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## Virtual corporate training through e-learning platforms for the personnel of a refinery of the National Refining System of PEMEX in Mexico

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**Abstract.** This project focuses on the design of a personalized corporate training program through the use of e-learning platforms based on the theory of connectivism and oriented to the upskilling of the collaborators of the human development coordination area of one of the refineries of the National Refining System of Petróleos Mexicanos in Hidalgo. Mexico. To detect the training needs, a survey was applied to the personnel of the area to know their perception in this regard and a checklist was designed based on the description of each of the positions that make up the area in order to evaluate the skills that each employee demonstrates when executing the activities of the position they occupy. The designed program had a positive impact on the perception of 100% of employees and generated a 31% increase in the development of soft skills.

**Keywords:** corporate training, e-learning, connectivism, upskilling, hard skills, soft skills.

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## 1 Introduction

One of the biggest challenges for companies, regardless of their sector, is to improve the individual and collective performance of their employees. This is crucial to increase productivity, profitability and adaptability, as well as to foster the personal and professional progress that is essential for organizational development and growth. In Mexico, this need permeates all companies, including those in the energy sector, a relevant sector for the country's economy.

Ensuring that staff have the right mix of profile and experience to meet performance expectations depends heavily on training. This process is essential to make the most of current human resources through their development, thus ensuring the internal supply of qualified collaborators.

The company Petróleos Mexicanos (PEMEX), aware that human capital is essential to obtain outstanding results in all its subsidiaries, highlights training as a key tool to consolidate itself as a State Productive Company. One of the six refineries that make up the National Refining System of this company is located in the state of Hidalgo and has around 40 departments

and 12 administrative areas, including the Human Development Coordination. This coordination is responsible for managing the Specialized Training, Training, and Development Program for refinery personnel in order to comply with PEMEX's Institutional Training and Specialized Training Program (PICADE).

In this sense, despite being the area in charge of recording and monitoring the program's activities, the organization of courses and training activities, as well as the evaluation of the impact on the performance of the staff, it faces the challenge of not having a specific training program for the collaborators who are part of it.

Among the factors that have caused the deficiency in the training of coordination staff is mainly the limitation in the budget allocated for this purpose. In addition to the above, with the diagnosis carried out through the survey applied to employees, it was detected that the training they have received does not respond to the needs of training and professional updating that are required to be covered to favor the achievement of ideal performances.

If the problem described persists, the risk of experiencing a decrease in productivity, an increase in errors in the performance of functions, difficulty in adapting to the changes that the sector presents with respect to human capital management, as well as demotivation and dissatisfaction on the part of the collaborators of the area is foreseen. Consequently, the negative effects on their results would be imminent.

As an alternative solution, the design of a personalized training program was proposed, consisting of courses available on e-learning platforms, which provide access to a wide range of resources in multiple areas and with different levels of complexity and expertise, developed by prestigious universities worldwide and at a low cost.

In this way, it is intended, not only that the training of workers is relevant and updated to achieve the strengthening of their skills. But flexible and generating dynamic and interesting learning experiences.

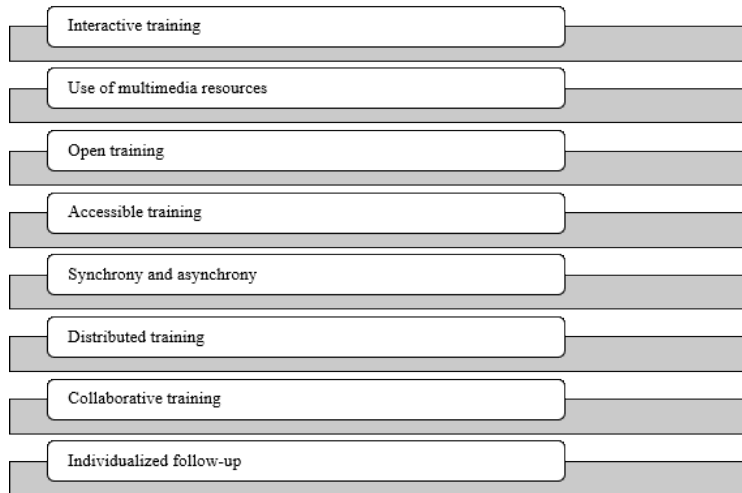
In reference to the above, the impact of the proposal to address the problems of the organization is economic and social.

