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Scientific articles

El pensamiento computacional en estudiantes de Contaduría: desarrollo de competencias integrales para los estudiantes de negocios del siglo XXI

The Computational thinking on accounting students: Developing integral competencies for the 21st-century.

Desenvolvendo competências e habilidades abrangentes para estudantes de negócios do século XXI. Pensamento computacional para estudantes de contabilidade

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Resumen

El mercado laboral actual, impulsado por la digitalización, la automatización y la economía colaborativa, exige que los estudiantes desarrollen diversas competencias. Estas se categorizan de acuerdo a la tipología de Tobón en transversales, disciplinarias y de aprendizaje, destacando la importancia del pensamiento crítico y la adaptabilidad en la Educación 4.0, paradigma que alinea la enseñanza con la Cuarta Revolución Industrial mediante la integración de tecnologías avanzadas y habilidades sociotécnicas.

En este marco, es fundamental que los estudiantes de negocios desarrollen el pensamiento computacional para posibilitar habilidades como la descomposición de problemas, el reconocimiento de patrones y la abstracción.

El estudio empleó un enfoque descriptivo y transversal mediante la aplicación de las Escalas de Pensamiento Computacional (CTS). La investigación se llevó a cabo en una muestra de 488 estudiantes de Contaduría de la Universidad Veracruzana, México. Finalmente, el procesamiento de los datos incluyó análisis de normalidad y pruebas de correlación estadística de Pearson para evaluar la percepción del pensamiento computacional en dicha población.

Los resultados muestran diferencias de género en las puntuaciones. Además, se identificó que las asignaturas de literacidad digital, pensamiento crítico, matemáticas administrativas y estadística cuentan con asociaciones estadísticas positivas con las dimensiones de las CTS Pensamiento crítico y Resolución de problemas. Lo anterior evidencia la relevancia del diseño curricular para fortalecer las habilidades esenciales del siglo XXI. Se concluye que integrar estas áreas es determinante para que el egresado responda con éxito a las exigencias de los entornos organizacionales modernos y tecnológicos.

Palabras clave: educación superior, STEM, disciplinas no STEM, desarrollo de habilidades.

Abstract

The current labor market, driven by digitalization, automation, and the gig economy, demands that students develop a diverse set of competencies. These are categorized into soft, disciplinary, and learning skills, highlighting the importance of critical thinking and adaptability in Education 4.0—a paradigm that aligns teaching with the Fourth Industrial Revolution by integrating advanced technologies and socio-technical skills.

In this context, business students need to develop computational thinking skills, including problem decomposition, pattern recognition, and abstraction.

This study analyzes perceptions of computational thinking among accounting students at the Universidad Veracruzana in Mexico. A descriptive, cross-sectional approach was used with the Computational Thinking Scale (CTS) and a sample of 488 students. Data processing included normality tests and statistical correlation analyses.

The findings reveal gender differences in performance scores. Furthermore, it was identified that digital literacy, critical thinking, administrative mathematics, and statistics positively correlate with the dimensions of critical thinking and problem-solving. This evidence underscores the relevance of curricular design in strengthening essential 21st-century skills. It is concluded that integrating these areas is crucial for graduates to successfully meet the demands of modern, technological organizational environments.

Keywords: higher education, STEM, non-STEM disciplines, developing skills

Resumo

O mercado de trabalho atual, impulsionado pela digitalização, automação e economia colaborativa, exige que os estudantes desenvolvam diversas competências. Estas são categorizadas em transversais, disciplinares e de aprendizagem, destacando-se a importância do pensamento crítico e da adaptabilidade na Educação 4.0; paradigma que alinha o ensino à Quarta Revolução Industrial por meio da integração de tecnologias avançadas e competências sociotécnicas.

Nesse quadro, é fundamental que os estudantes de negócios desenvolvam o pensamento computacional para possibilitar habilidades como a decomposição de problemas, o reconhecimento de padrões e a abstração.

O estudo analisa a percepção do pensamento computacional em estudantes de contabilidade da Universidad Veracruzana, México. Para isso, aplicou-se uma abordagem descritiva e transversal mediante a Escala de Pensamento Computacional (CTS) em uma amostra de 488 estudantes. O processamento incluiu análises de normalidade e testes de correlação estatística.

