Revista Industrial Data 27(1): 185-205 (2024)
DOI: https://doi.org/10.15381/idata.v27i1.25984.g20445

ISSN: 1560-9146 (Impreso) / ISSN: 1810-9993 (Electrónico)
Facultad de Ingeniería Industrial - UNMSM

Impact of Extrinsic Factors on Not Dissatisfaction with the Quality of Engineering Processes Teaching at a Private University in Peru

JOSÉ LUIS PITA ESPINOZA [1]

SUBMITTED: 16/08/2023 ACCEPTED: 25/10/2023 PUBLISHED: 19/08/2024

ABSTRACT

This paper examines how implementing an Engineering Processes Laboratory (extrinsic factors) led to the non-dissatisfaction of Industrial Engineering students with the quality of teaching in said course. The study used the factor 10-SINEACE (National System of Evaluation, Accreditation and Certification of Educational Quality) and Herzberg's theory to measure this impact. This measurement was performed on a representative sample of students of the Engineering Processes course through a laboratory test. Data was collected on the laboratory equipment requirements and students' needs and was then analyzed using the Mann-Whitney U statistical test. The results showed that the teaching quality was "not dissatisfactory", providing statistical evidence of the positive impact of the Engineering Process Laboratory.

Keywords: extrinsic factors, teaching quality, factor 10-SINEACE, laboratory equipment, laboratory test.

INTRODUCTION

Reform of the Peruvian University System

A recent study conducted by Condori et al. (2022) found that, according to SUNEDU, 47 universities in Peru failed to obtain the longed-for licensing due to their inability to meet the quality standards set by the university system reform that aims to improve the quality of education offered by Peruvian universities.

As we reflect on the past, it becomes clear that we should be concerned about the quality of education and training professionals receive. This raises the question: have educational institutions adequately prepared students for the demands of the labor market? Unfortunately, the answer is no. In fact, as reported by Cuenca and Reátegui (2016), many universities lack basic resources such as drinking water and laboratory equipment, which is particularly concerning for students in engineering and health sciences. Furthermore, there have been reports of professors with serious health conditions teaching classes, which is not ideal.

According to the Superintendencia Nacional de Educación Superior Universitaria [SUNEDU] (2017), licensing is a powerful tool all universities must have. To obtain it, universities must meet eight basic quality requirements, with the most important being the improvement of physical facilities, including the acquisition of laboratory equipment. This is essential for students to receive the necessary technical-scientific training. However, this can be expensive.

1 Master in Business Management. Industrial engineer. Currently working as an Industrial Engineering professor at Universidad Tecnológica del Perú (Lima, Perú) and Universidad Privada del Norte (Lima, Peru).
Orcid: https://orcid.org/0000-0003-3662-2349
E-mail: jolupies2121@gmail.com

This issue is further compounded by the fact that 54% of large companies in Peru have difficulty filling positions due to a shortage of qualified workers, according to ManpowerGroup (2020). This brings us back to the initial question of whether universities are producing graduates who are adequately prepared for the workforce. This is a very worrisome reality.

Lastly, as of January 15, 2022, 143 universities were being reviewed for licensing, according to Medina et al. (2022), as shown in Figure 1.

The most surprising aspect of this statistic is that 34% of universities failed to obtain a license, which means that there is a risk of having a large number of professionals who are not adequately prepared to face a competitive labor market that requires high technical skills.

Based on the results, this study will make an academic contribution by providing relevant information on how external factors can influence non-dissatisfaction with the quality of teaching engineering processes. Additionally, a research model will be developed that can be applied to other Peruvian universities, setting a precedent for academic institutions to consider the needs of engineering students when making decisions.

The findings of this research will contribute to the strategic planning and development of projects, which aim to introduce basic equipment and improve the specialized course experience. This will help motivate students and better prepare them for their future careers.

Background

Verástegui (2021) conducted a study with 73 men and women who participated in simulated laboratories to examine the impact of virtual laboratories on their chemical solution preparation skills. The researcher found that students were able to enhance their procedural skills. This was supported by the Student's *t*-test, which resulted in a control group of 13.36 and an experimental group of 16.00.

In turn, Huerta (2015) proposed using video games in engineering students' internships and aimed to evaluate the effectiveness of the internship programs being taught in selected engineering majors. The author suggests that incorporating serious games in the inverted classroom is an effective way to complement the traditional learning process, as it brings various advantages related to the development of activities and the acquisition of skills.

