

## Analysis of the mechanical and electrical laboratory service at the faculty of electrical mechanical engineering of the Universidad Veracruzana in Poza Rica Veracruz, Mexico

## Análisis del servicio del laboratorio de mecánica y eléctrica en la facultad de ingeniería mecánica eléctrica de la Universidad Veracruzana en Poza Rica Veracruz, México

CHAGOYA-RAMÍREZ, Jorge Alberto†\*, LAGUNA-CAMACHO, Juan Rodrigo, CALDERÓN-SÁNCHEZ, Javier and JUÁREZ-BALTAZAR, Claudia Montserrat

*Universidad Veracruzana, School of Mechanical and Electrical Engineering, Poza Rica Veracruz, Mexico.*

ID 1<sup>st</sup> Author: *Jorge Alberto, Chagoya-Ramírez* / ORC ID: 0000-0002-8506-215X, CVU CONACYT ID: 1101227

ID 1<sup>st</sup> Co-author: *Juan Rodrigo, Laguna-Camacho* / ORC ID: 0000-0003-0974-5204

ID 2<sup>nd</sup> Co-author: *Javier, Calderón-Sánchez* / ORC ID: 0000-0002-1382-1081, CVU CONACYT ID: 730888

ID 3<sup>rd</sup> Co-author: *Claudia Montserrat, Juárez-Baltazar* / ORC ID: 0000-0003-4825-2234

DOI: 10.35429/JUM.2021.13.5.6.13

Received January 15, 2021; Accepted June 30, 2021

### Abstract

It is important to mention that educational quality and excellence within any Higher Education Institution lies in the importance of implementing continuous improvement in each of its different departments or areas, that is why constant analysis and self-evaluations of the services provided offered within it take on more and more importance, these are carried out in order to locate areas of opportunity in which it is necessary to implement strategies that help to achieve the desired levels of quality. This research is an analysis study focused on the services provided by the Mechanical and Electrical Laboratory to its users of the Faculty of Electrical Mechanical Engineering of the Universidad Veracruzana in Poza Rica Veracruz, Mexico, using an applied opinion survey. to a sample of 169 people, which allows identifying the indices of each of the services that are provided, the results obtained provide relevant data that will later be used for the design of an improvement plan that allows generating actions that favor the continuation being a quality educational institution.

**Quality, Education, Continuous improvement**

### Resumen

Es importante mencionar que la calidad y excelencia educativa dentro de cualquier Institución de Educación Superior radica en la importancia de implementar la mejora continua en cada uno de sus diferentes departamentos o áreas, es por eso, que los análisis y autoevaluaciones constantes de los servicios que se brindan dentro de ella toman cada vez más importancia, estos se llevan a cabo con el fin de localizar áreas de oportunidad en las cuales se necesite implementar estrategias que coadyuven a conseguir los niveles de calidad deseados. La presente investigación, es un estudio de análisis enfocado a los servicios que presta el Laboratorio de Mecánica y Eléctrica a sus usuarios de la Facultad de Ingeniería Mecánica Eléctrica de la Universidad Veracruzana en Poza Rica Veracruz, México, utilizando para ello una encuesta de opinión aplicada a una muestra de 169 personas, la cual permite identificar los índices de cada uno de los servicios que en él se prestan, los resultados obtenidos aportan datos relevantes que posteriormente servirán para el diseño de un plan de mejora que permita generar acciones que favorezcan a continuar siendo una institución educativa de calidad.

**Calidad, Educación, Mejora continua**

**Citation:** CHAGOYA-RAMÍREZ, Jorge Alberto, LAGUNA-CAMACHO, Juan Rodrigo, CALDERÓN-SÁNCHEZ, Javier and JUÁREZ-BALTAZAR, Claudia Montserrat. Analysis of the mechanical and electrical laboratory service at the faculty of electrical mechanical engineering of the Universidad Veracruzana in Poza Rica Veracruz, Mexico. Journal University Management. 2021. 5-13:6-13.

\* Correspondence of the Author (E-mail: gm.canedo@ugto.mx)

† Researcher contributing as first author.

## General objective

To carry out an analysis that generates new knowledge about the degree of satisfaction of the service provided by the Mechanical and Electrical Laboratory at the Faculty of Electrical Mechanical Engineering of the Universidad Veracruzana in the city of Poza Rica Veracruz, through a statistical research method descriptive.

