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Collaborative learning through virtual tools: Analysis of the perception of student satisfaction of teaching performance

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ABSTRACT

The objective of this article is to identify the results of the evaluation of collaborative learning through technological tools as part of the pedagogical strategies in the virtual teaching process. For the evaluation, the SERVQUAL model was used, through which it was identified that 97.73% satisfactorily evaluate the reliability and security of pedagogical strategies through technological tools used in collaborative learning in the teaching process in virtual environments. The optimal evaluation regarding the reliability of collaborative learning is 100% related to compliance with the syllable, to the teacher's disposition to help them in the use of technological tools and to the conformity of the technological tools used in the subject. Regarding the security of collaborative learning, 100% of the satisfactory evaluation is related to the trust and kindness that the teacher transmitted with the use of technological tools in teaching in virtual environments.

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1. INTRODUCTION

In recent years, due to the high efforts in the application of educational policies to improve quality, Latin American and Caribbean countries have become a showcase of transformation for university education [1], [2]. Thus, an alternative to improve the teaching level is to renew the quality of educational services, based on the qualitative evaluation of pedagogical strategies [3]-[5]. And it is that by developing and putting into practice a mechanism for evaluating the quality of academic services during collaborative learning, they guarantee to satisfy the basic needs of students [6], [7].

Nowadays, in the virtual teaching process it is considered necessary to monitor the performance of the pedagogical strategies of the university teacher, since their development in the collaborative learning process is linked to the educational quality and the achievements that the students can acquire [8]-[11]. It is pointed out that an aspect to be taken into account in teacher performance is pedagogical strategies, since that is where the degree of direct relationship between the teacher and the student is perceived [12], [13]. In this regard in [14]-[16], it is pointed out that the strategies that the teacher must develop in their educational practice must be centered on the student as the creator of their own knowledge, however, the teacher must generate the appropriate context so that learning can be done efficiently. It is pointed out that a model for evaluating the pedagogical strategies of higher-level institutions is the service quality (SERVQUAL) model,

and this instrument establishes a relationship between the expected service and the service received. In this regard, in [17], [18], the authors point out that the SERVQUAL model assesses the gap between expectations and perception of the quality of services along five dimensions: empathy, responsiveness, security, tangible elements and reliability [19], [20].

However, it is important to note that in the face of the state of health emergency declared worldwide by COVID-19, the use of technological tools, as well as the use of virtual platforms, have allowed the continuity of the educational service [21]-[23]. Universities today are aware of the importance of technological tools in training processes [24], [25]. It is pointed out that it is a generalized appreciation of teachers that technological tools in collaborative learning have become pedagogical strategies for the improvement of teaching in virtual environments [26], [27]. In this sense, this article aims to identify the results of the evaluation of collaborative learning through technological tools as part of the pedagogical strategies in the virtual teaching process, the evaluation of which will be carried out under the SERVQUAL model.

2. METHOD

2.1. Level of investigation

The research level is descriptive, because it analyzes the results in their natural state, without applying any action directly or indirectly on the variable under study. This description will focus on identifying the results of the evaluation of collaborative learning through technological tools, from the perception of Mechanical and Electrical Engineering students. The evaluation is carried out using the SERVQUAL quality evaluation model.

2.2. Participants

In this study, the participants are students of the National Technological University of Lima Sur. Of the professional school of mechanical and electrical engineering. Of the eighth cycle of studies and of the course of design of electrical control and command panels, whose number is 176 students.

2.3. Technique and validation of the collected data

The data collection technique used is the survey, the same as already indicated in the previous paragraphs, it is based on the SERVQUAL model, whose assessment levels range from totally disagree (5) to totally agree (1). In addition, it is specified that the indicators of the security and reliability dimensions of the only variable under study (evaluation of pedagogical strategies) were used. This analysis includes the academic year 2020 and 2021, periods where virtual education was adapted for the first time in the higher institution; the survey was conducted in the last week of each academic semester. In Figure 1 the indicators of each dimension selected for this analysis of the SERVQUAL model are detailed.