Os resultados mostram diferenças de gênero nas pontuações. Além disso, identificou-se que as disciplinas de literacia digital, pensamento crítico, matemática administrativa e estatística correlacionam-se positivamente com as dimensões de pensamento crítico e resolução de problemas. O exposto evidencia a relevância do desenho curricular para fortalecer as competências essenciais do século XXI. Conclui-se que a integração dessas áreas é determinante para que o egresso responda com sucesso às exigências dos ambientes organizacionais modernos e tecnológicos.

Palavras-chave: Educação superior, STEM, Disciplinas não STEM, Desenvolvimento de habilidades.

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Introduction

The current labor market is evolving rapidly due to global demand driven by scientific and technological advances, such as digitization, automation, telework, and the collaborative economy.

This transformation requires that professionals acquire comprehensive competencies that include knowledge, attitudes, and skills of a technical, interpersonal, cognitive and, socio-emotional nature (González-Pérez and Ramírez-Montoya, 2022).

Similarly, Raitskaya and Tikhonova (2019) and Ozturk (2022) established that employability depends on a combination of hard and soft skills. That is, technical knowledge alone is not enough; the development of skills such as communication, leadership, emotional intelligence, abstraction, critical thinking, and creative problem-solving is also essential.

Similarly, Christy and Lyau (2022), in the context of the fourth industrial revolution, indicate that business education students need to develop a diverse set of competencies to succeed in the changing labor market. Table 1 presents the identified critical competencies.

Table 1. Critical competencies of business education students

Skills	Description
Techniques	Mastery of specialized knowledge, digital tools and regulatory procedures in the accounting and administrative areas, enabling one to operate in the digital landscape and effectively leverage technology.
Methodological	Ability to apply logical strategies and problem-solving processes that allow one to address challenges and take advantage of opportunities in constant change and technological advances.
Personal	A set of attributes intrinsic to the individual, such as critical thinking and professional ethics, that play a fundamental role in their success in the business field.
Social	A set of interpersonal skills that are essential for business students to thrive in a collaborative and dynamic work environment.

Fountain: Original work

Within the competencies, computational thinking has become established as essential, as it helps solve problems, design systems, and understand processes through analytical logic (Wing , 2006; Korkmaz et al., 2017).

It is important to consider that computational thinking has been studied as an integral competence, mainly in students of science, technology, engineering and mathematics (known as STEM); however, the knowledge, skills and attitudes that it integrates are also desirable in students of business schools, who are called non-STEM students (López Simó et al., 2020).

Within this framework, the present study aims to analyze the perception of computational thinking skills among accounting students at the Universidad Veracruzana in Mexico, and to examine their relationship with academic and demographic variables. The analysis seeks to contribute to understanding how business courses can strengthen the comprehensive competencies required by 21st-century professionals.

Literature review

Business schools are currently at the forefront of integrating technologies and methodologies into their curricula to equip students with the skills necessary for success in the 21st-century landscape. These skills may involve a shift toward experiential learning methods, where students participate in real-world projects, simulations, and professional internships to gain practical experience in problem-solving, collaboration, and leadership.

This approach allows students to apply their knowledge in practical situations, enhancing their adaptability and critical thinking skills (Gachino & Worku , 2019).

Several studies on 21st-century skills are based on the OECD's Programme for the International Assessment of Adult Competencies (PIAAC). This framework assesses knowledge, skills, and attitudes in literacy, numeracy, and problem-solving in technological environments, with the aim of strengthening areas identified as critical (Al Khateeb et al., 2024; Engelhardt et al., 2021; Kawaguchi and Toriyabe , 2022; Maslov and Zhong , 2022).

The European Commission proposed another framework, the Digital Competence Framework for Citizens (DigComp), which can help people assess their digital competences, identify gaps in their knowledge, skills and attitudes, and participate in the digital society (Bartolomé and Garaizar, 2022; Budai et al., 2023; Nguyen et al., 2024; Van Audenhove et al., 2024).