## Particular objectives

- To interpret the data obtained on the degree of satisfaction of mechanical and electrical equipment.
- To analyze the qualification given to the Mechanical and Electrical Laboratory for the services it provides.
- To interpret the data obtained on the care provided to users.

## What is the importance of knowing the degree of satisfaction of the service in the Mechanical and Electrical Laboratory?

Talking about the Mechanics and Electrical Laboratory is to highlight the essence of this Faculty, this given the importance for each of the users who develop different academic activities within it, that is why the research carried out seeks to know the impact generated by the degree of satisfaction in each of the areas analyzed, all this in order to continuously improve as an Academic Institution, since the Faculty of Electrical Mechanical Engineering of the Universidad Veracruzana in the Poza Rica-Tuxpan region is a recognized and accredited academic entity in each one of its educational programs for their academic quality before the AC Engineering Teaching Accreditation Council in Mexico. That is why the importance of knowing the areas of opportunity, in which improvements can be implemented based on a previous investigation, which is carried out on a sample of a certain number of users that support the data of each of the results obtained.

## Background

Within the research works, it is important to mention if any exploration was previously carried out or carried out in the area or department where the current research is being carried out.

In particular, the Faculty of Electrical Mechanical Engineering of the Poza Rica - Tuxpan Region, is characterized by being an Institution of Higher Education (IES) in which a large amount of work, research and prototypes of an endless application of knowledge are developed, But not only the engineering part is the one that is worked on, one of the fundamental aspects in the correct functioning of the Faculty lies in the importance of Management, that is why this type of work helps to achieve the goals set internally.

As an antecedent within the analysis of degree of satisfaction in the Faculty of Electrical Mechanical Engineering, we can consider the publication *"Analysis of the Service of the Computing Laboratory of the Faculty of Mechanical and Electrical Engineering at the Universidad Veracruzana in Poza Rica Veracruz, Mexico"* which was published in the *"Higher Education Magazine, December 2020, Vol.4, No.12, 12-19."*

## Methodology

The method applied to the present investigation is based on the selection of a probabilistic sample, since these have many advantages; Perhaps the main one is that the size of the error in our predictions can be measured (Sampieri Hernández, 2014, p. 177), this given that first the identification of the segment to be evaluated was carried out, later it was possible to determine the procedure to follow, In this case, having a finite population, it was easier to dictate or establish the steps to follow, later a survey was carried out, all this to conclude with the interpretation of each of the data collected, as well as the opinions contributed by each of the participants.

To determine the sample size, it was necessary to implement the following formula:

$$n = \frac{k^2 N p q}{[e^2(N-1)] + [k^2 p q]} \quad (1)$$

### Formula 1 Sample Size

Source: (Sampieri Hernández, Metodología de la Investigación, 2014).

Where:

k: Confidence level.

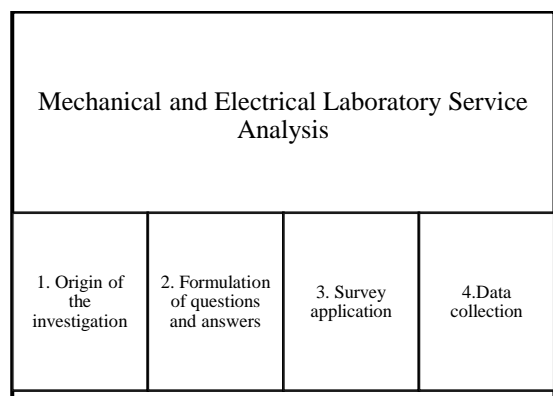
N: Population.

p: Probability of an event occurring.

q: Probability that an event will not occur.

e: Maximum accepted estimation error.

It is important to detail the analysis procedure step by step since every process has an order, then Figure 1 describes each of the stages carried out.



**Figure 1** Phases of research development

Source: Own elaboration

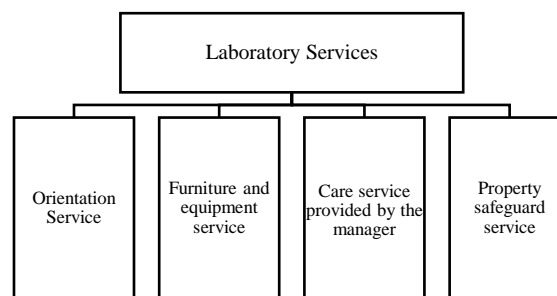
### Origin of the investigation

Establishing the purpose of an investigation and identifying each of the variables that may exist within the aspects to be evaluated is one of the priority points for any investigation.

