Revista Facultad de Ingeniería

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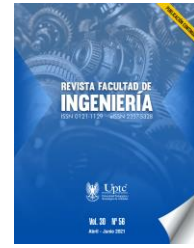
Do We Perceive a Gender Gap in Careers Associated with Technologies?

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Abstract

This study aims to establish the perception of the gender gap associated with careers in the technology area. For the above, an online perception survey was designed and applied. Responses were received for a period of 2 weeks. The instrument was applied to students and workers of computer studies as an area related to information and communication technologies. We obtained a sample of 104 people, composed primarily of young men. The data analysis was carried out through descriptive, inferential statistics, exploratory factor analysis, and reliability. In various sections of the study, differences in perception were found between men and women. We established different factors that evidence a perceived gender gap.

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The underlying dimensions of the gap perception identified were: perception of male superiority, educational competence, and labor competence. In addition, we established the perceived explanatory factors of the gap, which are: educational labor context, social and personal context, and competences and skills in the technological area. We showed that women do consider there is male chauvinism in careers associated with technologies and that the perception of workers is that the career is more appropriate for the male gender. Also, from a gender perspective, the gap is explained, considering the bias of employers as relevant. For future research, we expect to enlarge the sample and contrast the results with those provided by the national socioeconomic characterization survey.

Keywords: gender gap; perception survey; women in technology.

¿Percibimos una Brecha de Género en Carreras Asociadas a Tecnologías?

Resumen

Este estudio tiene como objetivo establecer la percepción de brecha de género asociada a carreras del área de la tecnología. Para lo anterior, se diseñó y aplicó una encuesta de percepción en línea. Se recibieron respuestas por un periodo de 2 semanas. El instrumento se aplicó a estudiantes y trabajadores relacionados con la informática como área relacionada a las tecnologías de la información y comunicaciones. Se obtuvo una muestra de 104 personas, compuesta por hombres jóvenes mayoritariamente. El análisis de los datos se realizó a través de estadísticos descriptivos, inferencial, análisis factorial exploratorio y de fiabilidad. En diversos apartados del estudio se encontró diferencias de percepción entre hombres y mujeres. Estableciéndose diferentes factores que evidencia una brecha de género percibida. Se identificaron las dimensiones subyacentes de la percepción de la brecha, las cuales son: la percepción de superioridad masculina, la competencia educacional y competencia laboral. Además, se establecieron los factores explicativos percibidos de la brecha que son: contexto laboral educacional, contexto social y personal, y las competencias y habilidades en área tecnológica. Se pudo evidenciar que las mujeres consideran que existe machismo en carreras asociadas a tecnologías y que la percepción de los trabajadores es que la carrera es más

adecuada para el género masculino. También, desde la mirada de género, se explica la brecha, considerando en ello como relevante el sesgo de los empleadores. Como trabajo futuro, se espera ampliar la muestra y contrastar los resultados con los provistos por la encuesta de caracterización socioeconómica nacional.

Palabras clave: brecha de género; encuesta de percepción; mujeres en tecnologías.

Podemos ver uma lacuna de gênero nas carreiras associadas à tecnologia?

Resumo

Este estudo tem como objetivo estabelecer a percepção de uma lacuna de gênero associada às carreiras na área de tecnologia. Para o exposto, uma pesquisa de percepção online foi desenhada e aplicada. As respostas são recebidas por um período de 2 semanas. O instrumento foi aplicado a estudantes e trabalhadores vinculados às tecnologias da informação como área relacionada às tecnologias da informação e comunicação. Obtém-se uma amostra de 104 pessoas, composta principalmente por jovens do sexo masculino. A análise dos dados foi realizada por meio de análise descritiva, estatística inferencial, análise fatorial exploratória e análise de confiabilidade. Em várias seções do estudo, foram encontradas diferenças de percepção entre homens e mulheres. Estabeleça diferentes fatores que mostram uma lacuna de gênero percebida. Foram identificadas as dimensões subjacentes à percepção do gap, quais sejam: percepção da superioridade masculina, competência educacional e competência profissional. Além disso, foram estabelecidos os fatores explicativos percebidos da lacuna estabelecida: contexto educacional de trabalho, contexto social e pessoal e competências e habilidades na área tecnológica. Pode-se evidenciar que as mulheres consideram que há machismo nas carreiras associadas à tecnologia e que a percepção dos trabalhadores é de que a carreira é mais adequada para o gênero masculino. Da mesma forma, na perspectiva de gênero, a lacuna se explica, considerando a lentidão dos empregadores como relevante. Como trabalho futuro, espera-se

ampliar a amostra e contrastar os resultados com os fornecidos pela pesquisa nacional de caracterização socioeconômica.

