International Journal of Evaluation and Research in Education (IJERE)
Vol. 11, No. 4, December 2022, pp. 1760~1768
ISSN: 2252-8822, DOI: 10.11591/ijere.v11i4.22696

Evaluation of the learning management system and its relationship in the perception of engineering students

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Article Info

Article history:

Received Aug 10, 2021
Revised Aug 7, 2022
Accepted Sep 1, 2022

Keywords:

Engineering students
Learning management system
Perception
Virtual teaching-learning

ABSTRACT

The objective of this study was to identify the results of the learning management system (LMS) functionality, and its relationship in the perception of electronic engineering students. The results serve as a basis for continuous improvement for the higher institution, because these systems are tools that have the purpose of improving the performance and retention of the student in the virtual teaching-learning process. Initially, the reliability of the data collected was determined using Cronbach's Alpha, obtaining a consistency coefficient of 0.868. After processing the data in the SPSS software, using the 5-level Likert scale, it was determined that the indicators that present a better perception are related to the design and ease of navigation. However, 21.4% do not fully agree with the functionality, due to the technical problems presented when downloading the study material. The effect generated by the optimal functionality of the LMS is 70.87% satisfaction in students. The Chi square test validated the cause-effect relationship, with a significance of 0.000, between the functionality of the LMS, on the perception of the students. It determined that the indicators with a greater relationship refer to design, availability (connectivity) and ease of communication and interaction with the teacher and their peers.

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1. INTRODUCTION

The multiple measures given by the Peruvian government due to the COVID-19 pandemic, originated a series of abrupt changes for the entire society [1], [2]. Its rapid spread has affected most sectors, including the education sector, which was forced to adapt its services to a virtual teaching environment that, until a few years ago in Peru, was only carried out on a small scale [3]–[5]. In this context of changes, the quality and satisfaction of the student becomes much more important, therefore it is necessary to have knowledge of the weak aspects, which must be corrected in the teaching method and the elements that are used in its development [6]–[8]. Within this entire process, the student constitutes a remarkable milestone, since his perception allows a global assessment of the teaching model [9], [10].

Under this context, the education sector made the decision to continue with the development of the academic activities of the teaching process, through the implementation of learning management system

(LMS) or tele-training platforms, for which it had to be carried out accelerated training for teachers and students in the use of this new virtual environment [11]–[15]. As this transition of the teaching process was sudden, it was possible to show some difficulties inherent to this new technology, but also many significant advantages. Some studies conclude that, due to technological advances, teachers have a variety of tools to improve and optimize their teaching practice with the demands that today's students demand [16], [17]. There are different degrees of student satisfaction with how they feel with the incorporation of LMS into their subjects, and it has been observed in some research that some even improve their academic performance [18]–[21]. The satisfaction of students regarding the use of technological, didactic and interactive tools by the teacher is part of the success of virtual programs [22], [23].

Learning management system is a set of synchronous and asynchronous computer applications that facilitate the management, development and distribution of subjects through the internet, which must guarantee interactivity, flexibility, scalability, usability and functionality [24], [25]. Taking into account that, at the moment, the university student is linked to the achievement of what has been called digital competence to obtain their higher degree, it is important to know the perception of the students with the implementation of the systems learning [26]. Faced with this panorama, the role of the student undergoes a redefinition of its vision, so it must now be placed in a holistic perspective that allows it to expand its training and generate new values, skills and visions of the educational and work world that surrounds it [27], [28].

The quality of the LMS in virtual education is visible in the degree of satisfaction that the student obtains from the tool, making it transparent for him the presence or absence of errors that have not been identified during its development [29], [30]. Previous researchers [31], [32] pointed out that the evaluation of a LMS in teaching through student satisfaction is necessary, because it represents the degree of acceptance and level of use of said technological tool. In this sense, the objective of this article is to identify the results of the evaluation of the functionality of the LMS, and its relationship caused in the perception of engineering students; the degree of relationship was determined through Chi square and crossed tables.

