Revista Iberoamericana para la Investigación y el Desarrollo Educativo
ISSN 2007 - 7467

https://doi.org/10.23913/ride.v14i28.1952

Scientific articles

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Exploring the synergy between mathematical skills and financial literacy in young university students: The role of previous economic-financial training

Exploring the synergy between mathematical and literary competencies finance for young people universitários : The role of economic- financial training previous

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Revista Iberoamericana para la Investigación y el Desarrollo Educativo
ISSN 2007 - 7467

Resumen

Con la creciente complejidad de los sistemas económicos, la educación financiera se ha convertido en un factor esencial para tomar decisiones apropiadas y enfrentar los desafíos y oportunidades financieros de manera más efectiva en la vida diaria. Por lo tanto, el objetivo de esta investigación fue evaluar el impacto de las habilidades matemáticas en la educación financiera de jóvenes mexicanos en el rango de edad de 18 a 30 años que asisten a la universidad, así como el grado en que la formación previa en áreas económico-financieras modera la fuerza de asociación entre ambas variables. Para ello, el método de investigación fue cuantitativo, para lo cual se combinó el enfoque descriptivo y correlacional. Asimismo, se implementó un modelo de regresión lineal simple con una variable moderadora. Los resultados revelaron una correlación significativa y positiva entre las habilidades matemáticas y el grado de educación financiera de los estudiantes universitarios. Además, se encontró que la formación previa en áreas económico-financieras fortalece esta relación, lo que implica la necesidad de fortalecer este tema en el sistema educativo mexicano desde edades tempranas.

Palabras clave: bienestar financiero, educación financiera, habilidades matemáticas, estudiantes universitarios.

Abstract

With the increasing complexity of economic systems, financial literacy has become an essential factor in making sound financial decisions and in meeting financial challenges and opportunities more effectively in daily life. The objective of this research was to evaluate the incidence of mathematical skills in the financial literacy of young Mexicans in the age range of 18 to 30 years who attend university and the degree to which previous training in economic-financial areas moderates the strength of association between both variables. The research method is quantitative and combines the descriptive and correlational approach. A simple linear regression model with a moderator variable was implemented. Results revealed a significant and positive correlation between college students' math skills and financial literacy. In addition, it was found that previous training in economic-financial areas makes this relationship stronger, which demonstrates the need to strengthen financial education in the educational system in Mexico from an early age.

Key words: Financial well-being, financial education, mathematical skills, university students.

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Resumo

Com a crescente complexidade dos sistemas económicos, a educação financeira tornou-se um factor essencial na tomada de decisões adequadas e no enfrentamento mais eficaz dos desafios e oportunidades financeiras na vida quotidiana. Portanto, o objetivo desta pesquisa foi avaliar o impacto das habilidades matemáticas na educação financeira de jovens mexicanos na faixa etária de 18 a 30 anos que frequentam a universidade, bem como o grau em que a formação prévia em áreas econômico-financeiras modera a força da associação entre ambas as variáveis. Para isso, o método de pesquisa foi quantitativo, para o qual foi combinada a abordagem descritiva e correlacional. Da mesma forma, foi implementado um modelo de regressão linear simples com variável moderadora. Os resultados revelaram uma correlação significativa e positiva entre as habilidades matemáticas e o grau de educação financeira dos estudantes universitários. Além disso, constatou-se que a formação prévia nas áreas económico-financeiras fortalece esta relação, o que implica a necessidade de fortalecer este tema no sistema educativo mexicano desde cedo.

Palavras-chave: bem-estar financeiro, educação financeira, habilidades matemáticas, estudantes universitários.

Reception date: February 2023 **Acceptance Date:** June 2024

Introduction

The constant evolution of the economy warns that in the immediate future, global financial skills will be increasingly indispensable as a consequence of a progressively dynamic and sophisticated financial environment, where complexity increases due to the impact of the rapid growth of technology and innovation. . For this reason, the offer and scope of new products and services has arisen that, although they lead to great opportunities, are also associated with various problems, especially when knowledge about financial concepts is deficient, which inhibits the ability to apply them effectively. and forces people to make hasty decisions in which they are exposed to risky conditions and high costs for their economic well-being.