In particular, within the field of business schools, several publications analyze innovative methods in higher education to strengthen competencies and , consequently, the skills most in demand by citizens and managers (Cyphert et al., 2019; Gimenez et al., 2020; Longmore et al., 2018; Ranta et al., 2022a). Some studies focus on faculties related to entrepreneurship (Pennetta et al., 2023; Peschl et al., 2021; Ranta et al., 2022b), while others examine skills associated with leadership (Ngayo) . Photo , 2021; Rony et al., 2023).

However, computational thinking is considered one of the most critical competencies for 21st-century university students. These competencies are primarily studied through two approaches: STEM and non-STEM students. As mentioned, this manuscript focuses on the latter, where students with limited exposure to computer science develop computational thinking through their coursework. In this regard, numerous studies have been published using different approaches, such as those based on computer programming (Laura-Ochoa & Bedreg al-Alpaca, 2021; Liao et al., 2022a; Wang et al., 2022) and those that measure the level of computational thinking development by considering the courses students have previously taken (De Santo et al., 2022; Jang et al., 2023; Kang et al., 2023; Rodríguez-Abitia et al., 2021).

This work is situated within the second approach, considering that, transversally through the knowledge implicit in the subjects, non-STEM students, in this particular case, Accounting students, perceive the development of computational thinking in their professional training.

Materials and methods

Studio design

This work was developed as a case study focused on the Bachelor's Degree program in Accounting of the Faculty of Accounting and Administration, Xalapa region, of the Veracruzana University, Mexico, with an exploratory and descriptive approach, whose purpose was to analyze student's perception of computational thinking skills.

This study adopted a quantitative approach with a descriptive-correlational scope, allowing detailed information to be obtained on a phenomenon that has been little explored in the field of economic and administrative sciences. This choice is justified by the need for a robust statistical analysis of perceptions, aimed at identifying patterns of behavior and statistically significant associations among the variables analyzed. The research was conducted in situ, using a non-experimental, cross-sectional design, as data collection took place at a single point in time (Gómez-Escalonilla, 2021).

Population and sample

For the present analysis, the population consisted of active Bachelor of Accounting students who entered between 2020 and 2023. According to the data provided by the Secretary of the Faculty of Accounting and Administration, the available enrollment is shown in Table 2.

Table 2. Active enrollment for the Bachelor's Degree in Accounting.

Year of entry	Active students
2020	177
2021	182
2022	208
2023	225

Source: Own elaboration

To determine the sample size, stratified probability sampling was used for finite populations, ensuring proportional participation from each randomly selected generation. The formula used for the calculation was as follows:

$$n = \frac{N * Z^2 * p * q}{e^2 * (N - 1) + Z^2 * p * q}$$

Where *Z* is the confidence level (95%), *p* is the probability, *q* is the probability that the event will not occur, *N* is the population and *e* is the maximum accepted estimation error (5%).

The student population of the Bachelor of Accounting program was divided into four strata corresponding to the active academic cohorts, and 122 informants were randomly selecting per cohort until a total sample of 488 students was obtained. This design guarantees uniform representativeness among the groups and ensures that the findings fairly reflect the evolution of the student profile throughout the various stages of the curriculum design.

The survey was administered digitally using the Microsoft Forms platform during October 2023, which allowed for efficient data collection and ensured student participation from their own devices.

Educational context

In the context of the Bachelor's Degree in Accounting at the University of Veracruz, it is worth noting that, although the curriculum is not directly related to computer science, it includes subjects that, according to some authors, could influence computational thinking.

The literature identifies several fundamental curricular areas for this purpose. First, it highlights subjects related to mathematical reasoning, such as administrative mathematics and statistics (Ersozlu et al., 2023; Kallia et al., 2021; Khoo et al., 2022; Wu & Yang, 2022). Second, it includes those related to computer science, specifically digital literacy and technological solutions applicable to organizations (Lee et al., 2020; Saad & Zainudin , 2022). Finally, it emphasizes the importance of educational experiences focused on critical thinking for problem-solving (Lyon & J. Magana , 2020) as a cross-cutting theme in professional training.

Instrument

Data collection was carried out using the instrument proposed and validated by Korkmaz , Çakir , and Özden (2017), known as the Computational Thinking Scales (CTS). The instrument consists of 29 items grouped into five dimensions. Responses were measured on a 5-point Likert scale, with reverse scored items in the Problem-Solving dimension, as detailed in Table 3.