## 2 Literature review

Training is one of the most important processes in the human resources area of organizations. It focuses on the development and continuous improvement of its human capital, in order to contribute to the successful achievement of results through ideal performances based on the application of relevant knowledge, skills and attitudes. In this sense, Simonassi (2009) states that an adequate training process favors innovation and competitiveness, as it contributes to the development of skills that allow employees to generate new ideas and solutions for the challenges faced by the organization. On the other hand, Aguilar and Siliceo (2006) state that training is a means to achieve high levels of productivity, but also of motivation and commitment in the staff.

The traditional way in which organizations provide training to their employees is face-to-face. However, the development of information and communication technologies (ICT) has allowed the incorporation of online and virtual training processes, generating multiple benefits such as flexibility, accessibility, quality, and ubiquity Fernández (2019).

This form of training and training through ICT tools such as virtual classrooms and educational platforms used as a means of support for the teaching and learning process is called *e-learning* and according to Pérez (2019) offers the characteristics shown in Figure 1.



**Fig 1.** Characteristics of e-learning

As mentioned in the previous paragraph, educational platforms also known as Learning Management Systems are a means of support for e-learning. According to Cabero (2007), they are virtual environments that, through the integration of specific tools in an interface, facilitate the carrying out of training processes on the network through various digital resources and activities.

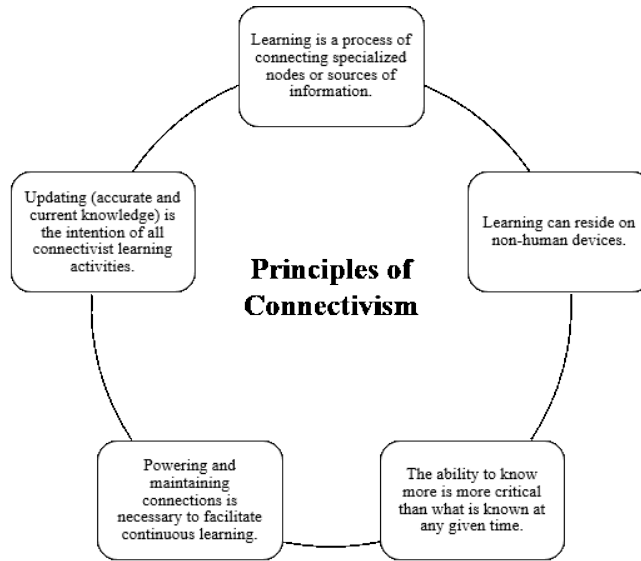
An online learning modality available through educational platforms are MOOC (Massive Open OnLine Course) courses, which establish their bases in connectivism (Zapata, 2013 cited by Alemán, 2020) and imply a dynamic of continuous learning and democratization of knowledge through the internet. Figure 2 defines the meaning of MOOC (Smowltech, 2024).

Massive	Open	Online	Course
<ul style="list-style-type: none"> <li>• There is no limit to the number of participants.</li> <li>• Anyone who wishes can access it regardless of their professional, personal, academic profile or geographical location.</li> </ul>	<ul style="list-style-type: none"> <li>• The only condition it establishes is to have access to the internet.</li> <li>• It is free and autonomous.</li> </ul>	<ul style="list-style-type: none"> <li>• They are developed online.</li> <li>• They allow for synchronous and asynchronous connection.</li> </ul>	<ul style="list-style-type: none"> <li>• The course is designed with the aim of promoting autonomous learning.</li> <li>• Active methodologies are implemented.</li> </ul>

**Fig 2.** Meaning of MOOC

For Benet, Sanahuja, García and Nieto (2018) cited by Atiaja & Martínez (2020), MOOCs are a very useful resource for continuous training, because they allow the exchange of knowledge in an open and flexible way, thus favoring professional training and access to inclusive education.

