

Perception of professional skills acquired in online learning among electronic engineering students

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ABSTRACT

The article aims to analyze the perception of professional skills acquired in online learning among electronic engineering students. The research method is qualitative, with a descriptive approach, since it focuses on analyzing the statistics of the students' perception (frequency of satisfaction levels). Initially, the reliability of the instrument was determined using Cronbach's Alpha, obtaining a consistency coefficient of 0.967 and 0.932, in the academic semesters 2020-I and 2020-II, respectively. The data collected by means of a virtual questionnaire were processed in the SPSS software transformed into the Likert scale. The results obtained show a high perception among electronic engineering students in reference to the professional skills they have acquired. There is an increase in satisfaction from 66.78% (2020-I) to 74.26% (2020-II) between the first and second academic semester, despite the abrupt and unexpected change in the teaching-learning modality, in the second semester achieved a greater adaptation of this process. However, the online learning method should continue to be improved so that students perceive with greater satisfaction that they possess the skills to solve problems and cases related to the specialty) and the skills to master practical professional skills.

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1. INTRODUCTION

The permanent change in science and technology generates new forms of production and work, the same that demands that university institutions orient their purposes towards the formation of competitive, innovative and creative people [1]–[3]. Thus, competency-based training of university students is a widely used approach in these times, which contributes to improving the training of professionals with a more inclusive perspective [4], [5]. Training by competencies of students appears as an irreversible trend, almost as a requirement [6], the competences in professionals of the different disciplines contribute to social development, the improvement of innovation and competitiveness.

The current vision of the training of university students is to build competent professionals, that is, to build on the skills acquired during the period of university training [7]. During their studies, the university

student must reconcile the acquisition of knowledge with professional skills, seeking the combination of integrity of skills and attitudes that lead to adequate and timely performance in various contexts [8], [9]. However, for competencies to really acquire the importance assigned to them, it is not so easy to achieve it from a practical or realistic point of view [10]. It is established that among the possible causes would be the commitment of teachers to plan and develop competencies throughout the university study cycle [11].

The current world of work demands a set of key and strategic competencies, which go beyond theoretical or technical knowledge, but must take into account intrapersonal and interpersonal skills [12]. The contents of the study programs in general must be strictly linked to the activities that are demanded at the level of organizations or companies, especially in the case of engineering, where technology shows a constant evolution, in such a way that in the end its studies, students can be optimally integrated into the labor field [13]–[15]. A competency-based curriculum aims to ensure that university students demonstrate their learned capabilities after acquiring a combination of knowledge, skills, and abilities [16].

However, due to the global health emergency situation, during the academic semesters of 2020, and due to the social isolation generated as a result of the COVID-19 pandemic, universities have been conditioned to implement virtual technological tools, in order to give continuity to the learning process [17]. In this regard, in studies [18], [19], the authors point out that in this scenario, the normality to which university students were exposed, as well as teachers, will be part of a past that invites in a mandatory way to modify behaviors in order to, students reach their skills, not through a classroom with face-to-face sessions, but through virtual platforms and technological tools. If we focus strictly on engineering careers, in study [20], the authors point out that information technologies in the current context are acquiring wide relevance, since in many universities that train engineering professionals, they require platforms simulation or software that approximates the laboratory experiences developed in face-to-face classes.

Therefore, learning processes in university institutions must emphasize that students possess skills and competencies through the development of the world of work. Therefore, the domain of the learning process, especially in the formation of professional competences, must include cognitive (knowledge), psychomotor (skills) and affective (attitude) aspects, for this an analysis is needed in online learning through questionnaires to have a better understanding of the student, about the perception of their comfort in online learning [21], [22]. Having defined the context in which this research was developed, the main objective of this article is to analyze the perception of the professional competences acquired in online learning among electronic engineering students.

2. RESEARCH METHOD

2.1. Research design

This was analytic quantitative research. It focused on analyzing the statistics of the perception (frequency of satisfaction levels) of the professional skills acquired in online learning among undergraduate students of electronic engineering. It also analyzed the evolution of the indicators that make up the only variable under analysis, in the two academic semesters that online learning has been carried out.

2.2. Population and sample

The population is made up of undergraduate students from the professional school of electronic engineering, enrolled in the academic semesters 2020-I and 2020-II, whose number is 170 and 150 students respectively. These students belong to the 7th and 10th cycle, this group was selected, because from the 7th cycle the specialty subjects are taken, these students being more aware when evaluating the professional skills, they are acquiring in their learning. Since it was possible to collect information from the entire population under study, the sample will be made up of all university students who are part of the population.