Palavras-chave: lacuna de gênero; mulheres em tecnologías; pesquisa de percepção.

I. INTRODUCTION

In an increasingly open and inclusive society, a topic of analysis is the gender difference in relation to education, work areas, presence in the labor field, among others. Related to education, a low participation of women was detected internationally in STEM [1] areas (science, technology, engineering, and mathematics). Chile is no exception, in technology-related careers, such as Computer Engineering or Computer Civil Engineering, there is a lower enrollment of women than men; in all different types of higher education institutions, whether they are universities, professional institutes or technical training centers [2].

Considering the history of low women participation rates in STEM, and the low number of women enrolled in careers associated with technology, in this paper, we present the analysis of a survey conducted with students and workers in a career associated with technology. The aim was to establish if there is a perception of the gender gap. Initially, the study was separated according to gender and economic activity in order to establish if there are differences in perception between them. The results showed that there are perceived gaps in favor of men. From a gender-related point of view, women do identify male chauvinism in careers associated with technologies, and from the workers' point of view, they consider that the careers are more appropriate for the male gender. Thus, showing a variation in perceptions when respondents have work experience. In addition, it was possible to establish differences in the perception of competences in favor of men, for example in areas of robotics.

The document is organized as follows: section 2 shows the methodology, then, section 3 presents the results, and finally, section 4 indicates the conclusions and future work.

II. METHODOLOGY

To begin this work, the background of gender gaps in Chile was reviewed. Next, the methodology and the survey were defined. Each of which is presented below.

A. Background of Gender Gaps

Chile is a country with a diversity in the earnings perceived by workers in general. Several studies on wage inequality have been carried out considering the national socioeconomic characterization survey [3]. In [4] the authors analyzed the change in wage inequality in relation to the diversification and expansion of higher education in Chile between the years of 1992 to 2000 and 2000 to 2013, finding an increase in inequality in the first years of the study and then a decrease in the remaining years due to the diversification of higher education.

Considering that STEM competences have been related to education and the development of a country, in [5] the authors exposed that Latin America has a level of delay in relation to other countries in the world. However, Chile appears better positioned than its neighbors in terms of science education and mathematics skills. It is also important to analyze the particular gender situation in STEM. The same study shows that there is an important gap in the Latin American regarding the situation of female researchers, in addition to showing a very low percentage in Chile of female graduates in relation to men in STEM disciplinary areas [5].

In Chile, studies have been carried out on gender gaps in university selection tests, showing important differences regarding women who study in technical-professional establishments, which could influence, among other things, the entry to STEM-related careers. Furthermore, it reveals initiatives from different universities to incorporate women in this area [6], thus demonstrating the existing concern and measures taken to improve this situation.

In a national context, according to data from the National Institute of Statistics, less than 25% of the people with a degree in technology fields are women [7]. The foregoing is consistent with the enrollment in higher education in the years 2007 to 2018 of women in knowledge of technology, which is also less than 25% [8]. Thus, evidencing a gender gap at the national level on careers in technology.

B. Survey Methodology

The research design is quantitative, non-experimental, and descriptive with a correlational approach. From the dimension of time, the study is cross-sectional. The

sample reached 104 cases. Students and workers related to computer science were the subjects of study, as part of the careers in the technology area. The instrument was applied through an online questionnaire, in a period of two weeks. The response rate was 94% for fully answered instruments.

C. Perception Survey

A gender gap perception questionnaire was applied in technology-related areas. The objective was to obtain the gender gap perceptions of students and workers in areas related to technology.

The questionnaire was applied at the beginning of May 2021. The participants who voluntarily answered the survey were informed that their answers would be used only for academic purposes and the personal data collected would be kept strictly confidential. The questionnaire is shown in Table 1.