Meanwhile, Del Valle (2016) proposed an experiment to learn physics. The experiment involved developing, implementing, and evaluating experimental didactic proposals to show optical interference and diffraction events and systematize the difficulties faced by university students in learning about optical interference and diffraction. The author states that students face many theoretical and practical difficulties, based on assumptions when constructing concepts independently, with no scientific support. Moreover, the experience with double slits shows that if there is no light diffraction phenomenon, there will be no interference in the slit output.

Yanitelli (2011) proposed using computers to solve experimental physics situations at the university level. In her study, the author attempted to determine the scope and prospects for the integration of computers in the teaching of physics. The author concluded that 61% of respondents used computers at home, which is a high percentage. She also demonstrated that e-mail is mainly used to manage

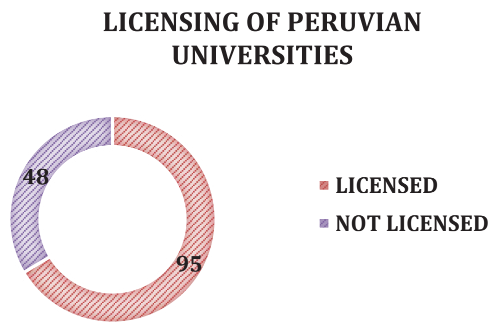

Figure 1. Licensing of Peruvian universities.
Source: Prepared by the author.

various types of software, virtual communities to make friends, download music, videos, and movies, and socialize.

Likewise, Apaza (2021) conducted a study on the impact of project-based learning on industrial automation at Universidad Andina del Cusco. The study included a non-probabilistic sample of 59 male and female students, who were taught to use modern tools such as Simmaq 3D, MS Project, and Cade Simu to improve their technical and practical skills. The researcher emphasizes the need for engineering students to demonstrate proficiency in computer programs to enhance their technical skills. The study found that 93.3% of the students were able to improve their technical skills, demonstrating the effectiveness of project-based learning in enhancing technical proficiency.

Basantes (2017) proposed a ServQual Model to determine the degree of satisfaction that students feel when receiving educational services at Universidad Nacional de Chimborazo, in Ecuador. The aim was to identify the impact of the ServQual academic model on the quality of educational service provided to students pursuing professional careers at said university. The author concluded that the ServQual academic model integrates elements of social demand, student needs, and accreditation requirements. Therefore, it is recommended that future research to identify social demand should be conducted based on competency-based profiles using market research techniques.

Theoretical Bases

Laboratories and their Importance for Education

According to Zaldívar (2019), incorporating the use of laboratories in university education significantly contributes to the training of students. This is because laboratories allow students to gain first-hand experience and develop the scientific method by trial and error to draw important conclusions about many phenomena of reality.

This premise becomes even more important since as many professionals in the labor market today are not even familiar with statistical software such as SPSS at a basic level, due to the lack of exposure during their university studies. This may affect their labor productivity and continuity in the long run.

As per Flores et al. (2014), laboratories provide an opportunity for students to interact with their teacher, who plays a crucial role in guiding their training. Using laboratories encourages students to be more active and engaged, and fosters a continuous relationship with their teacher who leads the main guidelines and demonstrates mastery of the subject matter.

Marín (2010) highlights the importance of laboratory practices for students to develop research skills and gain proficiency in the use of equipment and instruments.

As far as practical skills are concerned, regularly performing laboratory procedures helps standardize students' activities, allowing them to identify equipment, and materials, and understand the work environment, which is essential for their training and preparation for future work environments.

In addition, laboratory work is essential for the development of intellectual skills, particularly in handling and interpreting data and information. It is important to remember that companies are always seeking effective solutions and results, and are thus in search of highly skilled professionals who can efficiently analyze phenomena and make their businesses more competitive.

Moreover, laboratory work also helps students to develop personal skills. Students can exchange ideas, solutions, and criteria, which requires team organization within the laboratory and time management, considering the conditions set by the teacher.

The mentioned criteria complement each other to achieve significant learning. However, the value students perceive from their laboratory experiences is even more important.