In this scenario, the complicated and gradual challenge of making the population financially literate arises, which has caused, in recent years, the study of this topic to become especially relevant, since it constitutes a mechanism through which people can obtain knowledge. and skills for the correct administration of their resources and for participation in economic activities through making informed decisions. Indeed, financial literacy is understood as the acquisition of basic financial knowledge and the ability of individuals to apply it in a variety of situations (Cabrera-Baquedano *et al* ., 2022; Muñoz-Murillo *et al* .,

2020). In other words, it is the ability of a person to read, write, understand and reason financial concepts and procedures useful to face economic situations.

In the review of the empirical literature, some international studies highlight the low levels of financial literacy in many countries, which is more evident in young people (Lusardi and Michelle, 2014; Montaña and Ferrada, 2021), who face early age to making financial decisions as part of managing their personal finances.

On the other hand, it has been shown that the ability of young people to solve financial problems is linked to their level of mathematical ability, that is, their degree of competence to understand, reason and apply simple numerical concepts and procedures. These findings suggest that mathematics performance can be a determining predictor of financial literacy or illiteracy, and that interdisciplinary modeling tasks in mathematics represent an appropriate environment for the development of optimal levels in the subject (Amagir *et al* ., 2020; Cabrera-Baquedano *et al* ., 2022; Safronova *et al* ., 2020). Furthermore, it has been identified that there are significant favorable differences in students who are training in careers whose study plans include subjects related to the economic-financial area (Muyo Yildirim and Vardari , 2020).

Now, in the specific case of Mexico, the results of the review of data on the events reveal discouraging scenarios; Firstly, there is an evident limitation of research on the effects of financial literacy in young people because the studies focus to a greater extent on the evaluation of sociodemographic variables that affect the degree of financial literacy of the adult population, such as age, gender, marital status, education, region, number of dependents, income level, among others (Antonio-Anderson *et al* ., 2020, García-Mata *et al* ., 2021; Hernández Mejía *et al* ., 2022). Secondly, the few studies carried out on the subject confirm that the levels of financial literacy in Mexican students are low (Arceo-Gómez and Villagómez, 2017; Diez-Martínez, 2016; Muñoz-Murillo *et al* ., 2020) compared to those obtained in G-7 economies (United States, Japan, Germany, United Kingdom, France, Italy and Canada) (Kapper *et al* ., 2015). These authors find that the difference between Mexico and the seven largest economies in the world lies on average 16 percentage points, when considering 38% and 56% of young people as financial literates, respectively.

These data lead to the formulation of questions that allow identifying similarities or disparities in the financial literacy of young university students in the different regions of Mexico in order to generate initiatives that become another ally of national policies to increase indicators of financial well-being. in the country.

From the above, and with the objective of contributing to the discussion on the topic in the national context, the purpose of this research was to evaluate the incidence of mathematical

skills in the financial literacy of young Mexicans, in an age range of 18 to 30 years who attend to university, as well as the degree to which previous training in economic-financial areas moderates the strength of association between both variables.

Literature review and approach hypothesis

Financial literacy is considered a competence that can make a crucial difference in people's lives because it represents a determining process for well-being, entrepreneurship, social mobility and inclusive growth through the combination of knowledge, awareness, skill, attitude and behavior necessary to make sound financial decisions (Organization for Economic Co-operation and Development [OECD], 2017). Therefore, the issue of financial literacy has gained significant importance not only from a theoretical, but also a practical point of view.

There is evidence at an international level that shows that among the groups most affected by their low levels of financial literacy are young people (Lusardi and Michell, 2014), since many of them have expressed difficulty in mastering the increasingly complex financial products and services. In fact, despite the efforts made to increase levels of knowledge on the subject and favorable advances over the years, these users continue to experience scenarios of great inequalities.

In this sense, some authors point out that there are several fundamental concepts on which correct financial decisions are based; for example, 1) risk diversification, 2) inflation, 3) numerical skill applied to the calculation of simple interest, and 4) calculation of compound interest (Kappler *et al* ., 2015; Lusardi and Michell, 2014).

Regarding the younger population, Lusardi *et al* . (2010) found that the levels of financial literacy in young people in the United States were low, since only 27% of those evaluated understood the three basic financial concepts of inflation, interest calculation and risk diversification. On the other hand, in Chile, a similar study carried out by Montaña and Ferrada (2021) indicated that the results in the matter were also scarce in students of professional technical careers, since only 14% responded correctly to topics about interest rates, investment diversification and risk-return. Likewise, other analyzes—such as the one carried out by Avendaño *et al* . (2021) to university students—also point out that, although students have a favorable perception regarding financial issues, weaknesses and limitations are evident in the dimensions of financial skills-uses, that is, in the know-how related to financial literacy. .