2. RESEARCH METHOD

The research identified and described the behavior of people in the face of a circumstance. Without influencing it, the analysis was carried out on the results of the evaluation of the LMS according to the perception of the students engineering. The study in progress integrated 56 electronic engineering students belonging to the eighth cycle of the control engineering course. This research used the survey technique, in which, through a virtual questionnaire of 12 questions, the perception of the 56 students was obtained. The 5-level Likert scale was used to process the data collected through the questionnaire. The design of the instrument responds to the "Distance Higher Education Quality Service" (DIHEQS) model, the indicators of the selected dimensions and their respective abbreviations (A), Functionality of the LMS (FP) and student satisfaction (IS). They are shown in Table 1 (It should be noted that the instrument of the model used "DIHEQS" was validated in [19], while the reliability of the data collected from the present investigation was validated through Cronbach's alpha, whose reliability result is 0.868).

Table 1. Indicators of the dimensions of the LMS (FP) and student satisfaction (IS)

A	LMS functionality	A	Satisfaction towards the functionality of the LMS
FP1	The LMS features an attractive design	IS1	I feel good when I interact with other classmates through the LMS
FP2	The LMS maintains updated information on everything related to the subject	IS2	Visualizing the design of the LMS gives me satisfaction
FP3	The LMS never presents problems downloading study material	IS3	I am satisfied with the information I find in the LMS
FP4	The LMS is easy to use	IS4	I feel relaxed when navigating the LMS
FP5	The LMS always has availability (Optimal connectivity)	IS5	The LMS generates security because my private information is not shared with other who also enter
FP6	The LMS facilitates communication between students and teachers	IS6	I feel greater satisfaction when teachers and students participate simultaneously in the LMS

3. RESULTS AND DISCUSSION

The results of the evaluation of the functionality of the LMS according to the perception of engineering students are shown in Figure 1. Regarding the functionality of the LMS, Figure 1 shows that the FP2 and FP4 indicators are the ones that have been best evaluated, with 89.3% of students fully agreeing with the updated information they find on everything related to the control engineering course and with the ease of navigating the LMS. Next is the FP1 indicator with 75% of students who fully agree with the design presented by the LMS. However, it should be taken into account that 14.3% of the students disagree and

21.4% state that they do not agree or disagree with the technical problems presented by the LMS when downloading the material of study (FP3). However, 28.6% of student's state they do not agree or disagree with the ease of communication between students and teachers that the LMS gives them.

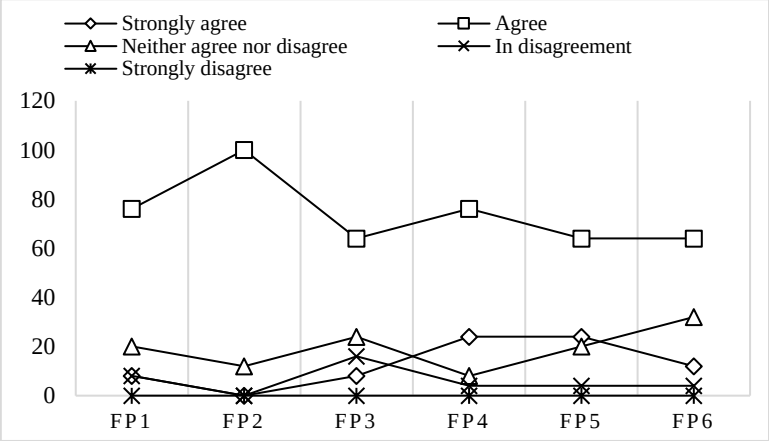

Figure 1. Evaluation of the functionality of the LMS

Figure 2 shows the results of the perception of satisfaction of the LMS, according to the students belonging to the control engineering course. Once the results of the evaluation of the functionality of the LMS have been analyzed, Figure 2 shows the results, regarding the effect caused on the perception of satisfaction of electronic engineering students in the control engineering course. Given this, it is identified that IS5 is the one that presents a better perception with 82.2% of students who fully agree with the security provided by the LMS, regarding their private information. Next is the IS2 indicator with 78.6% of students who feel satisfaction when viewing the design of the LMS. Likewise, there are the IS1 and IS6 indicators, both with 75%, of satisfaction when interacting with other classmates and with participating simultaneously with the teachers through the LMS. In general, the optimal functionality of the LMS generates a positive effect on the perception of electronic engineering students, with 70.87% being satisfied with the tele-training platform in the development of the engineering course of control.