Therefore, universities must analyze the needs of students and provide courses that offer solid scientific training that allows them to develop a scientific curiosity. Peru needs researchers who can discover innovative solutions and contribute to companies. They should not only come to learn from the companies but also develop new processes hand in hand with their experience from the university.

It is essential to remember that theory and practice are both necessary for achieving success, discovering new fields of human knowledge, and building a solid learning foundation. Professors are key figures in this process because they guide students in the correct use of laboratory equipment and the scientific method.

Teaching Quality

According to Mendoza (2018), quality in education is a broad variable that can improve constant processes, excellence in performance, and better competencies. The ultimate goal is to improve the knowledge of students and provide them with technical skills that are highly demanded in the labor market.

According to Sistema Nacional de Evaluación, Acreditación y Certificación de la Calidad Educativa (SINEACE, 2016), educational quality should focus on fulfilling the interests of the students. Therefore, educational institutions must commit to providing adequate university education that allows students to become promising researchers in the future.

It is suggested by Inga et al. (2020) that the institutional purpose of universities is to commit to their students. This commitment should be reinforced by implementing adequate educational infrastructure, such as high-quality classrooms and laboratories. This can be further complemented by hiring experienced university teachers who specialize in the transmission of knowledge and demonstrate mastery of laboratory equipment.

Quality management is essential in ensuring that students receive a proper education. However, as Álvarez et al. (2011) mentioned, quality is a major problem in Latin American universities. This is particularly true in Peru, where 48 educational institutions failed to obtain a license. These institutions failed to meet basic quality requirements, such as having trained teachers and adequate infrastructure, which are essential for the development of adequate knowledge in students.

As Inga et al. (2020) point out, the main recipients of educational quality are the students. When students enter the workforce, they can judge whether they have received an adequate education that prepared them for their professions.

The quality of teaching can also be measured from the perspective of the university teacher. Rodríguez et al. (2022) emphasize that a good professor should have a researcher profile that generates new knowledge and can transmit it to students. This reinforces the importance of the scientific method, which includes the technical handling of laboratory equipment. Additionally, professors must have academic preparation and scientific publications to support their appetite for scientific research.

In a study by Merellano et al. (2016), it was found that a good interaction between teachers and students is crucial for generating knowledge and developing adequate competencies in students. The teacher is the central figure in transmitting knowledge, and students must acquire the best possible information to enhance their competencies.

Moreover, Rodríguez et al. (2022) emphasize that universities should take the lead in creating new knowledge to provide solutions to the complex world we live in. It is essential to communicate this to students so that they understand their mission within the field of knowledge. They must not only aim to achieve passing grades but also generate new knowledge and solutions, accompanied by innovative processes, that help humanity.

Extrinsic Factors

According to Serrano (2021), motivation is a key factor in the achieving of goals or objectives. Often, university students attend classes unmotivated, which leads to disinterest in the subject or even falling asleep in class. However, it is a mistake to solely blame the students for this or blame it on their attitudes and lack of skills.

Teachers and universities must provide students with means and methods that spark their interest and engage them in the generation of knowledge. González (2007) adds that the infrastructure that surrounds a person is one of the main points that can generate dissatisfaction, as per Herzberg's theory of extrinsic or hygiene factors. This is concerning since a poorly motivated person may not be productive in executing duties.

Furthermore, the environment in which a person operates can cause anxiety or promote well-being. This reinforces the idea that universities must ensure that their facilities are of high quality, including modern laboratories and other experimental spaces that inspire curiosity and interest.

It is crucial to recognize that extrinsic needs must be met to ensure that students have a positive perception of their academic institution. García and Ovejero (2000) argue that workers are satisfied when they have positive beliefs and values about their work environment, which is similar to the feelings of many university students who demand modern infrastructure from their institutions to facilitate better knowledge generation.

As reported by many Peruvian newspapers, there are universities with cardboard facades, poorly equipped classrooms, and a lack of specialized engineering laboratories that prompted much surprise among the public. Herzberg (2003) once asked what is it that people want from their jobs; similarly, universities should ask themselves the question of what students want from their university. The answer is clear: students want a university that provides them with the best physical conditions to develop their scientific knowledge and technical capabilities so that in the future they can work efficiently and contribute to the progress of humanity.