In this sense, connectivism supports this learning modality through the principles set out in Figure 3, which also contemplate the challenges faced by organizations in their knowledge management activities. (Siemens, G., 2004).



**Fig 3.** Principles of Connectivism

Some of the educational platforms most recognized for their offer of up-to-date and quality MOOCs, designed by prestigious universities and institutions to allow training from anywhere and at any time, are presented in Table 1 (Center for the Development of Digital Competences Castilla-La Mancha, 2019).

**Table 1.** Most recognized MOOC platforms

Platform	Description
<b>Coursera</b>	Created by a group of Stanford University scholars in 2011, it offers more than 4,000 courses developed by more than 140 academic institutions. One of its outstanding features is the possibility it offers to participate in debates on the topics of the courses.
<b>EdX</b>	Its creation in 2012 is a collaboration between Harvard University and the Institute of Technology of Massachusetts. The level of the courses is university.
<b>Miriada X</b>	It was created in 2003 through the Universia training network by the companies Banco Santander and Telephone. It has the collaboration of more than 1,000 specialized teachers.

### 3 Methodology

To design the training program focused on strengthening the skills of the employees of the refinery's Human Development Coordination, a survey of 21 questions was first applied to identify the current state of the training process based on the perception of the four workers who collaborate in the area.

- The questions focused on obtaining information about:
- The application of an adequate diagnosis for the detection of training needs
- The existence of a relevant training programme
- The adequacy of the training they have received
- The effectiveness of the training received for the strengthening of skills
- Measuring training outcomes

Secondly, the detection of the training needs of the employees was carried out through the evaluation of the hard and soft skills demonstrated in the performance of the functions of the position they occupy. The instrument used was a checklist based on the job descriptions shown in Table 2.

**Table 2.** Human Development Coordination Positions

<b>Position</b>	<b>Level in the organization</b>	<b>Job Objective</b>
<b>Coordinator</b>	Middle Manager	Coordinate, execute, and follow up on the annual program, in order to promote competent and committed personnel to the workplace.
<b>Regional Analyst</b>	Technician	Manage and execute Human Development Programs.
<b>Local Analyst</b>	Technician	Execute, advise and coordinate the operation to apply models and methodologies for personnel development processes.
<b>Administrative Assistant</b>	Operative	Assist and provide various administrative activities in the area of Human Development.

A Likert-type scale was applied for the assessment with a numerical score from 1 to 5, which corresponds to the qualitative ratings shown in Figure 4.



**Fig 4.** Likert scale to assess staff skills

Once the training needs were identified, a search was carried out on the Coursera and EdX platforms in order to select appropriate courses to meet these needs, considering them for integration into the Coordination's training program.

The criteria that were taken into account for the search and selection of courses on the educational platforms mentioned in the previous paragraph were the objective of the course and the skills it offers to develop.

Subsequently, based on the results of the search, the training program for the Coordination of Human Development of the refinery was designed, considering the integration of courses that contribute to the strengthening of the hard and soft skills of the employees, necessary for the effective performance of the functions of the position they occupy. The training program is contemplated for the period from April to December 2024.

Finally, after the training corresponding to the April-May period, a second measurement was carried out to determine variations regarding the perception of the state of the training process in the Coordination and regarding the level of development of skills worked through training. Additionally, a satisfaction survey was applied to the employees who participated in the program.

The satisfaction survey was designed to assess:

- The level of satisfaction of employees with respect to the training program.
- That they liked or disliked the proposed courses.
- The relevance of the program.
- The quality of the content.
- Usability of learning platforms.

## 4 Data analysis

From the survey applied to the four collaborators of the Human Development Coordination to diagnose the training process in the area, the information presented in Table 3 was obtained.