Derived from the aforementioned, the present work arises from the need to know the current state of the degree of user satisfaction, through an analysis that provides data that allows identifying the aspects in which it can be improved in terms of the service provided by the Mechanical and Electrical Laboratory of the Faculty of Electrical Mechanical Engineering, likewise, locate each area of opportunity that is available and in which improvement designs based on strategies are subsequently generated, all in order to continuously improve as an institution.

### Formulation of questions and answers

The establishment and formulation of questions arises from an analysis based on each of the services that can be evaluated through a degree of satisfaction and with which the Mechanical and Electrical Laboratory of the Academic Entity has, Figure 2 breaks down each one of the services that were taken into account for your evaluation.



**Figure 2** Mechanical and Electrical Laboratory Services


Source: Own elaboration

Once the measurable services were identified through a degree of satisfaction, it was decided to include complements that could strengthen the present analysis, taking important points such as the evaluation of the application of the internal regulations of the Laboratory, this due to the fact that a correct application of the rules and regulations of a certain space encourages a good service of this.

Subsequently, each one of the questions that make up this survey was carried out.

The answers that were taken into account for each question are based on their own, standardized and homogenized criteria, where the Excellent answer is considered the most favorable and the Bad answer is considered the least favorable.

Once the questions and answers of our questionnaire were established, the process continued to continue. Figure 3 shows the order of the questions, the possible answers and the structure presented by the survey.



Universidad Veracruzana  
Facultad de Ingeniería Mecánica Eléctrica  
Región Poza Rica – Tuxpan

“working with quality to achieve excellence”

**SURVEY OF OPINION OF DEGREE OF SATISFACTION OF THE SERVICES OF THE MECHANICS AND ELECTRICAL LABORATORY**

With the aim of improving the level of quality and thanking you for your collaboration, the Faculty of Electrical Mechanical Engineering wishes to know your degree of satisfaction with the service provided by the Mechanical and Electrical Laboratory of this Faculty, for the following we invite you to answer the questions next questions:

1. What is your opinion regarding the orientation service when entering the Mechanical and Electrical Laboratory?  
A) Excellent B) Good C) Regular D) Bad
2. How do you consider the furniture and equipment of the Mechanical and Electrical Laboratory?  
A) Excellent B) Good C) Regular D) Bad
3. How do you consider the care provided by the person in charge of the Mechanical and Electrical Laboratory?  
A) Excellent B) Good C) Regular D) Bad
4. How do you consider the service of safeguarding your belongings during your stay at the Mechanical and Electrical Laboratory?  
A) Excellent B) Good C) Regular D) Bad
5. How do you consider the application of the regulations of the Mechanical and Electrical Laboratory?  
A) Excellent B) Good C) Regular D) Bad
6. According to your personal criteria and for academic purposes, would you like to make any comments, suggestions or observations about the Mechanics and Electrical Laboratory?
7. On a scale of 1 to 10, with 10 being the highest rating and 1 being the lowest. How do you rate your level of satisfaction with the Mechanical and Electrical Laboratory of the Faculty of Electrical Mechanical Engineering?

1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	----

*Thanks for your participation!*

**Figure 3** Satisfaction degree survey  
Source: Own elaboration

**Survey application**

For the application of the survey it was necessary to identify the total size of Population N, which was 593 students belonging to the different Educational Programs offered in this Academic Entity, however, it is important to mention that 145 of these belong to the Enrollment S19 and 147 to Enrollment S20, which have not been able to carry out activities related to this laboratory, all this due to the current health situation, therefore 292 students were discarded for the present research work, our final population being  $N = 301$  students.