The good image of a university is not limited to a beautiful building but it is also about its students who are the main product. Their success in the labor market or their scientific discoveries will validate the status of a good university. It all starts in the formative stage within the university. The students' training should be accompanied by the best physical conditions, not just for observation but for constant use that leads to discovery, manipulation, and the ability to contrast results that lead to important conclusions. This will also promote the satisfaction of students and lead them to a solid intellectual world where they can feel comfortable with their achievements.

We must not forget that university is not just a place for creating knowledge but also for human development, which should be in the best possible conditions.

Factor 10 - SINEACE

According to SINEACE (2022), universities continuously work on managing their infrastructure and facilities to keep up with the evolving needs of their students. In addition, to facilitate access to physical and virtual information, universities have information systems that enable the tracking of basic data on their operations.

METHODOLOGY

This experimental, explanatory, and causal research study was conducted to understand the degree to which students are not dissatisfied with the quality of teaching engineering processes at a private university in Peru. A questionnaire that included questions related to tangible and intangible elements, as well as basic quality requirements, was administered to a representative sample of students to better understand their perspectives.

The Mann-Whitney U statistical test for independent samples was used to measure the degree of causality, as there was a control group and an experimental group.

General Hypothesis

Extrinsic factors have a significant impact on the not dissatisfaction of students with the quality of engineering processes teaching at a private university in Peru.

Specific Hypotheses

H_1: The tangible elements of laboratories have a significant impact on the not dissatisfaction of students with the quality of engineering processes teaching at a private university in Peru.

H_2: The intangible elements of laboratories have a significant impact on the not dissatisfaction of students with the quality of engineering processes teaching at a private university in Peru.

H_3: The implementation of basic quality requirements has a significant impact on the not dissatisfaction of students with the quality of engineering processes teaching at a private university in Peru.

Identification of Variables

Independent variable (IV): extrinsic factors (X).

Dependent variable (DV): not dissatisfaction of students with the quality of engineering processes teaching (Y).

A population of 500 students from the Professional School of Industrial Engineering who belong to the Engineering Processes course was considered for a study. An annual sample of 216 students was inferred, and a questionnaire was applied to 108 students enrolled in the 2023-I semester. The sample was divided into two groups: 54 students in the control group, and the other 54 students in the experimental group. The study was conducted using a value of Z = 1.96 at 95%, a margin of error = 0.05, $p = 0.5$, $q = 0.5$.

A questionnaire was designed with three variables and 15 specific questions (Table 1), and it was evaluated by 15 participants. The resulting Cronbach's alpha was 0.459 (Table 2), indicating a moderate level of reliability, which supports the design of the questionnaire. The questionnaire was distributed via the Internet to study the variables.

RESULTS

The Mann-Whitney U statistical test was used to determine whether particular variables have an impact on the not dissatisfaction of students with

Table 1. *Questionnaire by Dimension.*

Tangible Elements
1. The university has sufficient physical resources such as laboratories for special courses, laboratory equipment, and materials.
2. The infrastructure (including laboratories and training equipment) is adequate in terms of appearance and accessibility.
3. The audiovisual equipment (e.g. video, computers, and sound) in the laboratories is sufficient.
4. The university regularly updates the laboratory equipment for each special course.
5. The program has the necessary infrastructure and hardware to function properly in the current state of virtualization.
6. The training program uses the program to develop, expand, maintain, renew, and secure its infrastructure and special training equipment.
Intangible Elements
7. The university offers sufficient virtual resources for special laboratories, including simulation software.
8. The university's online library has enough special materials available to pass special courses that require a visit to the laboratory.
9. The audiovisual equipment in the laboratories (e.g. video, computers, and sound) is sufficient.
Basic Quality Requirements
10. The professors of the special courses are knowledgeable in their subjects and know how to teach them effectively.
11. The didactic methodology used by the teaching staff in laboratory practices is sufficient.
12. The research fields or projects strengthen the students' practical and technical knowledge.
13. The curriculum evaluates the teaching effectiveness of the course through academic monitoring visits, which identify strengths and weaknesses that allow the teacher to improve.
14. The course instructor has a master's or doctoral degree.
15. The students periodically visit research and study laboratories as part of the special courses.

Source: Prepared by the author.

Table 2. *Cronbach's Alpha.*

Reliability Statistics	
Cronbach's Alpha	No. of Items
0.459	15

Source: Prepared by the author.

the quality of engineering processes teaching at a private university in Peru.