In Mexico, the panorama is similar, since Villagómez (2016) found that only 7% of high school students in the Metropolitan Zone of the country understand the three basic concepts of this construct: inflation, risk diversification and compound interest. On the other

hand, Hernández Mejía *et al* . (2022) found significant differences in the levels of financial literacy, which are accentuated in users excluded from the financial system and in those who lack training in financial education issues. Likewise, Moreno- Herrero *et al* . (2018), after analyzing factors that influence the level of financial literacy of young people, determined that promoting savings habits and offering access to financial services from an early age can provide students with opportunities to learn through experience.

The above is consistent with what was pointed out by Mena-Campoverde (2022) in a research carried out on 420 young people in Ecuador. In this research, the author defines financial literacy as a multidimensional construct that is explained not only by financial knowledge, but also by attitudes and behaviors in that area. Likewise, in a bibliometric study on the subject, Huston (2010) concludes that most authors associate financial literacy with a particular variable: knowledge. Therefore, the benefits of starting the financial literacy process at an early age to understand basic concepts such as inflation, calculation of interest rates and risk diversification are highlighted (Lusardi and Michell, 2014). In addition, there are proposals that indicate that numerical skills are also required to apply said knowledge in financial contexts (Arceo-Gómez and Villagómez, 2017). The theory, in fact, explains that cognitive skills in arithmetic are positively associated with levels of financial literacy (Muñoz-Murillo *et al* ., 2020). In accordance with this, Alexander and Pallas (1984) affirm that mathematics education promotes improvements in learning and cognitive skills, hence it is widely correlated with financial literacy.

Similarly, Lusardi and Mitchel l (2014) emphasize that both in the United States and in other countries, users who are more literate in mathematics are also more likely to actively participate in financial markets and invest in stocks. For their part, Álvarez-Franco *et al* . (2017) comment that the main difficulty in establishing the attributable effects of financial education programs on financial literacy is the presence of various confounding components such as cognitive skills, including arithmetic. For this reason, it is insisted that people, from an early age, be offered more mathematics courses, since the development of young people's financial skills is largely mediated by their level of numerical skills (Mancebón *et al* ., 2019).

In the empirical literature, international and national antecedents have been found that have incorporated variables such as mathematical skills and prior knowledge into the measurement of financial literacy. For example, Safronova *et al* . (2020)—in a work carried out with Russian students from grades seven to nine—came to the conclusion that school mathematics plays a crucial role in training students' financial literacy; Furthermore, learning materials with a financial focus not only develop the cognitive and social activity of young

people, but also stimulate motivation to study mathematics and increase financial competencies.

Amagir *et al* . (2020), meanwhile, examined the financial literacy levels of 2,025 15-year-old high school students in the Netherlands. These authors conclude that the lowest rates are found in students with poor mathematical proficiency. On the other hand, Muyo Yildirim and Vardari (2020)—in research aimed at university students in southeastern Europe—indicate that the highest levels of financial literacy are found in students with prior knowledge in mathematics; In other words, the authors demonstrate that students from the Faculty of Economics present higher levels of financial knowledge than those from the Faculties of Education and Technology.

Finally, in the national context, the evidence is limited to two important studies. In the first, carried out by Villagómez Amezcua and Hidalgo Everardo (2017), the impact of mathematical skills on the financial literacy of young students in the Valley of Mexico is analyzed. In this work, the authors explain that quantitative capabilities have a positive and significant impact on the financial literacy index, which includes the components of knowledge, attitude and financial behavior. In the second work, developed with *millennials* , García-Mata (2021) indicates that training in economic-financial areas has a significant relationship with the level of financial literacy obtained.

Although these authors have previously addressed the variables involved in the present study, it is essential to highlight that this research provides a significant contribution, since from a novel and holistic perspective it evaluates the moderating effect of previous training in economic-financial areas. and its relationship with mathematical skills and financial literacy. To this end, the following hypothesis is proposed: “There is a positive relationship between mathematical skills and the degree of financial literacy of young university students, and this association becomes stronger to the extent that prior training in economic areas increases. financial”.

