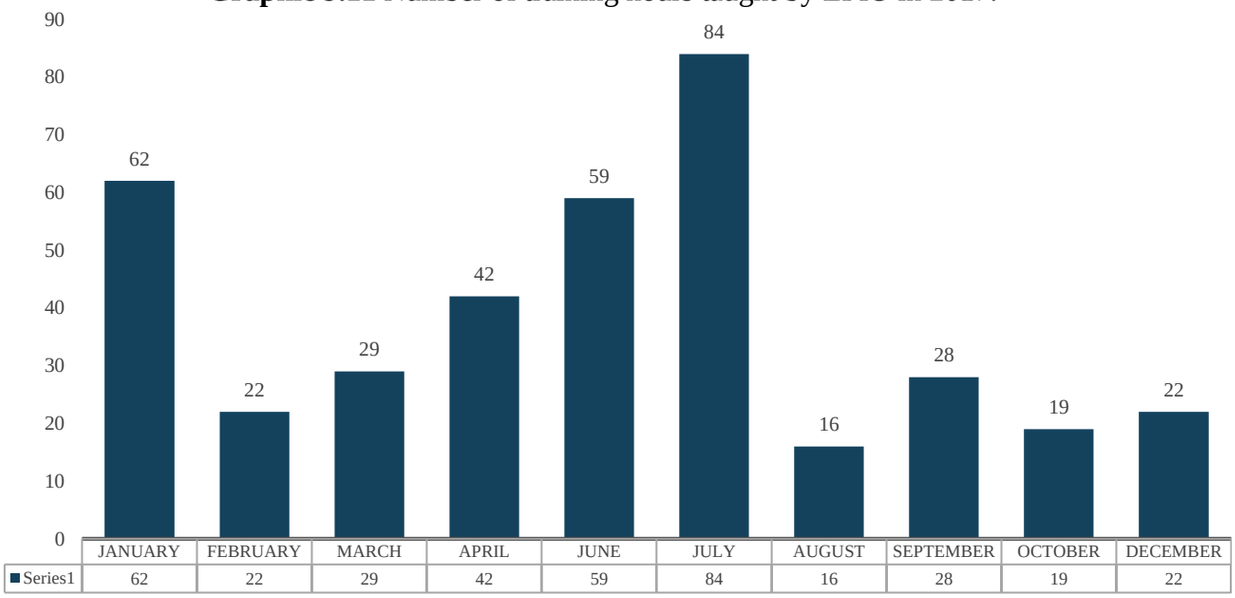
Graphs 9.10 and 9.11 represent the number of training hours in 2016 and 2017 respectively, which were invested in the technical staff among the administrative courses, such as the operational ones, corresponding to a total of 1086. The above represents an indication of the commitment of the company to maintain quality standards through the training of the operating personnel.

Graphic 9.10 Number of training hours given by EPIO in 2016



Source: Self Made. 2018

Graphic 9.11 Number of training hours taught by EPIO in 2017.

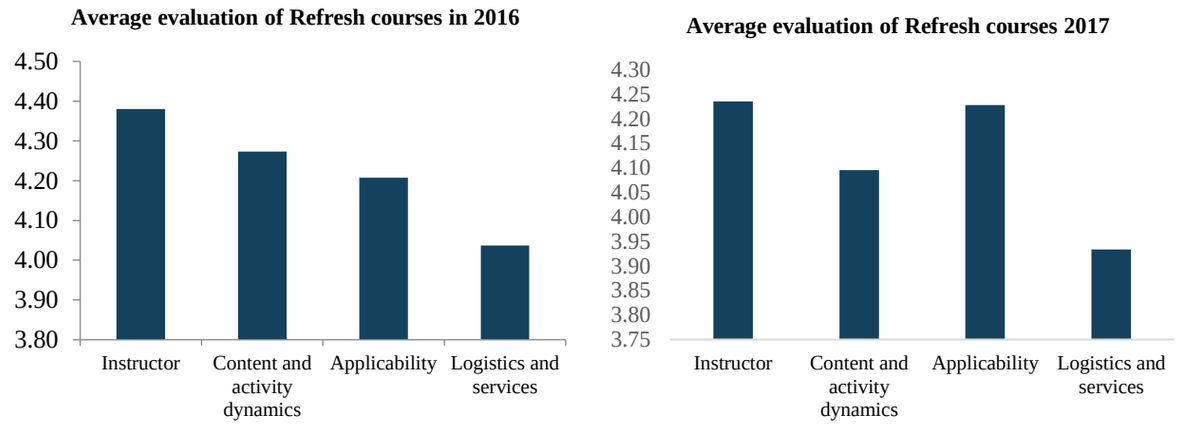


Source: Self Made. 2018

Evaluation of service satisfaction

For each course that was taught, the University evaluated the satisfaction of the service provided with the formats of the Quality Management System of the UTH. Previously in table 6 the evaluation criteria were described, in graph 9.12 the results of the refresher courses of 2016 and 2017 of the satisfaction surveys of the service carried out by the technicians of the EAP are summarized, who have between two and more of ten years working in the plant. In the graphs, there are evaluations with improvement trends above 4.20 points for the instructor, content and activity dynamics, as well as for the field of applicability, however, logistics has the lowest score. It is worth mentioning that this aspect corresponded to the EAP, since this type of courses were held in its facilities and the scheduling of dates, participating personnel, schedules and cafeteria services correspond to the needs of the EAP.