General Hypothesis

H_0: Extrinsic factors do not have a significant impact on the not dissatisfaction of students with the quality of engineering processes teaching at a private university in Peru.

$\beta_i = 0$

H_1: Extrinsic factors have a significant impact on the not dissatisfaction of students with the quality of engineering processes teaching at a private university in Peru.

One or more $\beta_i \neq 0$

Specific Hypothesis 1

H_0: The tangible elements of laboratories do not have a significant impact on the not dissatisfaction of students with the quality of engineering processes teaching at a private university in Peru.

$\beta_1 = 0$

H_1: The tangible elements of laboratories have a significant impact on the not dissatisfaction of students with the quality of engineering processes teaching at a private university in Peru.

$\beta_1 \neq 0$

Specific Hypothesis 2

H_0: The intangible elements of laboratories do not have a significant impact on the not dissatisfaction of students with the quality of engineering processes teaching at a private university in Peru.

$\beta_2 = 0$

H_1: The intangible elements of laboratories have a significant impact on the not dissatisfaction of students with the quality of engineering processes teaching at a private university in Peru.

$\beta_2 \neq 0$

Specific Hypothesis 3

H_0: The implementation of basic quality requirements does not have a significant impact on the not dissatisfaction of students with the quality of engineering processes teaching at a private university in Peru.

$\beta_3 = 0$

H_1: The implementation of basic quality requirements has a significant impact on the not dissatisfaction of students with the quality of engineering processes teaching at a private university in Peru.

$\beta_3 \neq 0$

A total of 108 questionnaires were statistically determined and used for the study. The normality testing was conducted using the SPSS software and the results are presented in Table 3.

Table 3. *Normality Testing.*

Tangible Elements Questionnaire	
Significance	
Pretest	0.049
Posttest	0.010
Intangible Elements Questionnaire	
Significance	
Pretest	0.010
Posttest	0.010
Basic Quality Requirements Questionnaire	
Significance	
Pretest	0.010
Posttest	0.010

Source: Prepared by the author.

Normality Testing

H_0: The variable follows a normal distribution.

H_1: The variable does not follow a normal distribution.

The Kolmogorov-Smirnov test was used to test the normality assumption of the data for each variable. The *p*-value obtained for each variable was greater than 0.05, indicating that the null hypothesis (H_0) cannot be rejected, and the assumption of normality of the data is maintained. It is important to verify the normality of the data to choose the appropriate statistic.

Hypothesis Testing

Specific Hypothesis 1

The hypothesis tested is as follows: Tangible laboratory elements have a significant impact on the non-dissatisfaction of students with the quality of engineering processes teaching at a private university in Peru. The Mann-Whitney U Test for independent samples (control and experimental groups) is used for the testing based on the responses to the Tangible Elements Questionnaire (Table 4).

Table 4. *Mann-Whitney Test for Tangible Elements.*

Test		
Null hypothesis	H_0: $n_1 - n_2 = 0$	
Alternative hypothesis	H_1: $n_1 - n_2 \neq 0$	
Method	**W-Value**	**P-Value**
Not adjusted for ties	24 675.00	0.000
Adjusted for ties	24 675.00	0.000

Source: Prepared by the author.

The corresponding hypotheses are stated to conduct the test.

H_0: The tangible elements of laboratories do not have a significant impact on the not dissatisfaction of students with the quality of engineering processes teaching at a private university in Peru.

H_1: The tangible elements of laboratories have a significant impact on the not dissatisfaction of students with the quality of engineering processes teaching at a private university in Peru.

The following decision rule should be followed to reject or accept the null hypothesis:

If *p*-value < 0.05, H_0 is rejected.

If *p*-value > 0.05, H_1 is rejected and H_0 is accepted.

A value of 0.000 was obtained, which is less than 0.05. Therefore, the null hypothesis (H_0) is rejected, and the alternative hypothesis (H_1) is accepted. This implies that tangible laboratory elements have a significant impact on the non-dissatisfaction of students with the quality of engineering processes teaching in a private university in Peru.

Specific Hypothesis 2

The hypothesis tested is as follows: Intangible laboratory elements have a significant impact on the non-dissatisfaction of students with the quality of Engineering processes teaching at a private university in Peru. The Mann-Whitney U Test for independent samples (control and experimental groups) is used for the testing based on the responses to the Intangible Elements Questionnaire (Table 5).