2.3. Technique and validation of the collected data

The technique used in the research is the survey, which, through a questionnaire that was developed in a virtual way, allowed to collect the results of the perception of undergraduate students of electronic engineering, this questionnaire was carried out on a mandatory basis, at the end of each academic semester (2020-I and II). The data collected were validated using the statistical software SPSS version 25, in which it was obtained that the Cronbach's alpha for the academic semester 2020-I and 2020-II, was 0.967 and 0.932 respectively, the values obtained show a high homogeneity and equivalence of the response of all the indicators, since values higher than 0.9 indicate a great consistency of the elements of the scale [3].

For data processing, the Likert scale was used, using the coding of 4 represents very satisfied; 3 represents satisfied; 2 represents not very satisfied; and 1 represents dissatisfied. Likewise, there are 10 indicators that are part of the instrument, which are linked to the variable perception of the acquisition of professional skills. They are displayed in the Figure 1.

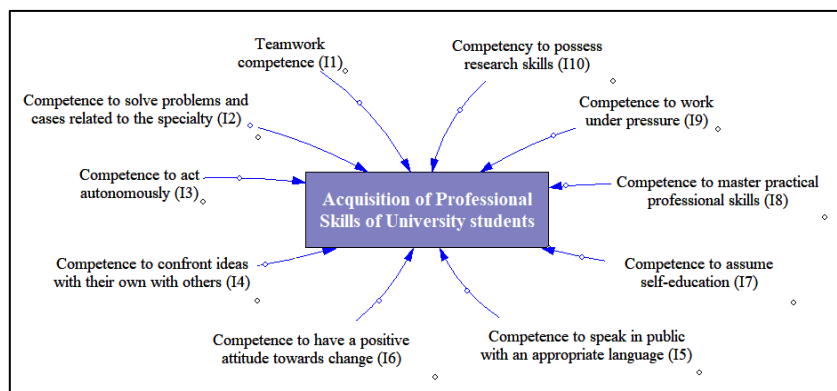


Figure 1. Indicators linked to the variable perception of the acquisition of professional skills

3. RESULTS AND DISCUSSION

Considering the main objective of the research, Figure 2 shows the results obtained from the perception of undergraduate students of electronic engineering in the academic semester 2020-I and 2020-II. Figure 2 shows that in the academic semester 2020-I, 56.76% of students are satisfied and 6.06% dissatisfied with the perception of the acquisition of acquired skills, if we consider the highest levels of satisfaction (the level satisfied and the level very satisfied) a satisfaction of 66.78% is reached. This result represents a point of reference, for the university institution under analysis, because the perception of the acquisition of professional competences was never evaluated in the context of an online learning process. As indicated in [22], most Peruvian universities were not prepared to face the challenges of a non-face-to-face education, especially when it was the result of a sudden and unexpected adaptation. For this reason, the importance of knowing the perception of the students, although in their entirety the engineering study programs were only developed in person, and before the declaration of the state of emergency, fifteen days before the start of the 2020-I academic semester, it was not possible to quickly prepare this new way of conducting class sessions.

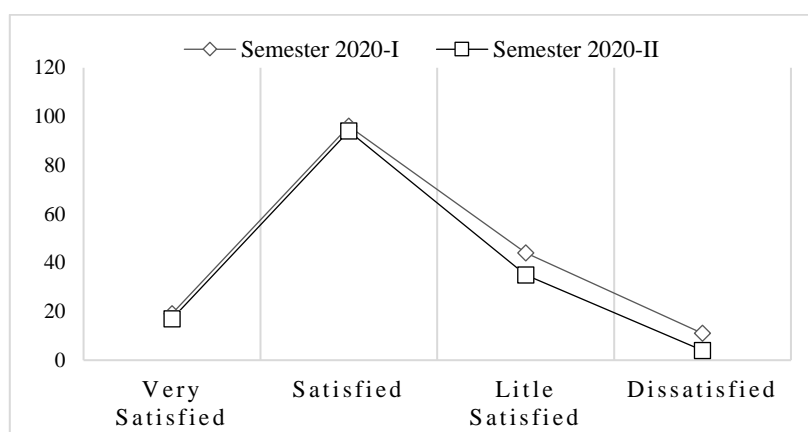


Figure 2. Comparison of the perception of professional competences

Another aspect to highlight, are the results of the academic semester 2020-II as presented in in Figure 2. It can be noted that on average the percentage of satisfied students (62.73%) was also well above the average of dissatisfied students (2.34%), if we consider the highest levels of satisfaction (the satisfied level and the very satisfied level) a high satisfaction of 74.6% is reached, this because in this semester there was a better adaptation of online learning. In this regard, the results of the satisfaction of university students in the development of academic activities through virtual environments were acceptable, since the adaptation of new methodologies was fully achieved [23].