The reliability of the instrument, determined by Cronbach's Alpha coefficient, was 0.828, which is considered good.

Table 3. Dimensions and items of the Computational Thinking Scales.

Dimensions	Items	Scale	Punctuation
Creativity	8	Always, frequently, sometimes, almost never, and never	5 to 1
Algorithmic thinking	6	Strongly agree, agree, undecided, disagree, and strongly disagree	5 to 1
Cooperativity	4	Strongly agree, agree, undecided, disagree, and strongly disagree	5 to 1
Critical thinking	5	Strongly agree, agree, undecided, disagree, and strongly disagree	5 to 1
Problem solving	6	Strongly agree, agree, undecided, disagree, and strongly disagree	1 to 5
Note: The 'Problem Solving' dimension has an inverted score (1 to 5) because its items were written in reverse order with respect to the attitude scale, requiring an adjustment in the norm to maintain the consistency of the statistical analysis.			

Source: Prepared by the author based on Korkmaz , Çakir and Özden , 2017.

To characterize the sample, sociodemographic variables (age and gender) and academic variables (income generation and course accreditation) were defined. Regarding the latter, informants were asked about their performance in the courses in digital literacy, critical thinking for problem-solving, administrative mathematics, statistics, and technological solutions for organizations.

These educational experiences were selected from the curriculum matrix of the Bachelor's Degree in Accounting (Universidad Veracruzana, n.d.) using a content association criterion. This consisted of identifying those subjects whose theoretical programs included key terms linked to the dimensions of the study, such as Creativity, Algorithmic Thinking, Innovation, Technology, and Problem Solving.

Procedure

The instrument was administered digitally. Students were invited to participate voluntarily through informed consent, which guaranteed the anonymity and confidentiality of their responses at all times.

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To determine the possible relationships between sociodemographic and academic variables and the dimensions of computational thinking, total scores were assigned to each dimension and classified into three levels: below average, average, and above average.

Results analysis

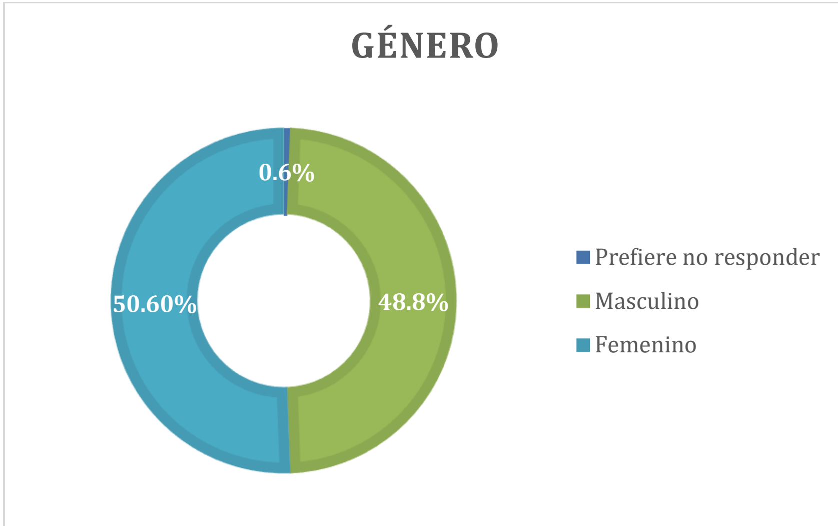
For the analysis of the results, the sums of the dimensions were tabulated in Microsoft Excel, and the data were subsequently processed using IBM SPSS Statistics software . Normality tests were performed using the Shapiro-Wilk method, and descriptive analyses based on measures of central tendency and dispersion were applied. Due to the nature of the variables, Pearson's chi-squared test was used to evaluate significant associations between gender and the computational thinking score, as well as between course accreditation and the critical thinking dimension. Results with significance values ($p < 0.05$) were interpreted as evidence of statistically significant associations, indicating a dependence between the analyzed variables.