Table 5. *Mann-Whitney Test for Intangible Elements*

Test		
Null hypothesis	H_0: $n_1 - n_2 = 0$	
Alternative hypothesis	H_1: $n_1 - n_2 \neq 0$	
Method	**W-Value**	**P-Value**
Not adjusted for ties	39 061.00	0.000
Adjusted for ties	39 061.00	0.000

Source: Prepared by the author.

The corresponding hypotheses are stated to conduct the test.

H_0: The intangible elements of laboratories do not have a significant impact on the not dissatisfaction of students with the quality of engineering processes teaching at a private university in Peru.

H_1: The intangible elements of laboratories have a significant impact on the not dissatisfaction of students with the quality of engineering processes teaching at a private university in Peru.

The following decision rule should be followed to reject or accept the null hypothesis:

If *p*-value < 0.05, H_0 is rejected.

If *p*-value > 0.05, H_1 is rejected and H_0 is accepted.

A value of 0.000 was obtained, which is less than 0.05. Therefore, the null hypothesis (H_0) is rejected, and the alternative hypothesis (H_1) is accepted. This implies that intangible laboratory elements have a significant impact on the non-dissatisfaction of students with the quality of engineering processes teaching in a private university in Peru.

Specific Hypothesis 3

The hypothesis tested is as follows: The implementation of basic quality requirements has a significant impact on the non-dissatisfaction of students with the quality of engineering processes teaching at a private university in Peru. The Mann-Whitney U Test for independent samples (control and experimental groups) is used for the testing based on the responses to the Basic Quality Requirements Questionnaire (Table 6).

Table 6. *Mann-Whitney Test for Basic Quality Requirements.*

Test		
Null hypothesis	H_0: $n_1 - n_2 = 0$	
Alternative hypothesis	H_1: $n_1 - n_2 \neq 0$	
Method	**W-Value**	**P-Value**
Not adjusted for ties	55 803.00	0.000
Adjusted for ties	55 803.00	0.000

Source: Prepared by the author.

The corresponding hypotheses are stated to conduct the test.

H_0: The implementation of basic quality requirements does not have a significant impact on the not dissatisfaction of students with the quality of engineering processes teaching at a private university in Peru.

H_1: The implementation of basic quality requirements has a significant impact on the not dissatisfaction of students with the quality of engineering processes teaching at a private university in Peru.

The following decision rule should be followed to reject or accept the null hypothesis:

If *p*-value < 0.05, H_0 is rejected.

If *p*-value > 0.05, H_1 is rejected and H_0 is accepted.

A value of 0.000 was obtained, which is less than 0.05. Therefore, the null hypothesis (H_0) is rejected, and the alternative hypothesis (H_1) is accepted. This implies that the implementation of basic quality requirements has a significant impact on the non-dissatisfaction of students with the quality of engineering processes teaching in a private university in Peru.

DISCUSSION

The Mann-Whitney U test was used to test specific hypothesis 1, obtaining a significance level of 0.000. This means that the tangible elements in laboratories have a significant effect on the non-dissatisfaction of students with the quality of engineering processes teaching. The experimental group ranks were found to be superior to the control group. This result is consistent with the findings of Yanitelli (2011), who discovered that 61% of students use computers at home to solve experimental physics situations. Similarly, Apaza (2021) found that engineering students must demonstrate competence in computer programs to improve their technical skills.

In his research, 93.3% of students were able to improve their technical skills.

The Mann-Whitney U test was used to test specific hypothesis 2, obtaining a significance level of 0.000. This means that the intangible elements in laboratories have a significant effect on the non-dissatisfaction of students with the quality of engineering processes teaching. The experimental group ranks were found to be superior to the control group. This result is consistent with the findings of Verástegui (2021), which emphasizes the importance of demonstrating that students can improve their procedural skills in virtual laboratories. This assertion was supported by the Student's *t*-test, which yielded a control group score of 13.36 and an experimental group score of 16.00. It also aligns with the research by Huerta (2015), which suggests that integrating serious games into the inverted classroom is an effective approach to traditional teaching, as it offers several benefits related to the development of activities and skill-building.