The questionnaire was divided into 2 sections: (i) sociodemographic characterization section, where the uniqueness of the participants is established, and (ii) gender perception section, aimed at obtaining perceptions about the performance of women in areas of the information and communication technologies and elements that can affect and cause a breach.

Table 1. Perception questionnaire.

Item	Type of answers
Sociodemographic characterization section	
Sex	Options
Age	Open question
Activity	Options
Area of specialization	Options
Gender perception section	
(P08) You feel that technology-related careers are more suitable for men than for women	Likert scale of 5 points
(P09) There is a lower academic performance in women who study careers associated with technology	
(P10) The cultural factor contributes negatively to the fact that women choose a career associated with technology	
(P11) There is male chauvinism in careers associated with technology	
(P12) Women have the leadership to assume leadership roles in areas associated with technologies	
(P13) Women can perform better than men in areas associated with technologies	
(P14) The level of income of women is lower than that of men in areas associated with technologies	

Item	Type of answers
(P15) Part-time job (P16) Low-income economic sectors jobs (P17) Level of educational preparation for employment (P18) Socially less valued jobs (P19) Self-perception of labor productivity (P20) Employer bias (P21) Leadership capacity (P22) Family responsibility	Likert scale of 5 points
Identify if there is a gap between men and women in the following areas: (P23) Mathematics (P24) Programming (P25) Project management (P26) Communications networks (P27) Security (P28) Robotics (P29) Business intelligence	Likert scale of 5 points

III. RESULTS

The data analysis was performed through descriptive and inferential statistics, exploratory factor analysis, and reliability analysis. The descriptive analysis used frequency, mean and standard deviation distributions. For the inferential analysis we applied the Kolmoorov-Smirnonov test for the analysis of the data distribution, the Chi-Square test, and the Spearman test to perform hypothesis contrasts of the variables sex and economic activity. Factor analysis and reliability to analyze the structure and reliability of the model. The significance level used at 0.10.

A total of 104 participants answered the survey. The characterization of the sample can be seen in Table 2. Based on the responses, it can be established that the majority of the participants are men (87%). They are young persons under 29 years of age (70%). Furthermore, the majority are students (64%). Of the participants who have work activities (36%), their area of specialization was mainly linked to Development (33%), Networks, and Security (13%).

Table 2. Sample characterization variables.

Characteristic	Percentage
Men	87.1%
>29 years old	29.7%
Students	64.4%
Development Specialization (Worker)	33.3%
Networks and Security Specialization (Worker)	13.8%

Table 3 shows the descriptive statistics of the questions associated with the perception of the gender gap, differentiated by sex. High percentage levels of Agreement (Agree and Strongly Agree on the Likert scale) are observed between men and women (7/7 items have aggregate distributions greater than 32% Agreement). The similar percentage distribution of the gap perception between men and women stands out with respect to (P08) "You feel that technology-related careers are more suitable for men than for women" and (P12) "Women have the leadership to assume leadership roles in areas associated with technologies". The dispersion statistics indicate a high diversity in the response (SD> 1.1), indicating a lack of consensus in the perception between men and women. The greatest variability for men and women in perception was in the cultural factor as an element that explains the low female participation in the area of technology. When contrasting the hypothesis that the distribution of perception is independent of sex, it is observed that women, unlike men, perceive that (P11) "There is male chauvinism in careers associated with technology" (X^2 = 128.4; df = 103, p-value = 0.046). For the rest of the variables, no difference in perception is observed (p-value> 0.1).

Table 3. Descriptive statistics indicators perception of gap according to sex.

Indicator	Male			Female			p-value
	% Agreement	Average	SD	% Agreement	Average	SD	
P08	9.1	1.932	1.1426	7.7	1.846	1.0682	0.715
P09	10.2	1.807	1.0489	23.1	2.077	1.3205	0.461
P10	45.4	2.966	1.4499	53.9	3.385	1.3253	0.674
P11	**38.6**	**2.932**	**1.3962**	**53.9**	**3.769**	**0.8321**	**0.046**
P12	71.6	3.920	1.3150	74.7	4.077	1.2558	0.686
P13	31.8	3.170	1.2796	53.8	3.923	0.9541	0.320
P14	36.4	3.114	1.2814	53.9	3.615	1.2609	0.766

When revealing the descriptive statistics (Table 4) for the questions associated with the perception of the gender gap differentiated from economic activity, high levels of agreement are observed (6/7 items have aggregate distributions greater than 40%). The distribution of the differentiated responses according to Student and Worker present similar percentages.