**Table 3.** Diagnosis of the Coordination's training process

<b>Process factors</b>	<b>Workers' perception</b>
<b>Diagnosis for the detection of needs of training</b>	100% of the employees surveyed indicate that, although it is carried out, there is no procedure or a defined instrument to detect the training needs of the area.
<b>Training Program</b>	There is a platform called Detection of Individual Training and Training Needs, but it is a tool that allows you to apply and register. There is disagreement regarding the existence of a training program. 50% of the employees surveyed say that it does exist and the other 50% mention that it does not.
<b>Adequacy of training</b>	75% of the employees surveyed indicated that they have received more than 6 trainings since they have been in their position. Therefore, in terms of quantity, they consider that the training they have received is sufficient.
<b>Training effectiveness</b>	50% of employees consider that the training they have received fits the needs of their position.  100% of employees are interested in receiving training that results in a tangible improvement in their performance.  100% of the employees state that the training they have received contributes to performing within a framework of compliance with the rules and policies that apply to the sector to which the organization belongs, but not to the development and strengthening of their professional skills.  50% of employees consider that the professional training they have received is outdated.
<b>Measuring Training Outcomes</b>	100% of employees indicate that the only method used to measure the effectiveness of training results is an opinion survey of trained personnel.

The results of the detection of needs based on the evaluation of the skills demonstrated in the performance of the position made it possible to identify which are the hard skills and soft skills that require strengthening the collaborators of the Coordination to improve their performance.

Table 4 shows the results of the evaluation carried out through the checklist designed from the job descriptions.

**Table 4.** Job Performance Skills Assessment

Evaluated Contributor	Qualification by Skill Type		Average Rating	% of development
	Hard Skills	Soft skills		
<b>Coordinator</b>	2.8	3.5	3.1	62%
<b>Regional Analyst</b>	3.5	3.2	3.3	66%
<b>Local Analyst</b>	3.3	3.8	3.5	70%
<b>Administrative Assistant</b>	2.6	4.2	3.4	68%

It is observed that employees have developed their hard and soft skills in 66% on average, with an average rating of 3.3 out of 5. The skills that need to be influenced to improve the performance of employees are shown in Figure 5.

Hard Skills	Soft skills
<ul style="list-style-type: none"> <li>• Customer Service</li> <li>• Information management with technological tools</li> </ul>	<ul style="list-style-type: none"> <li>• Collaborative work</li> <li>• Leadership</li> <li>• Emotional intelligence</li> <li>• Time management</li> <li>• Feedback</li> <li>• Communication</li> </ul>

**Fig 5.** Skills that require strengthening

The annual training program for employees of the Refinery's Human Development Coordination, which was designed based on the information collected, is shown in Figure 6.