The Mann-Whitney U test was used to test specific hypothesis 3, obtaining a significance level of 0.000. This means that the implementation of basic quality requirements has a significant effect on the non-dissatisfaction of students with the quality of engineering processes teaching. The experimental group ranks were found to be superior to the control group. This result is consistent with the findings of Basantes (2017), who concluded that the Academic ServQual model integrates elements of social demand, student needs, and accreditation requirements. It is recommended to conduct future research to identify social demand using market research techniques based on competency-based profiles.

CONCLUSIONS

- The Mann-Whitney U test obtained a significance level of 0.000, indicating that the tangible elements in laboratories have a significant effect on the non-dissatisfaction of students with the quality of engineering processes teaching at a private university in Peru.
- The Mann-Whitney U test obtained a significance level of 0.000, indicating that the intangible elements in laboratories have a significant effect on the non-dissatisfaction of students with the quality of engineering processes teaching at a private university in Peru.
- The Mann-Whitney U test obtained a significance level of 0.000, indicating that the implementation of basic quality requirements in laboratories has a significant effect on the non-dissatisfaction of students with the quality of engineering processes teaching at a private university in Peru.

REFERENCES

[1] Álvarez, S., Cuéllar, C., López, B., Adrada, C., Anguiano, R., Bueno, A., Comas, I., & Gómez, S. (2011). Actitudes de los profesores ante la integración de las TIC en la práctica docente: estudio de un grupo de la Universidad de Valladolid. *Edutec*, (35). https://doi.org/10.21556/edutec.2011.35.416

[2] Apaza Canaza, F. (2021). *Aprendizaje basado en proyectos y su influencia en el desempeño académico de los estudiantes de la Asignatura Automatización Industrial Escuela Profesional de Ingeniería Industrial*, Universidad Andina del Cusco, 2021. (Master's thesis). Universidad Andina del Cusco, Cusco. https://repositorio.uandina.edu.pe/handle/20.500.12557/4553

[3] Basantes Avalos, R. A. (2017). *Modelo ServQual Académico como factor de desarrollo de la calidad de los servicios educativos y su influencia en la satisfacción de los estudiantes de las carreras profesionales de la Universidad Nacional Chimborazo Riobamba-Ecuador.* (Doctoral thesis). Universidad Nacional Mayor de San Marcos, Lima.

[4] Condori Meléndez, H., Romani Miranda, U. I., Serrano Vega, B., Giles Abarca, C. A., & Rivera Muñoz, J. L. (2022). Realidades y perspectivas de la educación superior universitaria en el Perú actual. *Universidad y Sociedad, 14*(3), 469-477.

[5] Cuenca, R., & Reátegui, L. (2016). *La (incumplida) promesa universitaria en el Perú.* Instituto de Estudios Peruanos.

[6] Del Valle Bravo, S. (2016). *La experimentación en el aprendizaje de la física. Su incidencia en la construcción de conceptos referidos a la óptica ondulatoria.* (Doctoral thesis). Universidad Nacional del Centro de la Provincia de Buenos Aires, Tandil. https://ridaa.unicen.edu.ar:8443/server/api/core/bitstreams/60dac5b6-d7d4-4dd2-bec2-65c3f9deac0d/content

[7] Flores Cruz, J. A., Camarena Gallardo, P., & Avalos Villarreal, E. (2014). La realidad virtual, una tecnología innovadora aplicable al proceso de enseñanza de los estudiantes de ingeniería. *Apertura, 6*(2), 1-10.

[8] García Álvarez, A. I., & Ovejero Bernal, A. (2000). Feedback Laboral y Satisfacción. *Revista electrónica iberoamericana de psicología social.*

[9] González Collera, L. A. (2007). La motivación y su historia. *Mendive, 6*(1), 24-28.

[10] Herzberg, F. (2003). Una vez más: ¿Cómo motiva a sus empleados? *Harvard Business Review, 81*(1), 67-76.

[11] Huerta Gómez de Merodio, M. (2015). *Análisis del aprendizaje basado en videojuegos serios en las prácticas de los estudios de Ingeniería.* (PhD dissertation). Universidad de Cádiz, Puerto Real.