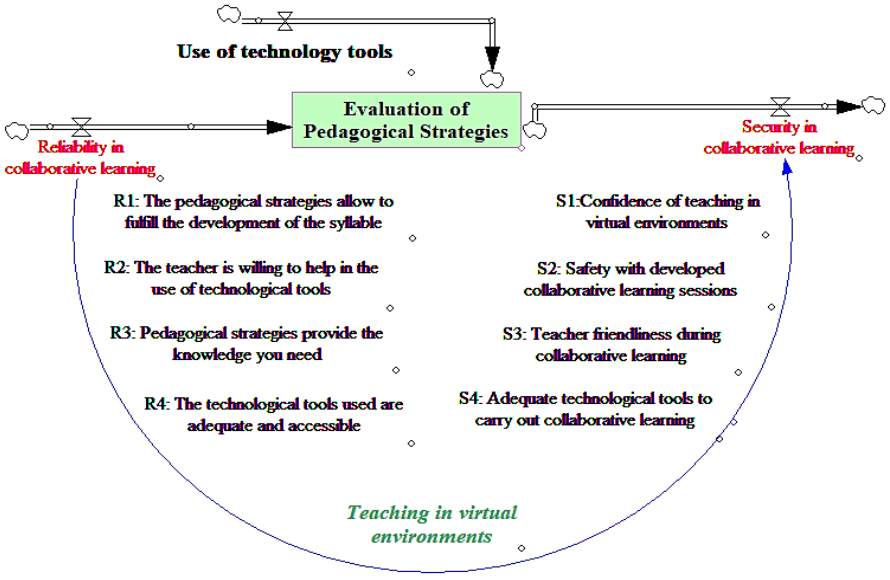

Figure 1. Indicators of the reliability and security dimension during collaborative learning

The content validation of the data collection instrument used is given through [20]. Likewise, the validation of the collected data was carried out using the Cronbach's Alpha statistic, which was calculated using the SPSS v25 simulation software, whose result was 0.863. In this way it is possible to validate the data collected by the instrument and presents the results.

2.4. Description of the pedagogical strategy through technological tools

The electrical control and command panel design course is a specialty course of the professional mechanical and electrical engineering school, and as part of the pedagogical strategies used in the virtual teaching process, developed in the context of emergency health. It can be specified that the activities are planned and organized under the technological support of a virtual platform developed by the university, in which the methodological design is based on collaborative learning, where there is multiple intervention through the use of virtual platforms in sessions Synchronous and asynchronous, in which through the use of technological tools such as Cad Simu, Logo Soft and Fluid Sim, students interact to obtain the design of a control panel that responds to the requested requirements. In Figure 2, the elements that intervene in the pedagogical strategies used in the development of the subject are outlined.

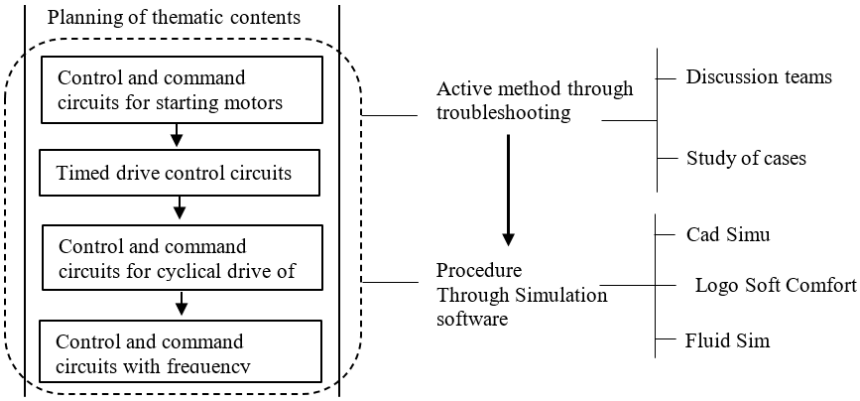

Figure 2. Elements that intervene in the pedagogical strategies of the subject

3. RESULTS AND DISCUSSION

3.1. Results

In Figure 3 the results obtained are shown, regarding the evaluation of the pedagogical strategies of the reliability dimension (R) in collaborative learning. The results of Figure 3 show that 97.73% satisfactorily evaluate the reliability of pedagogical strategies through technological tools used in collaborative learning in the teaching process in virtual environments. Indicators R1 and R2 are the ones that have been best evaluated, with 72.73% being in complete agreement and 27.27% in agreement that the pedagogical strategies have made it possible to comply with the development of the syllable and that the teacher was willing to help them in the use of technological tools. Then the R4 indicator, with 54.55% of students who totally agree and 45.45% agree that the technological tools are adequate to carry out collaborative learning. Regarding indicator R3, 63.64% totally agree and 27.27% agree that the pedagogical strategies provided them with the knowledge they needed, and 9.1% do not agree with this statement.