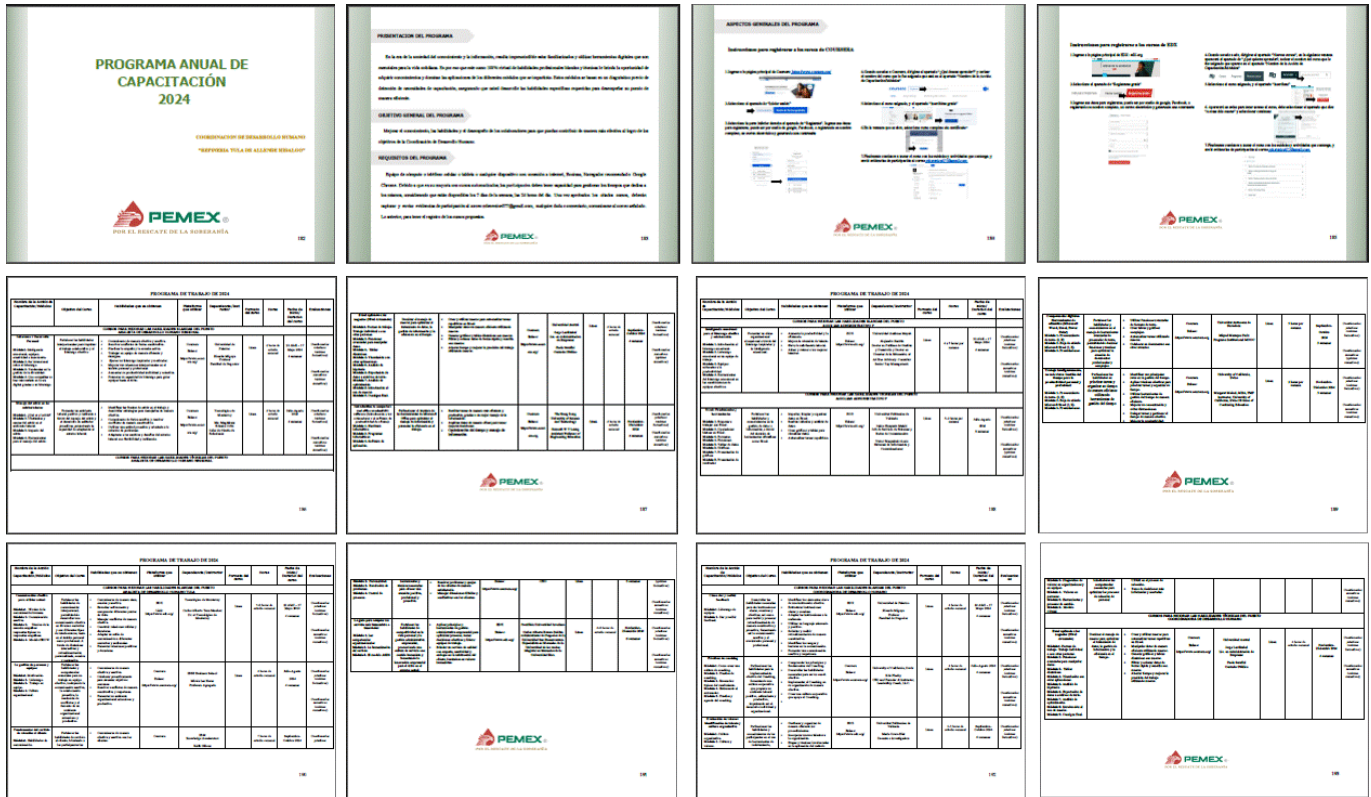


Fig 6. Annual Training Program for Human Development Coordination

The training corresponding to the April-May period is made up of the courses shown in Table 5.

Table 5. Training April-May 2024

Position	Name of the training action	Objective	Platform
<b>Coordinator</b>	How to Give and Receive feedback  Duration: 4 weeks	Develop the skills necessary to give clear, concise, and effective instructions, as well as to receive and process feedback constructively and proactively, thereby fostering assertive communication and personal and professional growth.	EdX
<b>Regional Analyst</b>	Leadership and developme personal  Duration: 4 weeks	Strengthen interpersonal skills to promote collaborative work and effective leadership.	Coursera
<b>Local Analyst</b>	Effective communication for the current leader  Duration: 4 weeks	Strengthen interpersonal communication skills, allowing them to develop effective communication in various contexts and with different types of interlocutors, both in the	EdX



		personal and professional spheres. Through interactive dynamics and personalized, concise and persuasive feedback.	
<b>Administrative Assistant</b>	Emotional intelligence for leadership effective and collaboration.  Duration: 4 weeks	Fostering an exceptional organizational climate through inspirational leadership and emotional intelligence.	EdX

## 5 Results

Before the implementation of the training program, only 20% of the Coordination's employees had a positive perception of the process regarding compliance with the factors mentioned in Table 3. After the implementation of the program, the positive perception was 100% of the employees.

Regarding the evaluation of skills for the performance of the position, the training of the April-May period focused on the strengthening of some of the soft skills identified as necessary according to the job descriptions. Table 6 presents the scores obtained before the implementation of the training compared to those obtained after the implementation.