Table 4. Descriptive statistics indicators perception of gap according to economic activity.

Indicator	Student			Worker			p-value
	% Agreement	Average	SD	% Agreement	Average	SD	
P08	10.8	2.062	1.1575	5.6	1.667	1.0420	0.171
P09	**6.1**	1.785	.9920	**22.2**	1.944	1.2408	**0.037**
P10	46.1	2.985	1.4196	47.2	3.083	1.4808	0.460
P11	41.5	3.031	1.3803	38.8	3.056	1.3511	0.739
P12	72.3	3.846	1.3719	75.0	4.111	1.1656	0.398
P13	36.9	3.338	1.2659	30.5	3.139	1.2684	0.810
P14	40.0	3.246	1.2873	36.6	3.056	1.2861	0.656

The contrast of hypotheses for the perception of the gap and economic activity allowed us to identify that there is a significant difference in the distribution regarding the perception of the gap in (P09) "There is a lower academic performance in women who study careers associated with technology" ($X^2 = 130.0$; df = 103, p-value = 0.037). The working participants agree more with this statement than the students. For the rest of the variables, no difference in perception was observed (p-value> 0.1). In Table 5, descriptive statistics are presented for the perception of contextual situations that would explain the gap differentiated by sex.

It is evidenced that there is a high and majority percentage consensus regarding the explanatory situations of the perception of the gap (7/8 items have aggregate distributions greater than 45% Agreement). Women, as a percentage, consider that the gap is explained to a greater extent by (P15) "Part-time job", P (17) "Level of educational preparation for employment" and (P21) "Leadership capacity". For their part, men consider, in percentage terms, that the gap is explained by (P16) "Low-income economic sectors jobs" and (P18) "Socially less valued jobs". Despite the different distributions observed according to sex, no differentiated behaviors were observed in the explanatory factors of the gap (p-value> 0.1).

Table 5. Descriptive statistics indicators context of perception of the gap according to sex.

Indicator	Male			Female			p-value
	% Agreement	Average	SD	% Agreement	Average	SD	
P15	50.0	3.466	0.9462	60.5	3.615	0.7679	0.673
P16	61.4	3.523	0.8967	43.9	3.692	0.7511	0.256
P17	44.5	3.386	1.1689	53.9	3.692	0.9473	0.782
P18	57.9	3.534	0.9820	46.2	3.462	0.7763	0.673
P19	37.7	3.364	0.9847	46.2	3.385	1.1209	0.925
P20	52.3	3.545	0.9458	52.9	3.692	0.7511	0.776

P21	43.2	3.193	1.2582	53.9	3.615	1.0439	0.627
P22	46.6	3.432	1.1527	46.2	3.692	1.0316	0.689

Table 6 indicates the frequency distributions and the descriptive statistics of the questions associated with the explanatory factors of the gap differentiated by economic activity. High percentage levels of Agreement are observed for both segments (all items have an aggregate frequency greater than 50% Agreement). Students have a higher aggregate frequency than workers for the context factors of the gap associated with (P15) "Part-time job", (P17) "Level of educational preparation for employment", (P18) "Socially less valued jobs", (P22) "Family responsibility", (P19) "Self-perception of labor productivity", and (P21) "Leadership capacity".

Table 6. Descriptive statistics indicators context of perception of the gap according to economic activity.

Indicator	Student			Worker			p-value
	% Agreement	Average	SD	% Agreement	Average	SD	
P15	**53.9**	3.615	0.7222	**47.2**	3.250	1.1802	**0.037**
P16	64.6	3.662	0.7557	52.7	3.333	1.0420	0.203
P17	**56.9**	3.677	1.0913	**37.8**	2.972	1.1081	**0.054**
P18	**58.2**	3.615	0.7845	**52.8**	3.361	1.1989	**0.049**
P19	**52.3**	3.508	0.8861	**38.9**	3.111	1.1409	**0.092**
P20	50.7	3.554	0.8666	55.5	3.583	1.0247	0.717
P21	**50.8**	3.523	1.0769	**33.3**	2.750	1.3601	**0.009**
P22	**49.8**	3.615	1.0108	**38.9**	3.194	1.3054	**0.090**