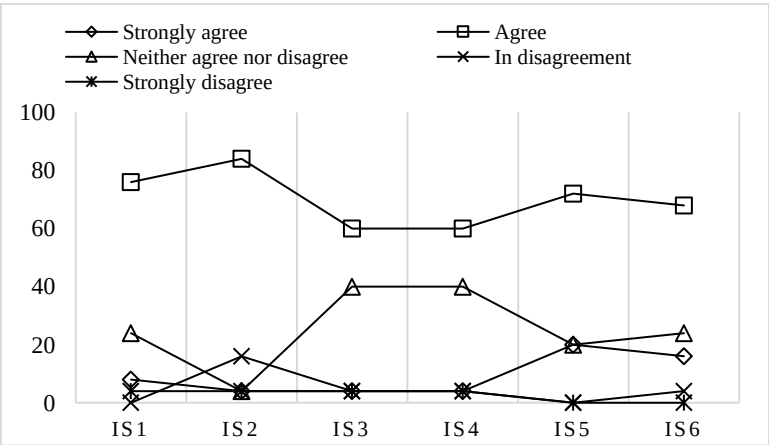

Figure 2. Perception of satisfaction with the learning management system

Finally, by means of the Chi-square test through the SPSS, the relationship between the functionality of the LMS on the perception of electronic engineering students of the control engineering course is validated. Table 2 shows the results obtained, also due to the Spearman correlation coefficient is used to measure the level of relationship of the variables under analysis.

Table 2. Chi-Square correlation test

	Chi-square test	
	Value	Asymptotic significance (bilateral)
Pearson's Chi-square	193.136	.000
Spearman correlation	0.602	.000
N of valid cases	56	

Being the level of significance of 0.05, according to Table 2, the value of the asymptotic significance is 0.000, this value being less than 0.05 (level of significance). The relationship between the functionality of the Management System is validated as a first step of LMS about the perception of electronic engineering students of the control engineering course. Hence, by means of the Spearman coefficient it is determined that the level of relationship is high.

Next, it was analyzed which of the indicators that make up the functionality variable of the LMS. This analysis was carried out using the Spearman coefficient. Table 3 shows the results. The table shows that the indicators of the functionality variable of the LMS that have a greater relationship with the satisfactory perception of the students refer to the design and the ease of communication, interaction with the teacher and with his colleagues from the control engineering course.

Table 3. Spearman correlation test

Indicators of the functionality of the LMS	Perception of student satisfaction
FP1	0.640
FP2	0.414
FP3	0.336
FP4	0.400
FP5	0.419
FP6	0.617

Once it has been determined in Table 3 that the FP6 indicator is the one that presents a greater relationship with satisfaction in the perception of students, through the cross-table test, we will state the relationship existing in both indicators. These results are shown in the Table 4. This table reveals that the existing relationship in both indicators is expressed as: 100% of 3.6% of the total of 56 students who disagree that the LMS facilitates the communication between peers and teachers (FP6), they also do not agree with the satisfaction that the LMS generates when teachers and students participate simultaneously (IS6). On the other hand, 62.5% of the 21.4% of the total of 56 students agree that they do not agree or disagree with FP6 and IS6, while 33.3% who strongly agree with FP6, state that they do not agree or disagree with IS6. In addition, 37.5% of the 60.7% of the total of 56 students who state that they do not agree or disagree with FP6 agree with IS6 and 81.3% who agree with FP6 agree with IS6, in the same way the 33.3% of the 14.3% of the total of 56 students agree to agree with both indicators.

Table 4. FP6 and IS6 cross tables

		IS6				
		In disagreement	Neither agree nor disagree	Agree	Strongly agree	Total
FP6	In disagreement	100.0%	0.0%	0.0%	0.0%	100.0%
	Neither agree nor disagree	0.0%	62.5%	37.5%	0.0%	100.0%
	Agree	0.0%	0.0%	81.3%	18.8%	100.0%
	Strongly agree	0.0%	33.3%	33.3%	33.3%	100.0%
	Total	3.6%	21.4%	60.7%	14.3%	100.0%

The development of the research generates a significant academic contribution. It allows identifying which are the indicators that do not contribute to the improvement of student satisfaction with respect to the use of the LMS, because from the identification the corresponding corrective measures is taken. In addition, during the accelerated change of the presential to virtual teaching process, which is being implemented for the first time, in the higher institution, the concern of students who are studying theoretical-practical careers must be taken into account. As is the case of the Engineering careers, since at the beginning of the teaching process, they stated that their learning could be given in a limited way or that they would lose a large part of the experiences that were achieved in person at the university. For this reason, the results of the research will

allow the teacher of the course and the higher institution to know the perception of the group in analysis about the LMS and its relationship with the satisfaction of the virtual teaching process.