Materials and methods

Method

This research was based on a quantitative approach , descriptive-correlational, with a cross-sectional design and supported by the statistical model of simple linear regression with moderating variable. This model is suitable for this study because an independent variable (X) predicts a dependent variable (Y) taking into account the causal strength of a third variable called *moderator* (W), which interacts between both (Galindo-Domínguez, 2019). In this sense, the foundations are laid to contrast the proposed empirical model , which indicates that mathematical skills influence the potentialization of the level of financial literacy of young university students when there is prior exposure to training courses in economic-financial areas.

The appreciation of the effect of the moderator variable (W) on the relationship X → Y involves a simple moderating linear regression equation that includes the X*W interaction. In this sense, the final specification to carry out the analysis is as follows:

$$AF= (o4 + bFP) + (a + cFP)HM + e4 \quad (1)$$

Where

AF = Financial Literacy.

HM = Mathematical skills.

FP = Previous training in economic-financial areas.

o4 = Intercept or constant term.

b = Coefficient that accompanies the PF variable.

a = Simple effect of HM when FP=0.

c = Coefficient that measures the moderation effect.

e4 = Error or residual term.

The first parenthesis corresponds to the intercept and the second to the regression slope of AF on HM for particular values of FP, where if there are no anomalies, the rejection of the hypothesis that c = 0 allows us to conclude that there is a moderating effect of PF on the relationship of HM → AF (Ato and Vallejo, 2011).

Population and sample

The study population was made up of 22,569 students, in the age range of 18 to 30 years, with and without training in economic-financial areas of the Autonomous University of Baja California (UABC), Tijuana campus, from the 2022 school year. 2, which includes the months from August to December of the same year. Being a large population universe, it was decided to work with a sample based on the following factors: the finite population formula was used with a confidence level of 95%, allowed margin of error of 3.92%, standardized proportion of success and failure of 50%, which resulted in a sample size of 626 students.

The type of sampling used was simple random because the data collection instrument was applied to university students through the subdirectorates of the various faculties that participated in the application. That is, the faculties of Accounting and Administration (38.3%), Sports, Law, Arts and Medicine (61.7 %) were included , for which it was considered that all elements had the same possibility of being chosen (Rodríguez and Mendivelso, 2018).

Data collection instrument

To collect data on this population group, an electronic survey was designed that was answered through the Google Forms platform , from which 626 responses were received. The form was divided into four dimensions (Annex 1, Table 8): the first requested descriptive data (name, surname, age and sex), the second delved into prior knowledge (training in economic-financial areas), the third included questions related to financial literacy (risk diversification, inflation, simple interest, compound interest), and the last one consisted of a series of questions regarding mathematical skills (percentage and division).

Kappler were used to collect the data. *et al* . (2015) —who suggest a four-factor index to measure financial literacy (FA)— and by García-Mata (2021), who contemplates two components for the evaluation of mathematical skills (HM) and a component that was taken as referent for the personal proposal of the moderation effect of prior training (FP) through the " Form " indicator, corresponding to economic-financial training (table 1).

Table 1. Operationalization of the variables

Variable	Indicators	Calculation form	Fountain	Variable type
Skills math (HM)	Q6. Numerical ability. (Percentage). Q7. Numerical ability. (Division).	HM = Q6+Q7 HM = [0, 2]	García-Mata (2021)	Independent (X)
Literacy financial (AF)	Q1. Risk diversification. Q2. Inflation. Q3. Simple interest calculation. Q4. Compound interest concept. Q5. Compound interest calculation.	Q4 and Q5 are considered as a single factor and taken as correct only if both answers are correct. AF = Q1+Q2+Q3+Q4*Q5 AF = [0, 4] Where AF ≥ 3 financial alphabet AF < 3 financial illiterate	Kappler *et al* . (2015)	Dependent (Y)
Previous training (FP)	Form . Economic-financial training.	Ordinal variable that is distinguished at three levels: 1. No course in economic-financial areas. 2. Some course in economic-financial areas, but does not study or study a career in these topics. 3. Study or studied a career in economic-financial areas.	García-Mata (2021)	Moderator (W)

Source: self made

To make the analysis of the results possible, it was necessary to process the data through the Process method in the *software.* SPSS Statistics , which allows you to reach solid and safe causal inferences.

Results

This section specifically contains the analysis and interpretation of the results obtained from the processing of the collected data , for which two approaches were used: the first, from a descriptive perspective where the characteristics of the university students surveyed are reasoned. function of the items evaluated in the financial literacy index, and the second, from the statistical point of view with the purpose of examining the findings from the proposed model.