When contrasting the hypotheses of the percentage distributions with respect to the variables that explain the gap according to work activity, it is observed that there is a significant relationship between several factors. Students perceive to a greater extent than workers that the gap is explained by (P15) "Part-time job" ($X^2 = 130.1$; df = 103, p-value = 0.037), (P17) "Level of educational preparation for employment "($X^2 = 127.1$; df = 103, p-value = 0.054), (P18)" Socially less valued jobs "($X^2 = 127.9$; df = 103, p-value = 0.049) , (P22) "Family responsibility" ($X^2 = 122.5$; df = 103, p-value = 0.090), (P19) "Self-perception of labor productivity" ($X^2 = 140.0$; df = 103, p-value = 0.092) and (P21) "Leadership capacity" ($X^2 = 122.7$; df = 103, p-value = 0.090).

Table 7 shows the frequency distributions for the perception of the skills gap in different areas of technology according to sex. The percentage of agreement reflects the perception of a strong or slight gap in favor of men. The results indicate that the perception of the gap between men and women indicates high levels of agreement regarding a direction of the gap in favor of men. (6/7 items have a higher percentage of agreement of 35% in men and 7/7 in the case of men). A percentage of perception of competences is observed in the areas that 53% of women indicate that the gap is in favor of men, which contrasts with the 30% perception of competencies of the male segment. The competencies with the greatest percentage differentiation in favor of a male gap are Programming, Networks and communications, Security and Robotics.

Table 7. Descriptive statistics indicators gap skills in technological area according to sex.

Indicator	Male			Female			p-value
	% Agreement	Average	SD	% Agreement	Average	SD	
P23	33.0	3.420	0.6560	30.8	3.462	0.7763	0.664
P24	44.3	3.580	0.8540	61.6	4.000	0.9129	0.533
P25	28.4	3.239	0.7427	46.2	3.692	0.8549	0.177
P26	43.1	3.511	0.8164	53.9	3.846	0.8987	0.568
P27	42.0	3.580	0.8404	61.6	3.846	0.8006	0.529
P28	**48.7**	**3.466**	**0.7420**	**69.3**	**4.077**	**0.8623**	**0.054**
P29	39.5	3.295	0.8862	46.2	3.615	0.7679	0.543

The contrast of hypotheses for the perception of competencies in the areas and sex allows us to reveal that there is a significant difference in the distribution with respect to the competencies in Robotics. Women present a greater bias gap than men, regarding the domain of robotic competencies (X^2 = 127.1; df = 103, p-value = 0.054). For the rest of the variables, no difference in perception is observed (p-value> 0.1).

Table 8 summarizes the frequency distributions and descriptive statistics for the skills perception gap in the technological areas according to work activity. On average, 40% of the participants consider that regardless of the type of gap in the area, it favors men.

The results indicate that the perception of the skills gap in the areas between students and workers has high levels of agreement regarding a gap direction in favor

of men (5/7 items have the percentage of perception of workers higher than students). For the variables, no difference in perception is observed (p-value> 0.1).

Table 8. Descriptive statistics indicators skills gap in technological area according to economic activity.

Indicator	Student			Worker			p-value
	% Agreement	Average	SD	% Agreement	Average	SD	
P23	29.2	3.385	.6541	38.9	3.500	.6969	0.601
P24	46.2	3.600	.8979	47.2	3.694	.8218	0.775
P25	29.3	3.277	.6961	33.3	3.333	.8944	0.390
P26	37.0	3.400	.8062	52.3	3.833	.8106	0.156
P27	44.6	3.646	.8738	43.5	3.556	.7725	0.624
P28	33.1	3.492	.7526	42.6	3.639	.8333	0.155
P29	32.9	3.369	.9112	30.7	3.278	.8146	0.303

In this research, the Kolmogorow-Smirnow test was used to verify the hypothesis that the variables are normally distributed. Table 9 shows that none of the variables have a normal distribution (p = 0.1 is used as the decision rule).

Table 9. Normal distribution analysis through Kolmogórov-Smirnov test for indicators according to constructs.