In this way, the originality of the research is also generated, since a specific study has not been carried out in the higher institution previously regarding the factors or dimensions that are related to the satisfaction of the teaching-learning process, even more, low a virtual education environment. For this reason, there is no reference point in said institution that indicates the development of the educational process. It is also important to have these results to be able to make decisions if it is possible to maintain this type of virtual modality in the higher institution. Since, since it does not have a base or a reference, a comparison could not be made to determine in the next semesters if there has been an improvement in the teaching process. That also allows virtual education to be maintained under the hybrid education approach.

For this reason, it is important for carrying out an analysis under the decisions and strategies taken by the government in the education sector. It allows to determine if an effect or repercussion is generated in students who study theoretical-practical careers, in public institutions that for the first time and of they have applied this virtual teaching-learning modality in an accelerated way. They need to have a point of reference for future lines of research, which fully cover the different professional careers that comprise it.

Regarding this, in [30] it is pointed out that the virtualization of the teaching-learning process has a complex and dynamic nature, as well as being highly demanding. It is especially in institutions that implemented for the first time. This is therefore innovative and highly dependent on the capacity, on the one hand, of the institution to make available relevant and suitable virtual tools, and on the other, on having teachers capable of taking on the challenge of virtualizing the process. The situation had already been noted in previous investigations.

The results of the functionality of the LMS show us that the satisfaction of the indicators under analysis focus on the reliability, design, security, availability, interaction and ease of use of the virtual platform. Regarding the ease of use of virtual platforms, it should be taken into account that in the digital environment the services offered must be friendly and fast for the user, in order to generate a good perception of the user experience. In addition, as it has been determined by means of Chi-square, there is a high cause-effect relationship of the functionality of the LMS on the perception of electronic engineering students of the control engineering course. In addition, the evaluation of the quality of the LMS indicates that the most influential indicators refer to the design, the ease of communication and interaction with the teacher and classmates.

The assessment of the LMS is proportional to the experience that the student has to access it. Although it is true, there is an optimal perception with the system, not all students can appreciate the good functioning, which is why this affects the level of satisfaction. As indicated in [5] there is a relationship between the efficiency of the platform and the satisfaction of the students, because 100% of the students who find the platform used “Very inefficient” are those who are “Very Dissatisfied”, with the implementation of the virtual system. On the other hand, 59% of the students who find the platform used "Very Efficient" are "Satisfied".

As indicated in [5], the assessment shown by the students regarding the efficiency of the support tools used by the universities varies depending on the experience they have with respect to the platforms used and the availability of means. Sought easy access and operation platforms, students believe that these tools are effective and are a factor that positively influences their satisfaction. However, on certain occasions this is affected due to the inconveniences caused by the lack of means. Likewise, in the research carried out by Zúñiga *et al*. [1] pointed out that it was determined a direct and significant relationship between the perception of the virtual platform and the satisfaction of the students of systems engineering (p=0.00).

According to the results, 28.6% of the students do not fully agree with the ease of communication between students and teachers provided by the LMS. This is similar to previous research [31], where it is stated that Communication between the teacher and the student, and between the students themselves, is essential. The students expected more interaction with the teacher through of the platform or that it should be more demanding, so that students make their contributions more frequently and in a timely manner in the forums. As indicated in previous study [31], these results become more relevant considering that 100% of the students were participating for the first time in the modality of teaching-learning formative processes.

In [6], it is pointed out that the analysis carried out in this work shows the acceptance by the people surveyed about the use of the Microsoft Teams platform for the development and approach of virtual classes held in the first semester of 2020. By having these results, it is advisable that in future circumstances or even for the use of distance classes this tool should be used. Since, there is not a high percentage of disagreement with the use of it in the development of the classes regardless of the subject taught. Therefore, without a doubt, this work allows us to identify the satisfaction obtained by the students based on the tools provided to complete a semester in the middle of a health emergency.

As indicated in previous study [18], university students value the contribution of the LMS when they understand that the teaching proposal helps them personally to have a greater organization (88.0%), to work more autonomously (87.7%), and to have a more global vision of the subjects (84.7%). It is also increasing the perception of quality about them (79.9%). Furthermore, this method allows a greater personalization of education processes (67.7%). The student perceives that he learns more (70.7%) and where communication/interaction between the parties grows (74.9%). It allows them to attend less tutorials or consultations with the teaching staff (54.5%) but, in turn, makes them become more involved or participate in the subjects (60.8%), thus perceiving satisfaction with the skills professionals acquired.