Results

Descriptive Analysis

The Shapiro-Wilk normality test was applied, and the result shows a significant *p -value less than* .05, indicating that the data do not follow a normal distribution. Regarding the sociodemographic analysis by gender, 50.6% of the responses were from women, 48.8% from men, and 0.6% preferred not to answer, as shown in Figure 1.

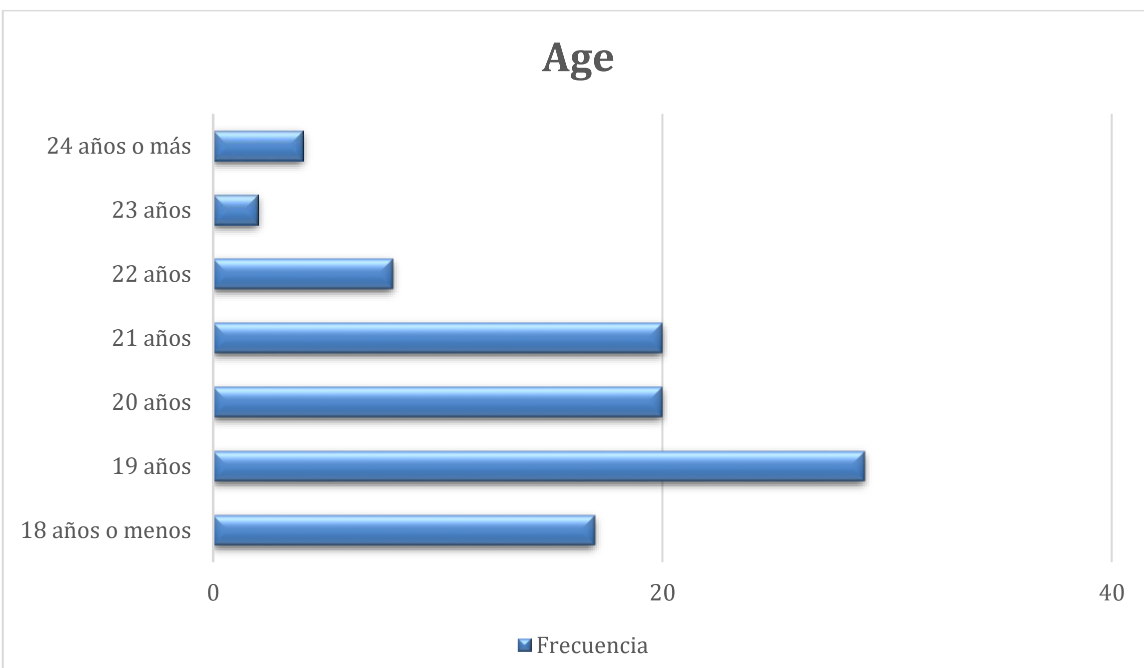
Figure 1. Distribution by gender.



Source: Own elaboration

The age distribution of the participants was also analyzed (see Figure 2). The group aged 18 and under represented 17% of the sample, followed by the 19-year-old group, which accounted for 29%. Students aged 20 and 21 each constituted 20%, while the categories of 22, 23, and 24 years and over registered participation rates of 8%, 2%, and 4%, respectively.

Figure 2. Age distribution



Fountain: Original work

Table 4 shows the distribution of computational thinking scores by gender. This analysis allows us to explore whether there are differences between men and women in their self-perception of the assessed skills, as well as to identify possible performance patterns associated with gender.

First, of those who identified as female, 26.4% were below the average, 21.9% above the average, and 2.3% at the average. Regarding those who identified as male, 27% were above the average, 20.7% below the average, and only 1% at the average. As for those who preferred not to answer about their gender, 0.6% were below the average.

Of the people who responded to the survey, 49% were above average, 47.7% were below average, and 3.3% at average in computational thinking score.

Table 4. Contingency table of gender and computational thinking.

			Computational thinking			Total
			Below average	On average	Above average	
Gender	Female	Count	129	11	107	247
		% of total	26.4%	23%	21.9%	50.6%
	Male	Count	101	5	132	238
		% of total	20.7%	1.0%	27.0%	48.8%
	I prefer not to answer	Count	3	0	0	3
		% of total	0.6%	0.0%	0.0%	0.6%
Total		Count	233	16	239	488
		% of total	47.7%	3.3%	49.0%	100.0%

Source: Prepared by the author using IBM SPSS software

Table 5 presents the results of the computational thinking assessment reporting the number of students (n) and their percentage distribution, segmented by income generation. The analysis aims to determine whether academic advancement is associated with greater development of computational skills, classifying participants into three categories according to their position relative to the arithmetic mean: below, at, and above the mean.