Gap Perception		Context Perception Gap		Computer skills	
Indicator	p-value	Indicator	p-value	Indicator	p-value
P8	0.000	P15	0.000	P23	0.000
P9	0.000	P16	0.000	P24	0.000
P10	0.000	P17	0.000	P25	0.000
P11	0.000	P18	0.000	P26	0.000
P12	0.000	P19	0.000	P27	0.000
P13	0.000	P20	0.000	P28	0.000
P14	0.000	P21	0.000	P29	0.000
		P22	0.000		

Based on the above data, the hypothesis of the relationship among the different indicators of perception of the gap is tested. In Table 10, numbers in bold indicate a statistically significant value of the Spearman test, using p <0.05 as a decision criterion.

Table 10. Spearman's correlation coefficient gap perception dimension.

	P08	P09	P10	P11	P12	P13	P14
P08	1.000	**0.600**	0.070	-0.033	**-0.261**	0.043	0.147

	P08	P09	P10	P11	P12	P13	P14
P09		1.000	0.098	-0.007	-0.193	-0.053	0.127
P10			1.000	**0.528**	**0.220**	0.135	**0.329**
P11				1.000	0.154	0.182	**0.445**
P12					1.000	**0.478**	0.143
P13						1.000	**0.215**
P14							1.000

Table 10 shows that there is a positive relationship between the perception that (P08) "You feel that technology-related careers are more suitable for men than for women" and (P09) "There is lower academic performance in women who study careers associated with technology "(r = 0.6; p-value = 0.021) and negative with (P13) "Women can perform better than men in areas associated with technologies" (r = 0.261; p-value = 0.051). (P10) "The cultural factor contributes negatively to the fact that women choose a career associated with technology" is positively related to (P11) "There is male chauvinism in careers associated with technology" (r = 0.528; p-value = 0.011), and with (P12) "Women have the leadership to assume leadership roles in areas associated with technologies" (r = 0.22; p-value = 0.062) and with (P14) "The level of income of women is lower than that of men in areas associated with technologies" (r = 0.329; p-value = 0.045). In turn (P11) "There is male chauvinism in careers associated with technology" (r = 0.445; p-value = 0.035) is positively related to (P14) "The level of income of women is lower than that of men in areas associated with technologies".

Table 11 reflects the indicators of the exploratory factor analysis for the perception of the gap. The data showed a gap perception structure made up of 3 dimensions, with an explained variance of 68.2% and a Cronbach's alpha reliability index of 0.659.

Table 11. Exploratory factor analysis gap perception dimension.

Question	Factor 1	Factor2	Factor 3
P11	0.856		
P10	0.803		
P14	0.650		
P8		0.870	
P9		0.855	
P13			0.901
P12			0.823
V, Explained	26.838	22.442	18.951

Question	Factor 1	Factor2	Factor 3
Reliability		0.659	
Indicators	3	2	2

The first dimension (F1) is called "Perception of Male Superiority" and it is made up of 3 indicators and explains 26.8% of the variance of the construct. The second dimension (F2) is called "Educational Competence", which is made up of 2 indicators and an explained variance of 22.4%. The third dimension (F3), labeled as "Labor Competence", explains 18.9% of the construct and it is made up of 2 indicators.

For the contexts that allow explaining the perceived gap, the hypothesis of the relationship among the different indicators is tested. Numbers in bold indicate a statistically significant value of the Spearman test, using $p < 0.05$ as the decision criterion. In Table 12, we can see that all the indicators are significantly and positively related to each other.

Table 12. Spearman's correlation coefficient dimension context explanation gap.

	P15	P16	P17	P18	P19	P20	P21	P22
P15	1.000	**0.531**	**0.538**	**0.408**	**0.387**	**0.374**	**0.420**	**0.359**
P16		1.000	**0.474**	**0.467**	**0.318**	**0.476**	**0.320**	**0.260**
P17			1.000	**0.459**	**0.437**	**0.306**	**0.549**	**0.324**
P18				1.000	**0.437**	**0.481**	**0.272**	**0.256**
P19					1.000	**0.424**	**0.435**	**0.324**
P20						1.000	**0.219**	**0.484**
P21							1.000	0.**462**
P22								1.000

Table 13 shows the indicators of the exploratory factor analysis for the items in the context of the gap. The data showed a gap perception structure made up of 2 dimensions, with an explained variance of 59.4% and a Cronbach's alpha reliability index of 0.828.