4. CONCLUSION

The implementation of LMS in higher education is an unquestionable reality today, as a result of this we find a new teaching system that has both positive aspects and limitations. However, its use implies that students generate an opinion both towards the tool and towards the system itself, since this technological tool must meet the objectives proposed by the higher institution, also meeting the expectations of the students. The perception of the respondents allowed to know the level of satisfaction about some pedagogical strategies that encompass the teaching process, in order to verify the effectiveness of virtual learning, collaborative learning and the evaluation system. The importance of the study lies in the fact that, knowing these criteria, it is possible to carry out improvement actions that encourage the higher institution to efficiently and effectively develop these technological tools to continuously guarantee the quality of education if the health emergency continues. This will allow a better adaptation on the part of the students, stimulating their desire to learn and possibly increasing the levels of satisfaction in the future around the new learning modality.

Taking into account the indicators that students state that they do not fully agree, with the ease of communication between students and teachers provided by the LMS, this reaffirms the important role generated by the use of suitable technological tools and the teacher performance in the teaching virtualization process. For this reason, it is necessary to invest decisively in training and, therefore, in acquiring competence in terms of the technological tools used by teachers in the development of courses, accompanied by training in the implementation of teaching strategies virtual that allow students to acquire professional skills that they consider to be of an appropriate level. This is due to the fact that student satisfaction is the fundamental element to achieve the expectations of quality of academic services. It is also necessary for teachers to adopt measures to motivate and help students both from the beginning and during the development of the training action. Likewise, to continue improving the educational process, virtual group activities should be considered in the planning of the courses, where collaboration between the participants is used to achieve their needs in terms of professional skills. The results of the research will allow working on the development and continuity of other lines of research that have emerged throughout the development process of this research, which can enrich the model presented here, a line of research is framed in determining long term, the impact of the use of technological tools on the achievement of competencies of electronic engineering students at the undergraduate level.

REFERENCES

[1] J. Padilla-Zúñiga, A. M. Soto-Estrada, I. N. Serratos, and N. Castañeda-Villa, "Remote teaching in the face of COVID-19: teaching experiences in four subjects of the UAM-I," *Educacion Quimica*, vol. 31, no. 5, pp. 144–151, 2020, doi: 10.22201/fq.18708404e.2021.6.77106.

[2] K. Syauqi, S. Munadi, and M. B. Triyono, "Students' perceptions toward vocational education on online learning during the COVID-19 pandemic," *International Journal of Evaluation and Research in Education (IJERE)*, vol. 9, no. 4, pp. 881–886, 2020, doi: 10.11591/ijere.v9i4.20766.

[3] K. M. A. Mena and Dustin Ezequiel Amador Jiménez, "Stress, coping strategies and academic experience in university students in times of the Covid-19 pandemic: The experience of Nicaragua and Chile," *Revista Torreón Universitario*, vol. 10, no. 27, pp. 1–14, 2021, doi: 10.53 77/torreon.v10i27.10839.

[4] F. J. García-Peñalvo, A. Corell, V. Abella-García, and M. Grande, "La evaluación online en la educación superior en tiempos de la COVID-19," *Education in the Knowledge Society (EKS)*, vol. 21, pp. 1–26, May 2020, doi: 10.14201/eks.23013.

[5] A. J. D. S. C. G. X. Villanueva Paredes, K. G. Calcina Málaga, K. P. Chipa Candia, A. J. Fuentes Calcina, "Satisfaccion Del Estudiante Respecto A La Educacion Virtual En Tiempos De Covid-19," *SCIENTIARVM*, vol. 1, no. 1, pp. 13–17, Jul. 2015, doi: 10.26696/sci.epg.0107.

[6] I. Bautista, G. Carrera, E. León, and D. Laverde, "Evaluación de satisfacción de los estudiantes sobre las clases virtuales," *Minerva*, vol. 1, no. 2, pp. 5–12, Aug. 2020, doi: 10.47460/minerva.v1i2.6.