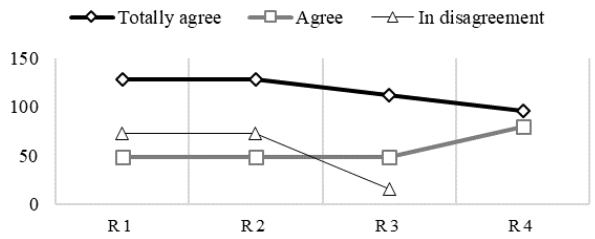

Figure 3. Evaluation of the pedagogical strategies of the reliability dimension

In Figure 4 the results obtained are shown, regarding the evaluation of the pedagogical strategies of the security dimension (S) in collaborative learning. The results of Figure 4 show that 97.73% satisfactorily evaluate the security of pedagogical strategies through technological tools used in collaborative learning in the teaching process in virtual environments. Indicators S1 and S3 are the ones that have been best evaluated, with 54.55% in complete agreement and 45.45% in agreement that the use of technological tools in teaching in virtual environments was given confidence (S1), likewise 45.45% were in complete agreement and 54.55% in agreement with the kindness of the teacher during collaborative learning. Then the indicator S2, finding 36.36% of students who totally agree and 63.64% agree with the security of the sessions developed during collaborative learning. Regarding indicator S4, 36.36% totally agree and 54.55% agree that the technological tools are adequate to carry out collaborative learning, also 9.1% do not agree with this statement.

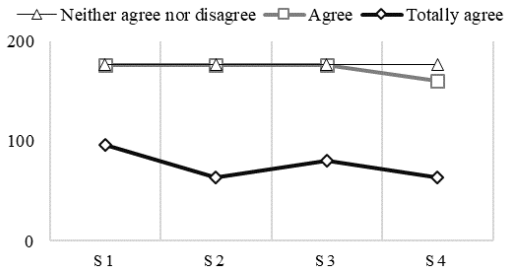

Figure 4. Evaluation of the pedagogical strategies of the security dimension

As part of the research, the correlation analysis is carried out between the reliability and security dimensions in collaborative learning using technological tools. To do this, the normality test is initially performed, in Table 1, the results are shown. Because the sample is greater than 176 students, the Kolmogorov-Smirnov test is used. This analysis will be carried out by means of the SPSS software. As shown in Table 1, the significance (sig.) Is less than the significance level of 0.05, according to the established theory, there is no normality in the data, for this reason the non-parametric Rho statistic is used for the correlation test. by Spearman. As shown in Table 2, there is a high correlation level of 0.765 between the reliability and security dimensions. This relationship is simulated in Figure 5, where the linear regression between the reliability and security dimensions is shown. Likewise, as seen in Table 3, the best relationship model between the reliability and security dimensions is the quadratic model, with an R2 of 0.871.

Table 1. Normality test

	Kolmogorov-Smirnov		
	Statistical	gl	Sig.
Reliability	0.233	176	0.000
Security	0.262	176	0.000

Table 2. Spearman's RHO correlation

		Reliability	Security
Reliability	Correlation coefficient	1.000	0.765
	Sig. (bilateral)		0.000
	N	176	
Security	Correlation coefficient	0.765	1.000
	Sig. (bilateral)	0.000	
	N	176	

Table 3. Linear regression model

Equation	Model summary			Parameter estimates		
	R square	F	Sig.	Constante	b1	b2
Linear	0.687	382.557	0.000	-2.680	1.101	
Quadratic	0.871	585.899	0.000	162.576	-17.061	0.496