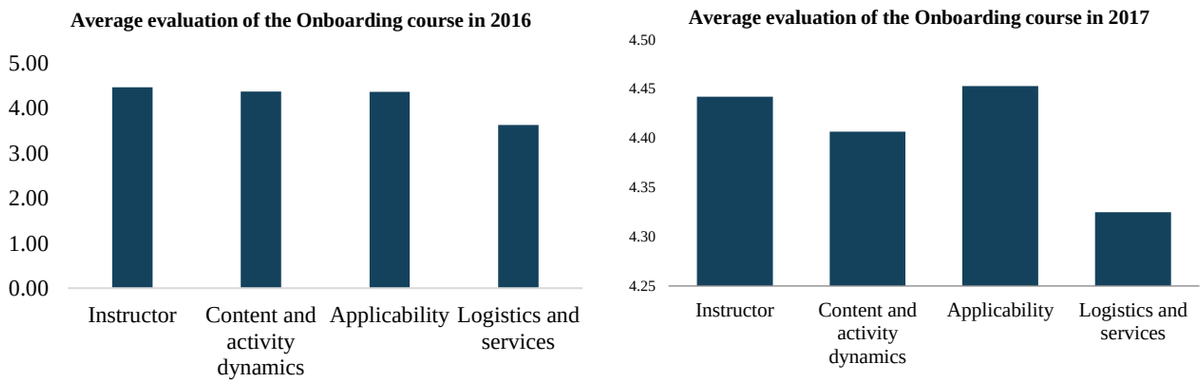
Graphic 9.12 Average evaluations of technical courses 2016-2017



Source: Self Made from documents of the UTH SGC. 2016- 2017

Graphic 9.13 presents results for 2016 and 2017 for the onboarding course, which was given to new entrants to the EAP, which was held at the UTH facilities. The logistics again have the lowest evaluations, however the comments for this item in general are; the recommendations to improve the cafeteria service. In the results of graphs 9.12 and 9.13, trends similar to those obtained in the evaluations obtained for training services provided are identified.

Graphic 9.13 Evaluation of onboarding courses 2016-2017



Source: Self Made from documents of the UTH SGC. 2016-2017

Due to time management issues and the processes inherent to collaboration agreements between the company and the university, the measurement of the impact on the application of the PIC in productivity has not been possible due to the need for prior work of agreements that benefit both parties, and being a study of great importance should be done in the near future and hand in hand with those responsible for the project. So the presentation of results will be done in another report. However, it is worth mentioning that as of the date these results are presented in 2018, the application of the PIC for the new personnel continues. Likewise, adjustments have been made to the original PIC according to the production plans in the EAP and for situations beyond the University.

Conclusions

In relation to what was established in the objectives of the research, by means of the diagnosis the training needs for the EAP were identified, the results showed the guidelines that set the pattern to carry out the development of the PIC, allowing to define what type of courses would develop, specific topics to deal with, effective hours for each course, suitable personnel for the design, development and teaching.

An important finding for the UTH was the contact with the EAP, which resulted in a strong link between the university and the productive sector, demonstrating that universities can also be directly involved in strengthening the area of knowledge and transfer of technology in companies, allowing an approach and link between both, where the main purpose is win-win. That in addition, encourage updating in the practical field of teachers, so that in turn, they propose innovations in the plans and study programs under which they are governed, so that at a certain moment they are susceptible to be modified, and individually enrich your professional practice and personal growth.

For companies that opt for training as a means to increase productivity, the benefit is greater, because the personnel update is guaranteed according to what the company needs. When this type of link is made, companies are able to access programs to obtain extraordinary financial resources from CONACYT, from the state or federal government that promote the growth of companies, as long as they involve universities and the benefits are materialized in direct actions of improvement for the company.

The final product that the UTH designed, approved and delivered to the company was the Comprehensive Training Plan, which was officially implemented in the EAP. Although at the beginning of its elaboration it was thought to develop it for the internal personnel of the same, in the end it was also extended to the personnel that was in recruitment, it is necessary to clarify that this does not imply that the candidate is integrated to the company, but still you are required to participate in the training program. Therefore, the PIC to date remains in operation hand in hand with the teachers of the UTH, who are responsible for delivering the courses, which has allowed the incorporation of new teachers, thereby expanding the training of the same for his entry into the UTH-EAP project. From the experience that was had in the planning of the diagnosis, design, delivery and implementation of the PIC, it is important to take into account the following considerations:

In relation to teachers:

- They must be up-to-date in the professional competencies required by the work environment, especially those related to the area of influence where the UTH is located.
- Have certifications as trainers in the industrial and business field.
- Develop skills to provide training to groups in specific areas, according to the needs required by companies.
- Improve the link for the development of stays in the productive sector, to strengthen technical skills and identify the needs of the industry.
- It is, was and continues to be an excellent opportunity to involve students in the participation of projects that allow applying the knowledge acquired in their educational process at the university.

In relation to the university:

- Maintain the search for opportunities for the development of projects that link and benefit the UTH-EAP.
- Opportunities were opened for students to enter to make their professional stays in the company, and some were even hired.
- Through the process of linking the UTH, you must carry out the search of projects with organizations of different turns, where the students, teachers and company are involved, considering the benefits for both.

In order for the project to remain in force, a recommendation is to suggest continuity in the work with the EAP, to carry out an investigation where the impact of the PIC can be known from its implementation to date. Which would allow to validate the objectives that the company raised in the medium and long term. Make improvements, as well as the search of areas of opportunity for the continuity of projects between the UTH and the AEP.

Acknowledgement

A special recognition to the executives of the company, who showed interest, bridling all the support and facilities for the development of the project, as well as to all those involved by the UTH, who participated actively, demonstrating professionalism, dedication and commitment, which proved the importance of establishing links that lead to establish lasting relationships between business and university.

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