After describing these results, Figure 3 shows the evolution of all the indicators of the variable perception of professional competences (I1-I10), in which it is observed that the levels of satisfaction (level

satisfied and level very satisfied), in the 2020-II academic semester have increased compared to the previous semester. The results show that the level of satisfaction regarding the perception of the acquisition of professional competences has improved from one semester to another, this in the online learning environment where various technological tools were used. These results are similar to those obtained in [24], where there is evidence of a significant improvement in the perception of the professional competences of students in virtual teaching conditions. Regarding the use of technological tools, it is determined that there is a high perception of students about the use of information and communication technologies (ICT) in teaching and learning teaching and learning at the university [25]. Likewise, regarding the use of technological tools in previous study [26], it is pointed out that their main contribution is based on successful training feedback, so that both teachers and students improve their professional skills.

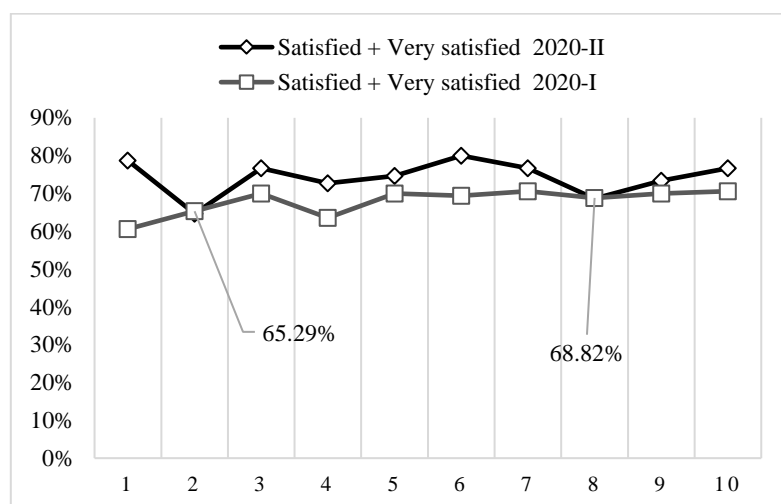


Figure 3. Evolution of the indicators of perception of professional competences

As can be seen in Figure 3, indicator 2 (I2: competence to solve problems and cases related to the specialty) and indicator 8 (I8: competence to master practical professional skills), are those that have not presented an improvement in satisfaction from one semester to the next. Which leads us to wonder if there is an association between these two indicators. As noted in previous study [26], student satisfaction is expressed in four key aspects: i) What students learn; ii) What students need to learn; iii) How they learn it; and iv) How confident students are of what they have learned in relation to their specialty.

Next, the analysis of the crossed tables through the SPSS is shown in Table 1, whose analysis is carried out in each academic semester. This test is carried out to identify the relationship between the indicators that have not presented an increase in their satisfaction, indicator 2 (I2: competence to solve problems and cases related to the specialty) and indicator 8 (I8: competence to master practical professional skills). The relationship between the indicators under analysis is visualized in Table 1 by means of chi-square.

Table 1. Result of the correlation test for indicators I2 and I8 of the academic semester 2020-I

	Chi-square test	
	Value	Asymptotic significance (bilateral)
Pearson's Chi-square	256.432	.000
Pearson's R	0.760	.000
Spearman correlation	0.700	.000
N of valid cases	170	

As presented in Table 1, the bilateral significance of the Chi-square test is equal to 0.000. It confirms the relationship between indicators 2 (I2: competence to solve problems and cases related to the specialty) and 8 (I8: competence to master practical professional skills), being the qualitative variables of ordinal scale, by means of the Spearman coefficient. This is determined that there is a high level of association of 0.700 between these indicators.

Likewise, the analysis of crossed tables, of Table 2 shows that 86.5% of the students satisfied (level 3) with indicator 2 (I2: competence to solve problems and cases related to the specialty) are also satisfied with the indicator 8 (I8: competence to master practical professional skills). Likewise, 73.4% of the students who are very satisfied (level 4) with indicator I2 are also very satisfied with indicator I8. In addition, 81.8% who are dissatisfied (level 1) with indicator I2 are also dissatisfied with indicator I8, these results show the association between both indicators. As indicated in previous research [27], the result reveals that 52.59% of the students are satisfied and 38.22% are dissatisfied, with the teacher's performance in managing online learning. Some teachers were not yet familiar with virtualization, which makes students perceive that their experience in the acquisition of knowledge, their performance and mastery of practical skills is not being properly fed.