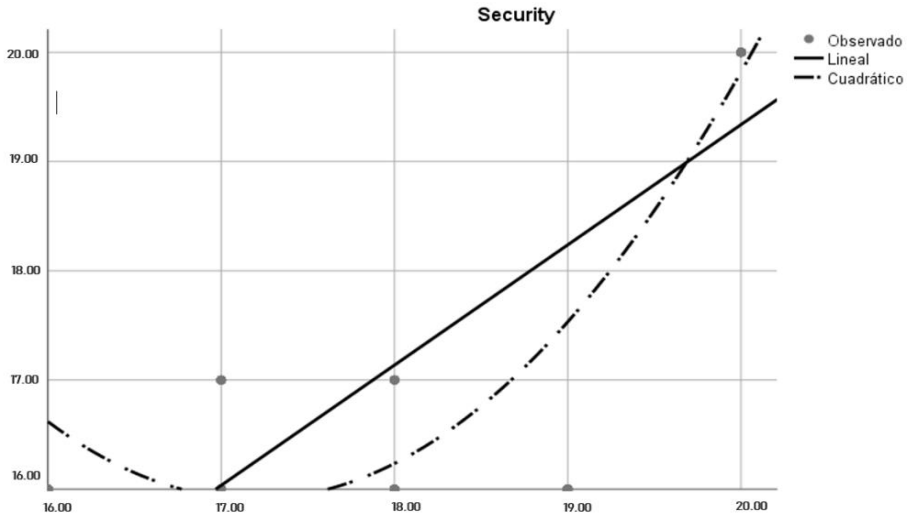

Figure 5. Linear regression between the reliability and security dimensions

Once the relationship has been determined, the relationship between the reliability and security dimensions' indicators is interpreted as a percentage. Table 4 shows the percentage association between indicators R1 and S1. Table 4 shows the association between the satisfaction of the students that the pedagogical strategies allow them to comply with the development of the syllable (R1) and the confidence generated by the teacher in collaborative learning during teaching in virtual environments (S1). As shown, of the 45.5% of the students who agree with indicator S1, 37.5% indicated that they totally agree with indicator R1 and 66.7% agree with R1. Similarly, of the 54.5% of those who indicated that they totally agree with indicator S1, 33.3% agree with indicator R1 and 62.5% agree with indicator R1.

Table 5 shows the percentage association between indicators R2 and S2. Table 5 shows the association between student satisfaction with the teacher's willingness to help them in the use of technological tools (R2) and the security generated with the collaborative learning sessions (S2). As shown, of the 63.6% of the students who agree with the S2 indicator, 50% indicated that they totally agree with the R2 indicator and 100% agree with R2. Similarly, of the 36.4% of those who indicated that they totally agree with the S2 indicator, 50% agree with the R2 indicator.

Table 4. Cross table between R1 and S1

		S1		
		Agree	Totally agree	Total
R1	Agree	66.7%	33.3%	100%
	Totally agree	37.5%	62.5%	100%
	Total	45.5%	54.5%	100%

Table 5. Cross table between R2 and S2

		S2		
		Agree	Totally agree	Total
R2	Agree	100%	0.00%	100%
	Totally agree	50%	50%	100%
	Total	63.6%	36.4%	100%

Table 6 shows the percentage association between indicators R3 and S3. Table 6 shows the association between student satisfaction that the pedagogical strategies provided the knowledge they needed (R3) and the kindness of the teacher during collaborative learning (S3). As shown, of the 54.5% of the students who agree with the S3 indicator, 42.9% indicated that they totally agree with the R3 indicator and 100% agree with R3. Similarly, of the 45.5% of those who indicated they totally agree with the S3 indicator, 57.7% agree that they totally agree with the R3 indicator and 100% disagree with the R3 indicator.

Table 7 shows the percentage association between indicators R4 and S4. Table 7 shows the association between student satisfaction that the technological tools used are adequate and accessible (R4) and that the technological tools are adequate to carry out collaborative learning (S4). As shown, of the 9.1% of the students

who indicated that they neither agree nor disagree with S4, 16.7% indicated that they totally agree with the R4 indicator. Similarly, of the 54.5% of those who indicated that they agree with the S4 indicator, 16.7% indicated that they totally agree with R4 and 100% agree with the R4 indicator. In addition to the 36.4% who indicated that they totally agree with the S4 indicator, 66.7% agree that they totally agree with the R4 indicator.