**Table 6.** Soft Skills Assessment Comparison

Position	Soft Skills Evaluated	Qualification before Training	% of development	Qualification after Training	% of development	Increment
<b>Coordinator</b>	Communication	3	60%	4	80%	33.3%
	Feedback	3	60%	3	60%	0%
	Collaborative work	3	60%	4	80%	33.3%
<b>Analyst regional</b>	Collaborative work	2	40%	3	60%	50%
	Emotional intelligence	3	60%	4	80%	33.3%
<b>Local Analyst</b>	Communication	3	60%	4	80%	33.3%
	Collaborative work	3	60%	4	80%	33.3%
<b>Auxiliary administrative</b>	Leadership	3	60%	4	80%	33.3%
	Emotional intelligence	3	60%	4	80%	33.3%

From this information, it is determined that on average, the employees of the Coordination had an increase in the development of some soft skills of 31.4% compared to the level of development they demonstrated before the implementation of the training program. The collaborator who works in the position of Coordinator had an increase of 22.2%, the regional analyst of 40%, the local analyst and the administrative assistant of 33.3%.

From the satisfaction survey that was applied after the training for the April-May period, the information shown in Table 7 was obtained.

**Table 7.** Satisfaction survey results

<b>Criteria</b>	<b>Evaluation</b>
<b>Satisfaction with the training program</b>	On average, employees rated their satisfaction with the training program with 4.5 points out of 5. 50% said they were satisfied and the other 50% very satisfied.
<b>Aspects that pleased the courses</b>	50% of the employees mentioned that the aspect they liked most about the course they took was the clarity with which the topics are addressed because it facilitates their understanding.  25% of the employees stated that the variety of topics covered with the courses that make up the training program was one of the aspects that they liked and that motivated their willingness to participate.  The flexibility of time to complete the course was the aspect that pleased the other 25% of the employees and that was also decisive in motivating their participation.
<b>Relevance of the content of the program</b>	100% of employees rated the relevance of the program's content as very relevant with a score of 5 to contribute to the development of the skills they require to perform effectively in their position.
<b>Usability of educational platforms</b>	The usability criterion of the educational platforms where the courses that make up the training program are available obtained an average rating of 4.2. 75% of employees consider them to be easy to use and 25% rate them as very easy to use.

## 6 Conclusions

The importance of human capital for the successful achievement of organizational objectives is increasingly recognized. In this sense, it is highlighted that it is essential to carry out relevant training processes to improve the performance of employees based on the development and strengthening of the necessary skills to effectively execute their functions. Consequently, to achieve positive effects on the productivity, profitability and adaptability of organizations.

However, one of the most common and significant challenges organizations face in implementing appropriate training programs is budget constraints and the lack of specific, up-to-date programs.

The Human Development Coordination of a PEMEX refinery in Hidalgo faces precisely this problem: the lack of a specific and relevant training program for its own employees. In order to avoid the negative impact that this can result from and manifest itself in the decrease in productivity, the increase in errors, the difficulty in adapting to changes in the environment and the demotivation of the staff, a personalized training program was designed based on the needs that, through the corresponding diagnosis carried out through the application of a survey and a checklist for the evaluation of were identified in each of the collaborators who occupy the four positions that make up the Coordination.

The training program was designed to be implemented in the period from April to December 2024, it is made up of courses available on e-learning platforms that offer variety, flexibility, updating and reduced costs. In addition, they are courses developed by prestigious universities.

After the implementation of the training program in the April-May period, an increase of 31.4% was observed in the development of some soft skills, such as collaborative work, leadership, communication and emotional intelligence. This means a successful start in the process of strengthening employees' skills.

The post-training satisfaction survey revealed high satisfaction among employees, highlighting as important aspects of the training program the relevance of the content, the clarity of the topics and the flexibility of the time to complete the courses.

E-learning educational platforms are an accessible alternative that can significantly contribute to the training function of organizations, helping to create dynamic and personalized continuous learning experiences.

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