Table 2. Result of the cross-table analysis between indicators I2 and I8, academic semester 2020-I

		I8			
		1	2	3	4
I2	1	81.8%	4.8%	0%	0%
	2	18.2%	61.9%	19.8%	0%
	3	0%	33.3%	86.5%	25.0%
	4	0%	0%	4.9%	73.4%
Total		100.0%	100.0%	100.0%	100.0%

Table 3 shows Pearson's Chi-square correlation test, between indicators 2 (I2: competence to solve problems and cases related to the specialty) and 8 (I8: competence to master practical professional skills) of the semester academic 2020-II. The results of Table 3 establish the relationship between indicators I2 and I8, because the bilateral significance of the chi-square test is equal to 0.000, the Spearman coefficient indicates a moderate level of association of 0.582 between the indicators. Table 4 shows that 74.4% of the students satisfied (level 3) with indicator 2 (I2: competence to solve problems and cases related to the specialty) are also satisfied with indicator 8 (I8: competence to master skills practical professionals). Likewise, 76.9% of the students who are very satisfied (level 4) with indicator I2 are also very satisfied with indicator I8. Furthermore, the 22.2% who are dissatisfied (level 1) with indicator I2 are also dissatisfied with indicator I8.

Table 3. Result of the correlation test for indicators I2 and I8 of the academic semester 2020-II

	Chi-square test	
	Value	Asymptotic significance (bilateral)
Pearson's Chi-square	121.178	.000
Pearson's R	0.603	.000
Spearman correlation	0.582	.000
N of valid cases	150	

Table 4: Result of the cross-table analysis between indicators I2 and I8, academic semester 2020-II

		I8			
		1	2	3	4
I2	1	22.2%	2.6%	0%	0%
	2	66.7%	63.2%	21.1%	7.7%
	3	11.1%	31.6%	74.4%	15.4%
	4	0%	2.6%	4.4%	76.9%
Total		100.0%	100.0%	100.0%	100.0%

As indicated in previous study [28], technology is currently undergoing spectacular innovation. However, in order to be successful, it is vital in the engineering community to have the necessary skills to make an impact, for this, attitudes, innovative mentalities, knowledge of changing trends and leadership skills must be integrated into the factors of formation of professional competencies and management with deep technical skill from students. As Syauqi, Munadi, and Triyono [29] pointed out, students need different attributes, such as knowledge about the use of technology, time management and organization and interactions using online technology, to increase their professional competencies. It could be indicated that if factors such as attitudes, skills and knowledge are present, this will tend to have an optimal perception with the indicators that make up the professional skills acquired in virtual learning [30]. Figure 4 shows the model, of what has been described, making use of the indicators that are part of the analysis of this research regarding the perception of the professional skills acquired in online learning.

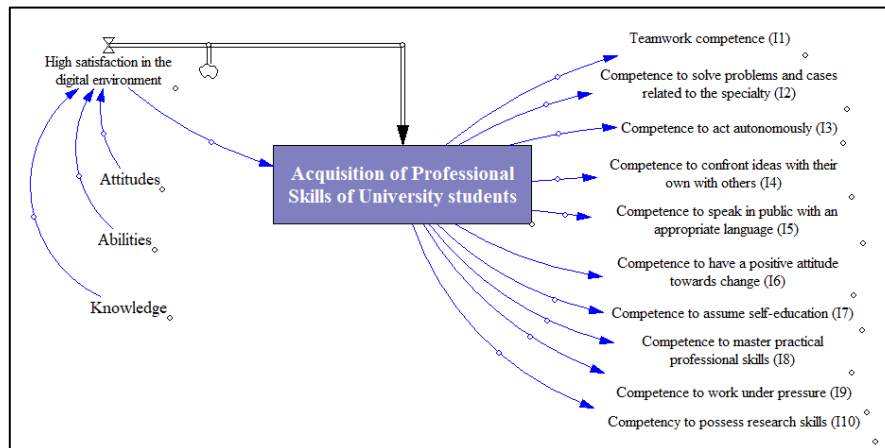


Figure 4. Factors of high satisfaction with respect to the indicators of acquisition of professional competences

4. CONCLUSION

Society demands that university graduates not only possess great technical knowledge about their profession, but also that they possess professional competencies, which includes factors such as attitudes, skills and knowledge, to reflect good teamwork, honesty, industry and leadership. Furthermore, future professionals are required to be capable of making decisions based on reflection and analysis, being sensitive and responsible also towards social problems. Although the declaration of the state of emergency caused an accelerated change in the adaptation of virtual environments by the teacher and the students, the present study reflects that a good adaptation was achieved, which turns out to be perceived by the students. It is also concluded that of the ten indicators that make up the variable perception of the acquisition of professional skills, indicator I2 (competence to solve problems and cases related to the specialty) and indicator I8 (competence to master practical professional skills), were the that did not reflect an increase in satisfaction in these two semesters, so it is suggested to take some corrective measures.




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