Table 13. Exploratory factor analysis dimension context explanation gap.

Question	Factor 4	Factor 5	Factor 6
P16	0.808		
P15	0.769		
P17	0.718		
P18	0.708		
P22		0.911	
P21		0.655	
P20		0.541	

Question	Factor 4	Factor 5	Factor 6
P19	0.471	0.520	
V, Explained	33.973	25.455	0.000
Reliability		0.828	
Indicators	4	4	0

The first dimension (F4), called "Educational Labor Context", is made up of 4 items and has an explained variance of 34%. The second dimension (F5), labeled "Social and Personal Context", explains 25.6% of the variance of the construct through 4 indicators. Regarding the interrelation among the items that structure the perception of the gap related to competencies in different technological areas, the hypothesis of the relationship among the different indicators is tested. Numbers in Table 14, in bold type, indicate a statistically significant value of the Spearman test, using $p < 0.05$ as the decision criterion. All the indicators are significantly and positively related to each other.

Table 14. Spearman's correlation coefficient dimension competences in areas.

	P23	P24	P25	P26	P27	P28	P29
P23	1.000	**0.553**	**0.340**	**0.515**	**0.415**	**0.560**	**0.472**
P24		1.000	**0.531**	**0.628**	**0.524**	**0.630**	**0.490**
P25			1.000	**0.560**	**0.599**	**0.583**	**0.642**
P26				1.000	**0.594**	**0.615**	**0.487**
P27					1.000	**0.667**	**0.658**
P28						1.000	**0.716**
P29							1.000

Table 15 shows the indicators of the exploratory factor analysis for the items of competencies in areas. The data showed a structure of skills perception in technological areas made up of 1 dimension, with an explained variance of 62.7% and a Cronbach's alpha reliability index of 0.897. From the above, factor (F6) is labeled as "Competence and skill in the technology area".

Table 15. Exploratory factor analysis dimension competences in areas.

Question	Factor 6	Factor 7	Factor 8
P28	0.872		
P29	0.798		
P26	0.798		
P27	0.791		
P25	0.778		
P24	0.777		

Question	Factor 6	Factor 7	Factor 8
P23	0.698		
V, Explained	62.209	0	0
Reliability		0.897	
Indicators	7	0	0

To analyze the hypothesis of the existence of significant differences among the perception of the participants for the study dimensions according to sex, the Mann-Whitney U test was used, using $p < 0.05$ as the decision criterion. The results are presented in Table 16.

Table 16. Differences in dimensions according to the Mann – Whitney u test for sex.

Gap Perception		Context Perception Gap		Perception of Gap Areas of Competence	
Indicator	**p-value**	**Indicator**	**p-value**	**Indicator**	**p-value**
P8	0.836	P15	0.598	P23	0.995
P9	0.609	P16	0.778	P24	0.124
P10	0.326	P17	0.402	**P25**	**0.073**
P11	**0.042**	P18	0.594	P26	0.235
P12	0.758	P19	0.923	P27	0.237
P13	**0.043**	P20	0.699	**P28**	**0.013**
P14	0.182	P21	0.305	P29	0.162
		P22	0.541		

There is a significant difference in the perception of men and women for the items (P11) "There is male chauvinism in careers associated with technology" ($z = -1.653$; p-value = 0.042), (P13) "Women can perform better than men in areas associated with technologies" ($z = -1.659$; p-value = 0.043). For the rest of the variables, no difference in perception is observed (p-value> 0.1).

For the contrast by explanatory context of the gap, no significant differences were observed by sex (p-value> 0.1). On the other hand, it is observed that there is a significant difference between men and women for the competences in (P25) "Project Management" ($z = -1.461$; p-value = 0.073) and (P28) "Robotics" ($z = -2.223$; p-value = 0.013).

Table 17 shows the results of the hypothesis test of the existence of significant differences among the perception of the subjects for the dimensions of the study according to economic activity. The Mann-Whitney U test was used, using $p < 0.05$ as the decision criterion.

Table 17. Differences in dimensions according to the Mann – Whitney u test for economic activity.