Regarding the distribution by dimensions, the following findings are observed based on the frequency of students (n):

Creativity: The highest count of students above the average is located in the 2021 generation (n = 69), while the highest frequency below the average belongs to the 2020 generation (n = 55).

Algorithmic thinking: The 2021 cohort has the highest number of students above the average (n = 60). In contrast, the group with the highest number of students below the average is the 2022 cohort (n = 54).

Cooperativity: The highest frequency above the average occurs in the 2021 generation (n = 48), while the highest count below the average is observed in the 2022 generation (n = 70).

Critical thinking: The 2021 cohort stands out with the highest number of students above average (n = 72). The highest number below average corresponds to the 2022 cohort (n = 49).

Problem Solving: Generations 2022 and 2023 have the highest frequency above the average (n = 59 each), while the highest count below the average is in generation 2020 (n = 62).

Finally, in the total sum of Computational Thinking, the 2021 generation shows the highest count of students above the average (n = 67), while the 2020 generation registers the most significant frequency below the average (n = 68).

Table 5. Dimensions of computational thinking and generation contingency table.

				Generation			
				2020	2021	2022	2023
Dimensions	Creativity	Below average	Count (n)	55	38	53	48
			% of total	11.3%	7.8%	10.9%	9.8%
		On average	Count (n)	13	15	12	12
			% of total	2.7%	3.1%	2.5%	2.5%
		Above average	Count (n)	54	69	57	62
			% of total	11.1%	14.1%	11.7%	12.7%
	Algorithmic thinking	Below average	Count (n)	52	49	54	57
			% of total	10.7%	10.0%	11.1%	11.7%
		On average	Count (n)	21	13	17	15
			% of total	4.3%	2.7%	3.5%	3.1%
		Above average	Count (n)	49	60	51	50
			% of total	10.0%	12.3%	10.5%	10.2%
	Cooperativity	Below average	Count (n)	63	59	70	57
			% of total	12.9%	12.1%	14.3%	11.7%
		On average	Count (n)	15	15	13	20
			% of total	3.1%	3.1%	2.7%	4.1%
		Above average	Count (n)	44	48	39	45
			% of total	9.0%	9.8%	8.0%	9.2%
	Critical thinking	Below average	Count (n)	34	32	49	39
			% of total	7.0%	6.6%	10.0%	8.0%
		On average	Count (n)	23	18	15	22
			% of total	4.7%	3.7%	3.1%	4.5%
		Above average	Count (n)	65	72	58	61
			% of total	13.3%	14.8%	11.9%	12.5%
	Problem solving	Below average	Count (n)	62	55	53	45
			% of total	12.7%	11.3%	10.9%	9.2%
		On average	Count (n)	5	10	10	18
			% of total	1.0%	2.0%	2.0%	3.7%
		Above average	Count (n)	55	57	59	59
			% of total	11.3%	11.7%	12.1%	12.1%
Total Sum	Computational thinking	Below average	Count (n)	68	49	62	54
			% of total	13.9%	10.0%	12.7%	11.1%
		On average	Count (n)	2	6	2	6
			% of total	0.4%	1.2%	0.4%	1.2%
		Above average	Count (n)	52	67	58	62
			% of total	10.7%	13.7%	11.9%	12.7%

Fountain: Created using IBM SPSS software

Table 6 details the relationship between the dimensions of computational thinking and the accreditation of subjects linked to analytical, technological, and critical competencies. The analysis seeks to identify whether passing specific educational experiences is associated with the distribution of students across performance levels (below, at, or above average).

The findings indicate that among the students who passed the analyzed subjects (column 'Yes'), a predominant percentage of participants scored above average in the Critical Thinking dimension, reaching 40.2% of the total sample in most subjects. Conversely, in the Cooperativeness dimension, the highest concentration of students who passed these educational experiences is below average, representing approximately 39.3% of the overall sample.