Subsequently, it was ruled that the Confidence Level would be:  $k = 95\%$  (1.96),  $p = 50\%$  (Because it is unknown),  $q = 50\%$  (Because it is unknown) and  $e = 5\%$ , in such a way that, when inserting the data to the formula raised at the beginning, it is as follows:

$$n = \frac{(1.96)^2(301)(.5)(.5)}{[(.05)^2(301-1)]+[(1.96)^2(.5)(.5)]} \tag{2}$$

**Formula 2** Data substitution in formula  
Source: Own elaboration

$$n = \frac{289.08}{[0.75]+[0.96]} \tag{3}$$

**Formula 3** Reduction of terms  
Source: Own elaboration

$$n = 169.05 \tag{4}$$

**Formula 4** Sample size result  
Source: Own elaboration

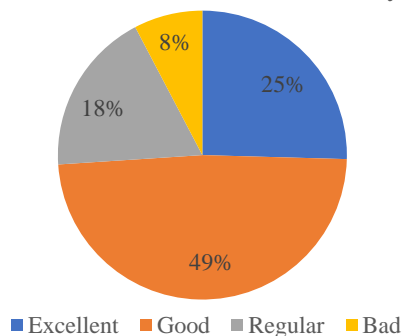
The final sample size was 169 users assigned to the Faculty of Electrical Mechanical Engineering. It is important to mention that the procedure for the application of the survey was carried out at the time of completing the registration within the Microsoft Forms platform, after that it was shared in different study groups, which allowed it to be answered remotely It should be noted that participation in this research was voluntary.

**Data Collection**

In this phase, the opinion results of the surveys were quantitatively analyzed, the results of each question yield relevant information about the objective set out with this analysis, then the results of the frequency indices are shown in each item of each one. of the questions.

Question 1 evaluates the service received upon admission to the laboratory.

1. What is your opinion regarding the orientation service when entering the Mechanical and Electrical Laboratory?



Results → Excellent: 43 people, Good: 82 people, Regular: 31 people, Bad: 13 people.

Graphic 1 Results of question 1

Source: Own elaboration

1. What is your opinion regarding the orientation service when entering the Mechanical and Electrical Laboratory?		
Answer	Opinions	Percentage
Excellent	43	25%
Good	82	49%
Regular	31	18%
Bad	13	8%
Total	169	100%

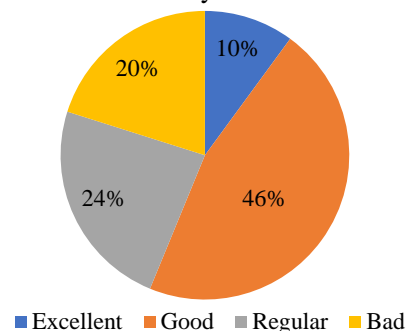
Table 1 Values recorded in question 1

Source: Own elaboration

Interpretation of the data obtained in question 1:

It is determined that the orientation service at the time of entering the Mechanics and Electrical Laboratory is "Good". Question 2 of the survey refers to the state of the furniture and equipment found within the Mechanical and Electrical Laboratory.

2. How do you consider the furniture and equipment of the Mechanical and Electrical Laboratory?



Results → Excellent: 17 people, Good: 78 people, Regular: 40 people, Bad: 34 people.

Graphic 2 Results of question 2

Source: Own elaboration

Interpretation of the data obtained in question 2:

The equipment and furniture of the Mechanical and Electrical Laboratory is determined to be "Good".

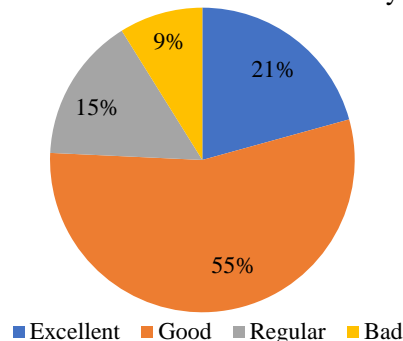
2. How do you consider the furniture and equipment of the Mechanical and Electrical Laboratory?		
Answer	Opinions	Percentage
Excellent	17	9%
Good	78	51%
Regular	40	22%
Bad	34	18%
Total	169	100%

Table 2 Values recorded in question 2

Source: Own elaboration

Question 3 shows a more personalized approach when evaluating the care provided by the person in charge of the Mechanical and Electrical Laboratory.

3. How do you consider the care provided by the person in charge of the Mechanical and Electrical Laboratory?



Results → Excellent: 35 people, Good: 93 people, Regular: 26 people, Bad: 15 people.