Gap Perception		Context Perception Gap		Perception of Gap Areas of Competence	
Indicator	**p-value**	**Indicator**	**p-value**	**Indicator**	**p-value**
P8	**0.064**	P15	0.230	P23	0.349
P9	0.798	P16	0.149	P24	0.697
P10	0.676	**P17**	**0.003**	P25	0.895
P11	0.960	P18	0.427	**P26**	**0.015**
P12	0.352	**P19**	**0.073**	P27	0.712
P13	0.362	P20	0.756	P28	0.558
P14	0.449	**P21**	**0.005**	P29	0.877
		P22	0.100		

There is a significant difference in the perception of Students and Workers for the items (P08) "You feel that technology-related careers are more suitable for men than for women" ($z = -1.522$; p-value = 0.064), (P17) "Level of educational preparation for employment" ($z = -1.883$; p-value = 0.003), (P19) "Self-perception of labor productivity" ($z = -1.453$; p-value = 0.073), (P21) "Leadership capacity" ($z = -2.576$; p-value = 0.005) and (P26) "Gap in Networks and Communications" ($z = -2.170$; p-value = 0.015). For the rest of the variables, no difference in perception is observed (p-value > 0.1).

In Table 18 the factor score for each of the factors found in the exploratory factor analysis was calculated and contrasted to the variables of sex and economic activity.

Table 18. P-value for differences in factorial scores according to sex and economic activity.

Factors	Sex	Economic activity
	p-value	**p-value**
F1	**0.057**	0.886
F2	0.799	0.447
F3	0.245	0.918
F4	0.739	**0.047**
F5	0.398	**0.064**
F6	**0.060**	0.460

Regarding the first factor (F1) "Perception of Male Superiority", the results indicate that this dimension is perceived differently between men and women ($t = 1.594$ df = 103; p-value = 0.057). Men perceive themselves with a higher superiority score and women do not perceive themselves inferior to men. For the explanatory dimension

of the gap (F4) "Educational Labor Context" a significant difference is observed between students and workers (t = 1.690 df = 103; p-value = 0.047). Workers consider that the gap is explained, in part, by the employment and educational context. In relation to the explanatory dimension (F5) "Social and personal Context", the results do not allow accepting the null hypothesis of equality of factorial means by economic activity (t = 1.534 df = 103; p-value = 0.064). Finally, for the (F6) "Competences and Skills in Technological Areas", a difference in perception is observed between men and women (t = 1.568 df = 103; p-value = 0.060). The surveyed men self-perceive they have greater technological skills and abilities than women.

IV. CONCLUSIONS

We obtained 104 responses to the applied questionnaire. The sample was composed mainly of young men. Among the workers, the specialization in development, security, and networks and communications stands out. In relation to the objectives, there is a high consensus regarding the aspects that generate and determine the perception of the gap, which implies that there is a high degree of agreement in most of the items evaluated. In addition, there is a high consensus in indicating that there is a latent gap in the area of technologies.

In terms of gender, men do not consider to a greater extent that there is male chauvinism in the computer studies area. In addition, they consider that women can perform better in the leadership role and that they can perform better than men in the labor field. For their part, women consider that there is male chauvinism in careers in the areas associated with technologies and the careers are also suited to female expectations. When contrasting by economic activity, some perceptions tend to decline in intensity, indicating that work experience conditions the perception of the gap. With work experience, the gap is oriented to the association of the career with gender, it is considered adequate for the male gender.

Also from the gender perspective, there is a high consensus regarding the factors that would explain the gap, among which the employer bias stands out. The incorporation of the participants of study into the world of work generates a change

in perception regarding the variables that would explain the gap. The workers' perception is oriented to the fact that the gap is explained by conditions of the educational work context and personal social context.

The underlying dimensions indicate that the perception of the gap is in "Perception of Male Superiority", "Educational Competence" and "Labor Competence". On the other hand, the perceived explanatory factors of the gap are the "Educational Labor Context" and the "Social and Personal Context".

Finally, among the participants under study, the dimension of male superiority is rejected by women, but not by men.

For future research, it is expected to enlarge the sample of this survey. In addition to conducting research associated with the statistical data provided by the CASEN survey, in such a way as to contrast the findings of this study with the data provided at the national level.

AUTHOR´S CONTRIBUTION

Jenny Morales-Brito: research, conceptualization, data collection, methodology, original draft writing, writing revision and editing.

Germán Rojas-Cabezas: research, data collection, formal analysis, methodology, original draft writing, writing revision.

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