Table 6. Percentage distribution by subject accreditation and dimension level.

		Digital literacy		Critical thinking		Administrative Mathematics		Technology solutions for organizations		Statistics	
		Yeah (n,%)	No (n,%)	Yeah (n,%)	No (n,%)	Yeah (n,%)	No (n,%)	Yeah (n,%)	No (n,%)	Yeah (n,%)	No (n,%)
Creativity	Below average	29.90%	9.80%	29.90%	9.80%	29.90%	9.80%	19.10%	20.70%	29.90%	9.80%
	In the middle	8.20%	2.50%	8.20%	2.50%	8.20%	2.50%	5.70%	4.90%	8.20%	2.50%
	On average	37.10%	12.50%	37.10%	12.50%	37.10%	12.50%	25.20%	24.40%	37.10%	12.50%
Algorithmic thinking	Below average	31.80%	11.70%	31.80%	11.70%	31.80%	11.70%	20.70%	22.70%	31.80%	11.70%
	In the middle	10.50%	3.10%	10.50%	3.10%	10.50%	3.10%	7.00%	6.60%	10.50%	3.10%
	On average	33.00%	10.00%	33.00%	10.00%	33.00%	10.00%	22.30%	20.70%	33.00%	10.00%
Cooperativity	Below average	39.30%	11.70%	39.30%	11.70%	39.30%	11.70%	25.00%	26.00%	39.30%	11.70%
	In the middle	9.00%	3.90%	9.00%	3.90%	9.00%	3.90%	6.10%	6.80%	9.00%	3.90%
	On average	26.80%	9.20%	26.80%	9.20%	26.80%	9.20%	18.90%	17.20%	26.80%	9.20%
Critical thinking	Below average	23.60%	8.00%	23.60%	8.00%	23.60%	8.00%	13.50%	18.00%	23.60%	8.00%
	In the middle	11.50%	4.50%	11.50%	4.50%	11.50%	4.50%	8.40%	7.60%	11.50%	4.50%
	On average	40.20%	12.30%	40.20%	12.30%	40.20%	12.30%	28.10%	24.40%	40.20%	12.30%
Problem solving	Below average	34.80%	9.20%	34.80%	9.20%	34.80%	9.20%	24.00%	20.10%	34.80%	9.20%
	In the middle	5.10%	3.70%	5.10%	3.70%	5.10%	3.70%	3.10%	5.70%	5.10%	3.70%
	On average	35.20%	11.90%	35.20%	11.90%	35.20%	11.90%	23.00%	24.20%	35.20%	11.90%

Note: Table 6 details the relationship between the dimensions of computational thinking and the accreditation of subjects linked to analytical, technological, and critical competencies. The analysis seeks to identify whether passing specific educational experiences is associated with the distribution of students across performance levels (below, at, or above average).

Fountain: Prepared by the author using IBM SPSS software.

Statistical associations

The associations show the relationship of dependence between the categorical variables of the study. Pearson's chi-square test was used to determine the existence of a statistically significant association between sociodemographic and academic factors and performance levels in computational thinking.

Table 7 shows the included elements: gender variables and the total score in computational thinking. The analysis identifies the factors with the greatest impact on the development of 21st-century skills among accounting students. The test yielded a significant value of 0.022, less than 0.05, indicating a dependency between the two variables. Furthermore, passing the digital literacy course and the score in the critical thinking dimension were positively associated with a significant value less than 0.05, as was passing the critical thinking, administrative mathematics, and statistics courses with the score obtained in the critical thinking dimension, with a significant value of 0.023.

Regarding age and total score of computational thinking, the test shows an asymptotic p-value of 0.104, which is greater than 0.05, so no statistically significant association was observed.

Table 7. Associations between variables and the level of computational thinking.

Element	Asymptotic significance
Gender and total computational thinking score	0.022
Age and total computational thinking score	0.104
Digital literacy course completed and score in the Critical Thinking dimension	0.023
Critical Thinking course completed and score in the Critical Thinking dimension	0.023
Administrative mathematics course completed and score in the Critical Thinking dimension	0.023
Statistics course completed and score in the Critical Thinking dimension	0.023

Fountain: Created using IBM SPSS software

Discussion

The findings should be analyzed in light of the premise that an educational model grounded in computational thinking enables students to deploy skills for the 21st century (Buitrago-Flórez et al. 2021; Gretter & Yadav 2016; Yadav et al. 2016).