Descriptive analysis

In total, 626 responses were collected. According to the results, it can be indicated that the students of the 2022-2 school period of the Autonomous University of Baja California, Tijuana campus, have a level of financial literacy of 61.7%, with a greater prevalence of men in the index obtained in compared to women, producing a gender gap of 10.4%.

Regarding training in economic-financial areas, it was found that 50.2% of the sample has never taken a related course, 38.3% studied or studied a career in these areas of knowledge and 11.5% stated that they had taken a related course. but he does not study nor did he study a career in these topics.

In Table 2 you can see the results by item, where it was found that the concept of inflation (Q2) is understood by 81.78% of the university students who participated in the study; Furthermore, it was observed that the second concept with the highest proportion of correct answers among university students is risk diversification (Q1), which was correctly understood by 77.47% of the participants.

The item that evaluated the concept of simple interest (Q3) was answered satisfactorily by 67.57% of the respondents; In contrast, it was shown that the questions related to compound interest, both in its definition (Q4) and in its calculation (Q5), presented the lowest correct rates, with 44.24% and 29.39%, respectively.

The items related to mathematical skills measured with percentage calculation (Q6) and division (Q7) also stood out with high percentages of correct answers, with 86.58% and 83.70%, respectively. However, since this is a study carried out at the university level, the results are not encouraging with regard to the performance of basic mathematical operations that are taught at previous educational levels. Therefore, students would be expected to demonstrate higher rates of mastery in these concepts.

Table 2. Total correct answers in the financial literacy survey (AF)

Variable	Observations		Questions (% correct)							AF rate (%)
	N	%	Q1	Q2	Q3	Q4	Q5	Q6	Q7	QF5
Sex										
Female	371	59.3	77	84	62	38	24	85	82	57.4
Male	255	40.7	78	78	75	53	37	89	85	67.8
Economic-financial training										
No course in economic-financial areas	314	50.2	75	77	61	43	26	87	81	55.7
Some course in economic-financial areas, but does not study or study a career in these topics	72	11.5	69	79	72	39	30	71	79	51.4
Study or studied a career in economic-financial areas	240	38.3	83	88	74	47	33	91	89	72.5

Source: self made

Linear regression analysis with moderator variable

For the moderation analysis between the variables under study, the Johnson- Neyman Process technique was used . This is an extension that is added to the SPSS Statistics statistical *software* to quickly and easily analyze the interaction between the predictor variables (XW) on the dependent variable (Y). Even so, it is crucial to carry out an initial evaluation to verify the validity of the proposed model.

Table 3 shows different statistics that evaluate the quality of the model used in the study: the coefficient of determination (R-sq or R^2) and the significance value (p) are some of them. The results indicate that the proposed model adequately fits the test, since the R^2 value is significant at 0.000 and explains 40.80% (0.4080) of the total variance of the level of financial literacy, taking into account both mathematical skills and Previous training in economic and financial areas. Therefore, it is suggested that there is a statistically significant correlation between the variables that occur in the model.

Table 3. Validation of the linear regression model of W, X and XW on Y

Model Summary						
R	R-sq	MSE	F	df1	df2	*p
.6388	.4080	1.1587	142.9190	3.0000	622.0000	.0000

* Sig (p) ≤ 0.05

Source: self made

Coefficients of determination (*coeff*), on the other hand, are an important tool for validating regression analysis. Table 4 shows that the independent variable (*HM*) has a statistically significant effect (*p = 0.000*) on the dependent variable (*AF*), while the moderator variable (FP) exerts a statistically significant impact (*p = 0.002*). in the dependent variable (*AF*). Furthermore, the coefficient " *Int_1* ", which represents the interaction between the independent and moderating variable (*HM*FP*) on the dependent variable (*AF*), also shows a statistically significant result (*p = 0.050*). The presence of representative values in these interactions indicates the existence of a moderation effect, which suggests that the evaluation of the phenomenon is reliable.

Table 4. Linear regression analysis of W, X and XW on Y

model						
	Coef	HE	T	*p	LLCI	ULCI
constant	1.2676	.3105	4.0820	,000	.6578	1.8774
H.M.	1.8150	.1732	10.4802	,000	1.4749	2.1551
FP	.4908	.1644	2.9848	.002	.1679	.8137
Int_1	.1765	.0901	1.9595	.050	.3535	.0004

* Sig (p) ≤ 0.05

Source: self made

On the other hand, in order to delve deeper into the effect of mathematical skills independently in relation to financial literacy, the construction of a contingency table was carried out.