Graphic 3 Results of question 3

Source: Own elaboration

3. How do you consider the care provided by the person in charge of the Mechanical and Electrical Laboratory?		
Answer	Opinions	Percentage
Excellent	35	21%
Good	93	55%
Regular	26	15%
Bad	15	9%
Total	169	100%

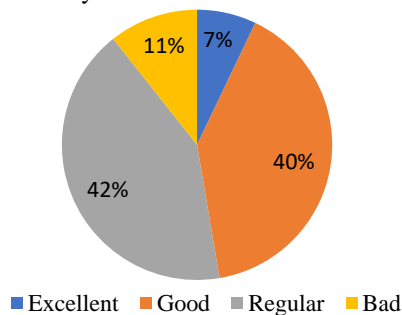
Table 3 Values recorded in question 3

Source: Own elaboration

Interpretation of the data obtained in question 3:

It can be established that the care provided by the person in charge of the Mechanical and Electrical Laboratory is "Good". On the other hand, in question 4 the service of the safeguarding of belongings is evaluated during the stay that the user has within the Laboratory.

4. How do you consider the service of safeguarding your belongings during your stay at the Mechanical and Electrical Laboratory?



Results → Excellent: 12 people, Good: 68 people, Regular: 71 people, Bad: 18 people.

**Graphic 4** Results of question 4  
Source: Own elaboration

Interpretation of the data obtained in question 4:

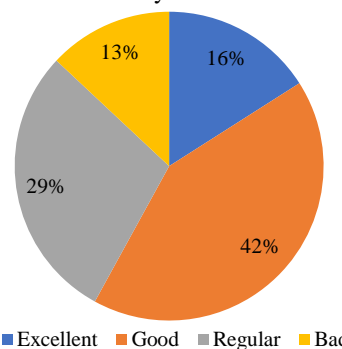
The survey participants consider that the safeguarding of their belongings during their stay in the Mechanics and Electrical laboratory is "Regular".

4. How do you consider the service of safeguarding your belongings during your stay at the Mechanical and Electrical Laboratory?		
Answer	Opinions	Percentage
Excellent	12	7%
Good	68	40%
Regular	71	42%
Bad	18	11%
Total	169	100%

**Table 4** Values recorded in question 4  
Source: Own elaboration

Undoubtedly the regulatory part of any space contributes considerably to providing a good service, since it encourages the proper use of the facilities and everything that is in them, that is why, question 5 considers the part regulations of the Mechanics and Electrical Laboratory.

5. How do you consider the application of the regulations of the Mechanical and Electrical Laboratory?



Results → Excellent: 27 people, Good: 71 people, Regular: 49 people, Bad: 22 people.

**Graphic 5** Results of question 5  
Source: Own elaboration

Interpretation of the data obtained in question 5:

It is determined that the application of the regulations in the Mechanical and Electrical Laboratory is "Good".

5. How do you consider the application of the regulations of the Mechanical and Electrical Laboratory?		
Answer	Opinions	Percentage
Excellent	27	16%
Good	71	42%
Regular	49	29%
Bad	22	13%
Total	169	100%

**Table 5** Values recorded in question 5  
Source: Own elaboration

Among the questions asked, question 6 is asked qualitatively, due to obtaining information through comments, suggestions or observations regarding the Mechanics and Electrical Laboratory, it is important to mention that said question was established in order to collect data that later they allow the design of improvements based on antecedents, which, if well formulated, could be implemented within it.

Table 6 contains the responses obtained.

According to your personal criteria and for academic purposes, would you like to make any comments, suggestions or observations about the Mechanics and Electrical Laboratory?

The users participating in the survey state within their needs:

- Updating of equipment necessary for practices in each of the Educational Programs.
- Constant maintenance of main equipment.
- Increase of practices within the laboratory.
- Material available for practices.

**Table 6** Values recorded in question 6

Source: Own elaboration.

Interpretation of the data obtained in question 6:

As previously mentioned, the purpose of this question is to obtain information based on direct opinions of the user, at the time of the interpretation of the answers it was possible to arrive at the analysis of a generation of research lines, which to give continuity to the This work can generate improvement designs and in turn considerably increase the desired quality levels.

Finally, it is of utmost importance for any Institution to have facilities that cover and satisfy the needs of each individual belonging to its Academic Community, in this case those belonging to the Faculty of Electrical Mechanical Engineering, that is why it is proposed in Question number 7 qualify the degree of satisfaction that the user has regarding the Mechanical and Electrical Laboratory.