[12] Inga Ávila, M. F., Churampi Cangalaya, R. L., & Álvarez Tolentino, D. (2020). Estilos de aprendizaje en estudiantes de ingeniería de sistemas en la Universidad Nacional del Centro del Perú. *CONRADO, 16*(77), 229-233.

[13] ManpowerGroup. (2020). *Cerrando la Brecha de Habilidades: Lo que los trabajadores quieren.* https://www.manpowergroup.pe/wps/wcm/connect/manpowergroup/26fcbef6-6e3d-4172-b251-e56f1e361b47/Estudio-Escasez-de-Talento-2020_FINAL_Lo.pdf?MOD=AJPERES&CONVERT_TO=url&CACHEID=ROOTWORKSPACE.Z18_2802IK01OORA70QUFIPQ192H31-26fcbef6-6e3d-4172-b251-e56f1e361b47-n9ojyG0

[14] Marín Quintero, M. (2010). El trabajo experimental en la enseñanza de la química en contexto de resolución de problemas. Revista *EUCyT, 1*. https://bibliotecadigital.univalle.edu.co/server/api/core/bitstreams/bea6e250-3888-4838-8deb-9b87bfe9117d/content

[15] Medina Chalco, K. Y., Mamani Machaca, E. S., & Barrientos Quintanilla, K. P. (2022). Método para la Implementación del Estándar 8 del Modelo de Acreditación de SINEACE para el Aseguramiento de la Calidad en el Proceso de Acreditación de un Programa Profesional. *Proceedings of the 20th LACCEI international Multi-conference for Engineering, Education and Technology: “Education, Research and Leadership in Post-pandemic Engineering: Resilient, Inclusive and Sustainable Actions”.*

[16] Mendoza, D. J. (2018). Estrategias de enseñanza y su efectividad en los procesos de aprendizaje en los estudiantes de turismo de la Universidad Iberoamericana de Ecuador. *Espacios, (39)*43, 25.

[17] Merellano Navarro, E., Almonacid Fierro, A., Moreno Doña, A., & Castro-Jaque, C. (2016). Buenos docentes universitarios: ¿Qué dicen los estudiantes? *Educação e Pesquisa, 42*(4), 937-952. https://doi.org/10.1590/S1517-9702201612152689

[18] Rodríguez Díaz, B., Barboni Morales, L., Arboleya Arboleya, A., & Hartmam Basaistegui, R. H. (2022). Paradigm shift in education and research in the subject design of antennas and of circuits. *Telemática, (21)*2, 60-71

[19] Serrano, V. (2021, June 11). Factores Higiénicos y Factores Motivadores: Herzberg, *Uvedevisi.* http://uvedevisi.blogspot.com/2018/11/factores-higienicos-y-factores.html

[20] Sistema Nacional de Evaluación, Acreditación y Certificación de la Calidad Educativa. (2022). *Factores que intervienen en la decisión de acreditar programas de estudio de educación superior universitaria en el Perú.* https://hdl.handle.net/20.500.12982/7119

[21] Sistema Nacional de Evaluación, Acreditación y Certificación de la Calidad Educativa. (2016). *Modelo de Acreditación para instituciones de Educación Básica.* https://hdl.handle.net/20.500.12799/5143

[22] Superintendencia Nacional de Educación Superior Universitaria. (2017). *Informe bienal sobre la realidad universitaria peruana.* https://hdl.handle.net/20.500.12799/5716

[23] Verástegui Betalleluz, A. V. (2021). *Uso didáctico del laboratorio virtual y su influencia en el aprendizaje por competencias de soluciones químicas en estudiantes de la Universidad Continental 2020.* (Master’s thesis). Universidad Continental, Huancayo. https://repositorio.continental.edu.pe/bitstream/20.500.12394/10372/1/IV_PG_MEMDES_TE_Verastegui_Betalleluz_2021.pdf

[24] Yanitelli Ruiz, M. S. (2011). *Un cambio significativo en la Enseñanza de las Ciencias: El uso del ordenador en la resolución de situaciones experimentales de Física en el nivel universitario básico.* (Doctoral thesis). Universidad de Burgos, Burgos.

[25] Zaldívar Colado, A. (2019). Laboratorios reales versus laboratorios virtuales en las carreras de ciencias de la computación. *IE revista de investigación educativa de la Rediech, 10*(18), 9-22. https://doi.org/10.33010/ie_rie_rediech.v10i18.454