Table 6. Cross table between R3 and S3

		S3		
		Agree	Totally agree	Total
R3	In disagreement	0.00%	100%	100%
	Agree	100%	0.00%	100%
	Totally agree	42.9%	57.1%	100%
	Total	54.5%	45.5%	100%

Table 7. Cross table between R4 and S4

		S4			
		Neither agree nor disagree	Agree	Totally agree	Total
R4	Agree	0.00%	100%	0.00%	100%
	Totally agree	16.7%	16.7%	66.7%	100%
	Total	9.1%	54.5%	36.4%	100%

3.2. Discussion

The results show that 97.73% satisfactorily evaluate the reliability and security of pedagogical strategies through technological tools used in collaborative learning in the teaching process in virtual environments. The optimal evaluation regarding the reliability of collaborative learning is 100% related to compliance with the syllable, to the teacher's disposition to help them in the use of technological tools and to the conformity of the technological tools used in the subject. Regarding the security of collaborative learning, 100% of the satisfactory evaluation is related to the trust and kindness that the teacher transmitted with the use of technological tools in teaching in virtual environments. Although the results are more than satisfactory, students' perception should continue to improve that the use of technological tools provides them with the knowledge they need, also 9.1% do not agree with this statement, being adequate for carry out collaborative learning.

Alvarado-Lagunas *et al*. [28], it is indicated that the domain of the subjects (academic program) and the ability to transmit knowledge using technological tools are of great relevance to increase the level of student satisfaction by 50.6%, since these components directly affect the development and comprehensive training of the student in 25.8%. In the same way, the analysis carried out by [28] shows that the aspects of training or integral development, values and skills enrich and favor the academic or professional trajectory of the students, as well as the use and management of technology by the strategies pedagogical aspects of the teacher, plays a role of great importance in the perception of the student, since it is through this that the academic level of the university is reflected. Likewise, in Kraleva *et al.* [29] it is pointed out that students satisfactorily evaluate the pedagogical strategies of the teacher, when they have the capacity and ability to transmit the knowledge or topics of classes, since the explanatory clarity of current topics and the confidence that the teacher offers students an essential element that determines their satisfaction are considered by the students. These results support what was obtained in [30], where it is indicated that the variables with the greatest impact, from highest to lowest degree, on the perception of educational quality in the higher institution are the use of technological tools (49.1%), the physical components (36.4%), the teaching staff (10.1%) and the teacher's skills and strategies (4.4%), obtained from this, it is statistically sustained that the perception of the students is highly explained by these four factors, since the R2 obtained is of the 89.4%.

According to Susheelamma and Ravikumar [31], it is pointed out that the evaluation of perceptions of the level of quality of pedagogical strategies are necessary for the continuous improvement of educational policies, resulting in the average value 3.41, which indicates that there is a quality satisfactory education in the virtual environment. As indicated in Bárcenas and Morales [32], in collaborative learning, communication is a relevant factor for maintaining a dialogue contact, resolving doubts about the activities to be carried out, student satisfaction is related to compliance in the programmed time of the syllabus and the use of didactic and interactive tools. In the virtual teaching environment, it becomes necessary for teachers to innovate teaching and learning strategies, efficiently combining virtual platforms and technological tools.

In Latiff *et al*. [33] it is pointed out that currently students are very involved with technological tools, since, although new applications continue to appear, they will be willing to use them. Teachers also have to get involved with these tools and applications, since new developments make classes enjoyable and dynamic. It is important to emphasize that technological tools are not only providing academic support, but we could even relate it to emotional support. With this, students can be motivated during their stay at the

university, in addition to being involved in their training by actively participating in the teaching-learning process, using and applying tools to achieve maximum use.

4. CONCLUSION

The pedagogical quality is a key indicator for the management of higher education institutions, since it helps to identify strengths and weaknesses in the provision of the service, which leads to the taking of actions to improve the virtual teaching process, the results obtained reflect that despite the sudden and accelerated change from face-to-face to virtual teaching-learning, 97.73% of students satisfactorily evaluate the reliability and security of pedagogical strategies through technological tools used in collaborative learning in the teaching process in virtual environments. The optimal evaluation is related 100% to the fulfillment of the syllable, to the teacher's disposition to help them in the use of technological tools, to the conformity of the technological tools used in the subject, to the security of collaborative learning and to trust and confidence. kindness transmitted by the teacher with the use of technological tools in teaching in virtual environments. Given the results, the use of technological tools by the teacher must occur on a daily basis, to strengthen their weaknesses in the proper reception of them and promote the renewal of the teaching process in virtual environments. The challenge in this scenario involves the effort and commitment of the teacher, the institution and the student, where each one from their position contributes in an integral way to the collaborative learning process.

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