According to the case study results, computational thinking skills are associated with various factors, such as credited courses and gender. It was also observed that some elements, such as age and student cohort, showed no statistically significant association with the results, influencing only the academic year in which they are currently enrolled. For example, Table 5 shows no significant variations in the percentages of students above or below the average; the number of students with a final score across all cohorts varies only between 10.7% and 13.7%.

Regarding gender, the tests conducted show a significant association, with 27% of those identifying as male reporting scores above the average compared to 21.9% for females; furthermore, fewer men scored below the average (20.7%) than women (26.4%). This contrast with Rodríguez- Abitia et al. (2021) reveals similarities in the heterogeneity of the results, attributable to the similar profile of non-STEM students . However, the differences in gender and family environment suggest variations in the institutional or socioeconomic context. Likewise, the lack of association with age indicates that, without specific pedagogical intervention, academic advancement does not guarantee these skills.

It is also important to highlight that most of the published works on the perception or development of computational thinking in non-STEM contexts that were reviewed first instruct students through courses and then measure their development (De Santo et al., 2022; Jang et al., 2023; Liao et al., 2022; Prado Ortega et al., 2023). Some of the reviewed works directly consider the courses taken and their impact on the development of this competency (Camargo Pérez & Munar Ladino, 2021; Kang et al., 2023; Rodríguez- Abitia et al., 2021). In this sense, the present study differs by evaluating the relationship between the educational experiences specific to the Accounting curriculum and computational thinking.

Additionally, the associations obtained reinforce the relevance of certain educational experiences: the Critical Thinking dimension showed a statistically positive association with the subjects of Digital Literacy, Critical Thinking, Administrative Mathematics, and Statistics (p-value = .023), and was also the dimension with the highest number of students above the average (more than 40%). This coincides with what was reported by Rahman

(2019), who highlights that problem-solving, a skill closely linked to the critical thinking analyzed, involves selecting innovative procedures and objectively analyzing information.

The educational experiences analyzed present descriptive trends related to the study's dimensions. First, Creativity is linked to technological solutions applied to organizations and administrative mathematics, fostering the generation of innovative proposals within organizations. Second, Critical Thinking for Problem Solving allows for the effective evaluation of alternative problem-solving approaches. Third, Statistics is associated with Problem Solving, providing quantitative tools for decision-making. Finally, in Digital Literacy, the use of software strengthens both Critical Thinking and Algorithmic Thinking, which aligns with Rahman's (2019) observations regarding the role of these competencies in strengthening 21st-century skills.

Conclusions

According to the results and discussion, the study allows us to conclude that computational thinking in accounting students is associated with gender and accredited subjects, while no statistically significant association was observed with age and generation.

Furthermore, the results obtained suggest that the educational experiences of the curriculum are linked to the development of computational thinking.

The Critical Thinking dimension showed the highest level of performance, with over 40% of students in the total sample (N=488) scoring above the average, highlighting its strategic value in professional training. Subjects such as Digital Literacy, Critical Thinking for Problem Solving, Administrative Mathematics, and Statistics are associated with the development of computational thinking, confirming the relevance of their inclusion in non-STEM academic programs.

The results obtained allowed the research objective to be met.

The study achieved its objective by demonstrating that demographic and academic factors influence accounting students' perceptions of computational thinking. The findings revealed significant gender differences in overall scores, as well as a direct association between passing specific courses and the Critical Thinking and Problem-Solving dimensions. These results confirm that curriculum design in business areas (non-STEM contexts) is crucial for strengthening essential 21st-century skills.

Future lines of research

Based on these findings, the following lines of research are proposed: first, applying the instruments in other non-STEM fields of study to explore the relationship between curriculum and computational thinking. Second, conducting comparative and longitudinal studies to observe the evolution of competencies throughout academic careers is also advisable. Finally, designing interventions or support courses focused on strengthening 21st-century skills and subsequently evaluating their effectiveness is recommended.

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