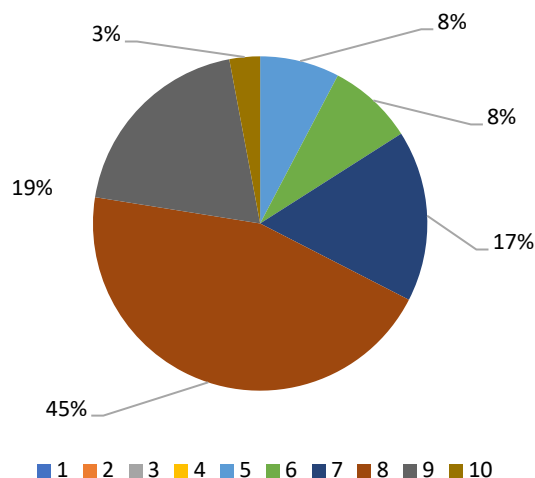
Below is each of the ratings assigned by the 169 survey participants.

Qualification	Frequency
1	0
2	0
3	0
4	0
5	13
6	14
7	28
8	76
9	33
10	5

**Table 7** Values recorded in question 7

Source: Own elaboration

7. On a scale of 1 to 10, with 10 being the highest rating and 1 being the lowest. How do you rate your level of satisfaction with the Mechanical and Electrical Laboratory of the Faculty of Electrical Mechanical Engineering?



**Graphic 6** Results of question 7

Source: Own elaboration

Interpretation of the data obtained in question 7:

Given the importance of obtaining current and realistic knowledge about the Laboratory's qualification, all this for academic purposes can be established that 45% of the sample considers that the degree of satisfaction provided is equivalent to an qualification of 8.

### Importance of the Data Obtained

The importance of the data obtained lies in the analysis of the basic elements of the information obtained.

Each of the results obtained in the present work, generate a real perspective of the degree of satisfaction of the users who attend the Mechanical and Electrical Laboratory of the academic entity, in turn it is considered that the research is acceptable due to the favorable responses However, given the current demand of the educational world, it is necessary to design strategies that promote continuous improvement in each of the evaluated aspects, which in due course can be implemented in order to increase the levels previously obtained and thus achieving the desired quality to later achieve excellence.

### Conclusions

Derived from the research it is concluded:

- This research generates new current knowledge of the degree of satisfaction of the services provided in the Mechanical and Electrical Laboratory.
- This work opens the possibility of creating analysis of each of the areas of the Faculty of Mechanical and Electrical Engineering, this in order to implement strategies that allow solving the problems that are obtained.
- After making each of the conclusions in the respective questions, we can identify that there are areas of opportunity in which to work later.
- Finally, it is important to highlight that the time invested in this work achieves the scope established at the beginning, which lies in generating new knowledge within this area, on the other hand, one of the limitations with which it had to be dealt with It is focused on the current health situation, all this because the students are taking each of their classes remotely, however, every Educational Institution has to adapt to certain conditions, likewise, the Faculty of Electrical Mechanical Engineering is characterized for being a dependency accredited by quality organizations that guarantee the quality of its educational programs and the teaching that is imparted through them, in the same way to highlight that the line of work to be followed as an Institution of Higher Education is to work with quality to achieve excellence.

Hernández Sampieri, R., Fernández Collado, C., Baptista Lucio, M. (2014). *Metodología de la Investigación*, 6ta. Ed., McGraw - Hill / Interamericana Editores, S.A. de C.V.

Mendoza Yucra, H. (2021). *Análisis de Calidad de Energía eléctrica en el hospital iii de Essalud juliaca en el año 2017.*

Siesquén Damián, J. J. (2021). *Análisis de la radiación solar para suministrar energía eléctrica al sector Las Malvinas en el distrito de Huarango-San Ignacio-Cajamarca.*

## References

Rivero, P. E. (2007). *Sistema de gestión de calidad del servicio*. 3a. ed. Bogotá: Ecoe ediciones.

Bologna, E. (2018). *Métodos estadísticos de investigación*. 1a ed. Córdoba, Argentina: Editorial Brujas.

Senlle, A., Gutiérrez N. (2005). *Calidad en los servicios educativos*. 1a ed. España: Ediciones Diaz de Santos.

Macías Rivera, O. B. (2020). *Análisis frecuencias de emisiones electromagnéticas por descargas parciales*