Table 5 demonstrates that there is a relationship between mathematical skills (*HM*) and financial literacy (*AF*), and that this relationship is intensified in those students who correctly answered all the items evaluated in this construct. The results indicate that the percentage of financial literacy varies from 74.5% for university students who answered both

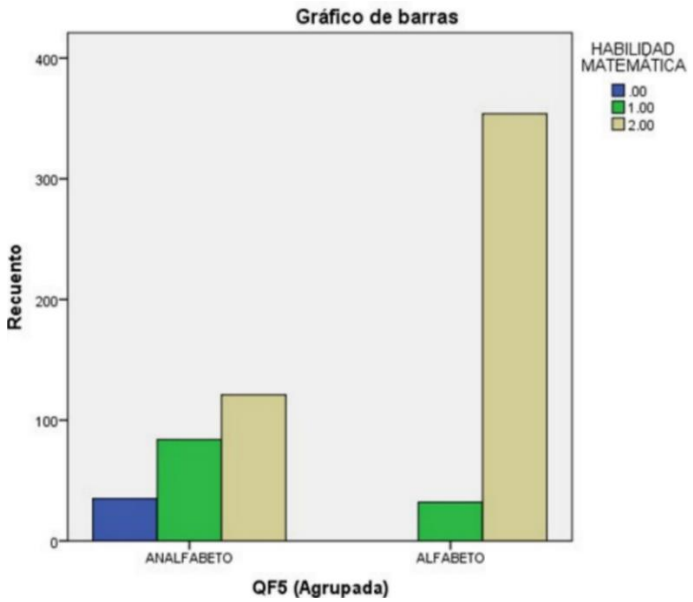
items correctly, to 25.5% for those who do not have knowledge in this subject. Therefore, it is proven that as the mathematical skills of the students of the UABC, Tijuana campus, increase, their level of financial literacy also increases (figure 1). This is consistent with the findings obtained in previous studies that highlight that higher levels of financial literacy are related to students who have greater knowledge in mathematics (Amagir *et al* ., 2020; Safronova *et al* ., 2020; Villagómez Amezcua and Hidalgo Everardo, 2017).

Table 5. Relationship between financial literacy and mathematical skills

			MATHEMATICAL ABILITY			Total
			.00	1.00	2.00	
QF5 (Grouped)	ILLITERATE	Count	35	84	121	240
		% within MATHEMATICAL SKILL	100.0%	72.4%	25.5%	38.3%
		Typed waste	5.9	5.9	-4.5	
	ALPHABET	Count	0	32	354	386
		% within MATHEMATICAL SKILL	0.0%	27.6%	74.5%	61.7%
		Typed waste	-4.6	-4.7	3.6	
Total		Count	35	116	475	626
		% within MATHEMATICAL SKILL	100.0%	100.0%	100.0%	100.0%

Source: self made

Figure 1. Graphic description of the relationship between mathematical skills and financial literacy



Fountain: Own elaboration

Pearson chi-square test of independence was carried out , which suggests the following:

H *0* = The variables are independent.

H *1* = The variables are not independent, there is an association.

In this sense, the results presented in Table 6 indicate that the relationship between mathematical skills and financial literacy is statistically significant, with an asymptotic (bilateral) significance of 0.000 , which suggests that the probability of obtaining a result like this by chance is extremely low. This data also rejects the previously established null hypothesis, and accepts the statement that there is a positive association between the variables subject to study.

Table 6. Chi-square tests for HM and AF relationship

	Worth	Gl	*Next. asymptotic (bilateral)
Pearson chi-square	146,522 [a]	2	,000
Likelihood ratio	157,699	2	,000
Linear-by-linear association	143,860	1	,000
No. of valid cases	626		
to. 0 boxes (0.0%) have an expected frequency less than 5. The minimum expected frequency is 13.42.			

* Sig (p) ≤ 0.05

Source: Own elaboration

On the other hand, measures of the degree of association between the *HM* and *PA variables were determined* in order to demonstrate whether this relationship is strong or weak. In general, a value of phi (φ) or Cramer's V around 0.3 is considered to represent a weak relationship, a value in the range of 0.3 to 0.5 means a moderate relationship, while a value between 0.5 and 1 demonstrates a relationship. strong. That said, the data obtained from Table 7 indicate that a Phi and Cramer's V value of 0.484 establish a moderate relationship between the two variables in the sample studied. These findings, in turn, suggest that there is a direct and proportional relationship between mathematical skills and financial literacy of students at the Autonomous University of Baja California, Tijuana campus.