[7] B. A. Alabadan, T. M. Samuel, P. I. Ajewole, and O. M. Anyanwu, "Competence-driven engineering education: A case for T-shaped engineers and teachers," *International Journal of Evaluation and Research in Education (IJERE)*, vol. 9, no. 1, pp. 32–38, 2020, doi: 10.11591/ijere.v9i1.20274.

[8] O. F. C. Atalaya, T. N. D. Leyva, D. Y. A. Santillan, J. I. C. Bedriñana, D. M. B. Pichilingue, and A. Roman-Gonzalez, "Satisfaction of the graduate for the continuous improvement of educational quality in untels," *Advances in Science, Technology and Engineering Systems*, vol. 4, no. 5, pp. 151–157, 2019, doi: 10.25046/aj040520.

[9] M.-I. González-Alonso, R.-Á. Fernández-Díaz, and M. De Simón-Martín, "Evolución de la autopercepción del nivel de adquisición de competencias de los estudiantes de una asignatura de Grado en Ingeniería," *Revista Infancia, Educación y Aprendizaje*, vol. 3, no. 2, pp. 441–447, Jun. 2017, doi: 10.22370/ieya.2017.3.2.762.
[10] O. F. C. Atalaya, D. Y. A. Santillan, J. I. C. Bedriñana, T. N. D. Leyva, and Denisse Marie Barrientos Pichilingue, "Comparative analysis of student dissatisfaction of the continuing academic semesters at UNTELS," *Advances in Science, Technology and Engineering Systems*, vol. 4, no. 6, pp. 203–207, 2019, doi: 10.25046/aj040626.
[11] A. C. Justo López, L. Castro García, W. E. Aguilar Salinas, and M. de las Fuentes Lara, "Digital educational strategies to support basic engineering science courses," *Apertura*, vol. 13, no. 1, pp. 52–67, 2021, doi: 10.32870/ap.v13n1.1983.
[12] D. Nofriansyah, Ganefri, and Ridwan, "A new learning model of software engineering in vocational education," *International Journal of Evaluation and Research in Education (IJERE)*, vol. 9, no. 3, pp. 572–582, 2020, doi: 10.11591/ijere.v9i3.20482.
[13] M. del M. López Guerrero, G. López Guerrero, and S. Rojano Ramos, "Uso de un simulador para facilitar el aprendizaje de las Reacciones de Óxido-Reducción. Estudio de caso en la Universidad de Málaga," *Educación Química*, vol. 29, no. 3, pp. 79–98, Aug. 2018, doi: 10.22201/fq.18708404e.2018.3.63728.
[14] P. Junpeng *et al*., "Validation of a digital tool for diagnosing mathematical proficiency," *International Journal of Evaluation and Research in Education (IJERE)*, vol. 9, no. 3, pp. 665–674, 2020, doi: 10.11591/ijere.v9i3.20503.
[15] M. Sarauz, J. Shuguli, D. Vaca, and R. Villafuerte, "Evaluación de satisfacción a los estudiantes sobre el uso del software Microsoft Teams," *Minerva*, vol. 1, no. 2, pp. 13–18, Aug. 2020, doi: 10.47460/minerva.v1i2.7.
[16] T. Baviera, A. Baviera Puig, and J. M. Buitrago Vera, "Cómo evaluar la competencia transversal 'trabajo en equipo' desde un enfoque 180º en estudiantes universitarios," in *Libro de Actas IN-RED 2018: IV Congreso Nacional de Innovación Educativa y Docencia en Red*, Jul. 2018, pp. 1453–1458, doi: 10.4995/INRED2018.2018.8733.
[17] J. R. Segrere-Arellana, Paez-Logreira, and A. A. Polo-Tovar, "Future professionals e-skills in pandemic times," *Utopia y Praxis Latinoamericana*, vol. 25, no. 11, pp. 221–229, Nov. 2020, doi: 10.5281/zenodo.4278352.
[18] F. B. Rodríguez, J. L. Lapaz Castillo, and M. A. Fueyo Gutiérrez, "Perception and Evaluation of The Pupils on The Proposals Learning in Grades of Industrial Engineerings and Of Telecommunication," *Scientific Journal of Opinion and Disclosure*, vol. 12, no. 34, pp. 1–16, 2016, [Online]. Available: https://raco.cat/index.php/DIM/article/view/313803.
[19] K. Al-Omar, "Evaluating the Internal and External Usability Attributes of E-Learning Websites in Saudi Arabia," *Advanced Computing: An International Journal*, vol. 8, no. 3/4, pp. 01–12, 2017, doi: 10.5121/acij.2017.8401.
[20] M. Delgado Fernández and A. Solano González, "Estrategias didácticas creativas en entornos virtuales para el aprendizaje," *Actualidades Investigativas en Educación*, vol. 9, no. 2, pp. 1–21, Mar. 2011, doi: 10.15517/aie.v9i2.9521.
[21] N. Bedregal-Alpaca, V. Cornejo-Aparicio, D. Tupacyupanqui-Jaén, and S. Flores-Silva, "Evaluation of the student perception in relation to the use of the moodle platform from the TAM perspective," *Ingeniare*, vol. 27, no. 4, pp. 707–718, 2019, doi: 10.4067/S0718-33052019000400707.
[22] M. S. De Peralta and J. Marín, "Alternativas de la Administración Educativa a nivel superior ante el efecto de la covid-19," *Centros: Revista Científica Universitaria*, vol. 9, no. 2, pp. 178–187, Jul. 2020, doi: 10.48204/j.centros.v9n2a11.
[23] D. A. González, F. Tucho, and R. Marfil-Carmona, "The dimensions of media competence in Spanish university students," *Icono14*, vol. 18, no. 2, pp. 217–244, 2020, doi: 10.7195/RI14.V18I2.1492.
[24] K. L. Soria-Barreto and M. R. Cleveland-Slimming, "Percepción de los estudiantes de primer año de ingeniería comercial sobre las competencias de pensamiento crítico y trabajo en equipo," *Formación universitaria*, vol. 13, no. 1, pp. 103–114, Feb. 2020, doi: 10.4067/S0718-50062020000100103.
[25] V. Miná, M. Silvestre, and L. Otero, "Self-regulated learning in engineering students: Strategies for pedagogical resource," *Anales de la Asociacion Fisica Argentina*, vol. 32, no. 1, pp. 32–38, 2021, doi: 10.31527/analesafa.2021.32.1.32.
[26] M. D. Montagud Mascarell and J. L. Gandía Cabedo, "Entorno virtual de aprendizaje y resultados académicos: evidencia empírica para la enseñanza de la Contabilidad de Gestión," *Revista de Contabilidad*, vol. 17, no. 2, pp. 108–115, Jul. 2014, doi: 10.1016/j.rcsar.2013.08.003.
[27] D. Y. A. Santillan, O. F. C. Atalaya, Y. P. L. Chacón, J. I. C. Bedriñana, and E. R. M. Santillán, "The proportionality of women graduated from the professional career of mechanical and electrical engineering at UNTELS: Analysis of their academic performance and labor field of action," *Advances in Science, Technology and Engineering Systems*, vol. 5, no. 1, pp. 368–372, 2020, doi: 10.25046/aj050147.
[28] O. F. C. Atalaya, D. Y. A. Santillan, J. I. C. Bedriñana, Y. P. L. Chacón, and M. D. Choque, "The correlation of the specific and global performance of teachers in UNTELS engineering schools," *Advances in Science, Technology and Engineering Systems*, vol. 4, no. 6, pp. 196–202, 2019, doi: 10.25046/aj040625.
[29] E. O. Cardoso and M. T. Cerecedo, "Valoración de las Competencias Investigativas de los Estudiantes de Posgrado en Administración," *Formación universitaria*, vol. 12, no. 1, pp. 35–44, Feb. 2019, doi: 10.4067/S0718-50062019000100035.
[30] R. A. Corporan, A. H. Martín, and A. V. M. García, "Satisfaction of Teachers and Students with the use of Collaborative Learning Methodologies Mediated by ICT: Two Case Studies," *Estudios Pedagogicos*, vol. 47, no. 2, pp. 79–97, 2021, doi: 10.4067/S0718-07052021000200079.
[31] R. Curci La Rocca, "Satisfacción de los estudiantes respecto a las acciones formativas e-learning en el ámbito universitario.," *Pixel-Bit Revista de Medios y Educación*, pp. 215–229, 2014, doi: 10.12795/pixelbit.2014.i44.15.
[32] R. Giordano Lerena and S. Cirimelo, "Competencias en ingeniería y eficacia institucional," *Ingeniería Solidaria*, vol. 9, no. 16, pp. 119–127, Apr. 2014, doi: 10.16925/in.v9i16.536.

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