Table 7. Symmetric measurements of HM and AF relationship

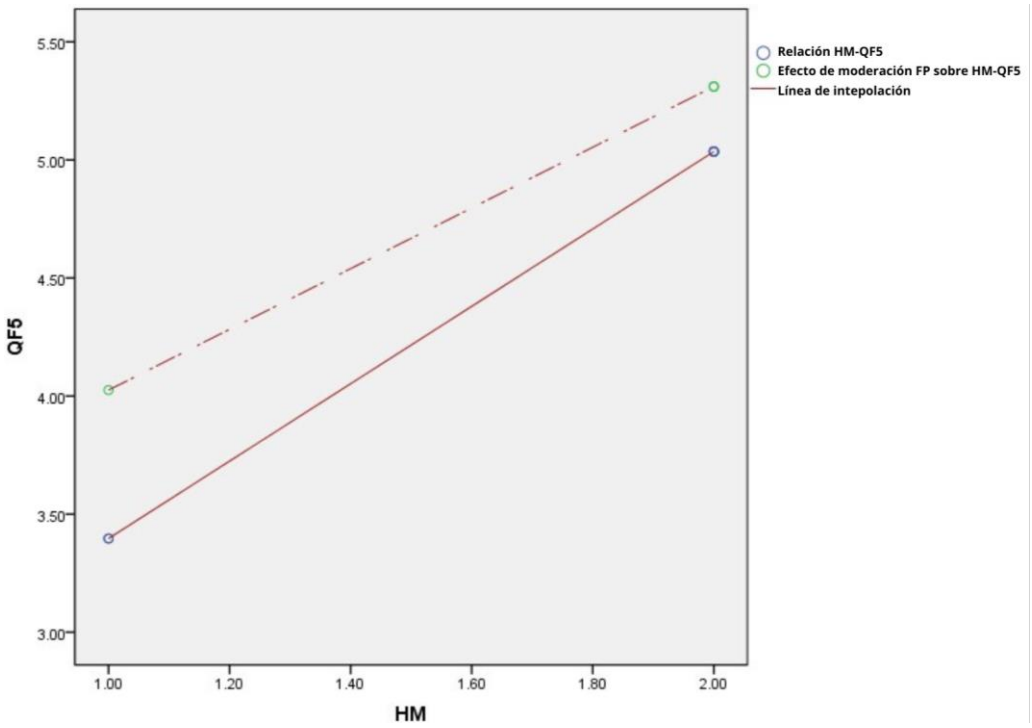
		Worth	Typical error _ I nodded. [to]	Approximate t [b]	Approximate Sig.
Nominal by nominal	Phi	.484			,000
	Cramer's V	.484			,000
Interval by interval	Pearson's R	.480	.030	13,659	,000c
Ordinal by ordinal	Spearman correlation	.480	.035	13,659	,000c
No. of valid cases		626			
to. Assuming the alternative hypothesis.					
b. Using the asymptotic standard error based on the null hypothesis.					
c. Based on the normal approximation.					

Source: Own elaboration

On the other hand, with respect to previous training, it was found that the level of financial literacy increases by 16.8% in those students who studied or are studying a career in economic-financial areas compared to those who did not (see table 2). This confirms what was observed by authors who suggest that prior knowledge on these topics can have a positive effect on the financial literacy of students at higher education institutions (García-Mata, 2021; Muyo Yildirim and Vardari , 2020).

The model established in this research, in particular, seeks to explain whether the moderating variable alters the magnitude and/or direction of the relationship between the dependent and independent variables. In this sense, Figure 2 shows a moderation effect, which is why the statement that "there is a positive relationship between mathematical skills and the degree of financial literacy of university students (p = 0.000) is accepted (p = *0.000*) and that This association is reinforced to the extent that prior training in economic-financial areas increases (*p= 0.050*)." In this sense, *p* (significance) establishes sufficient foundations to accept the hypothesis raised in this study.

Figure 2. Moderation effect of prior training on the mathematical skills-financial literacy relationship



Source: self made

Discussion

The research results provide a unique perspective by exploring that the financial literacy of students at the UABC, Tijuana campus, is associated with mathematical skills, and that prior training in economic-financial areas has a moderating effect on this relationship. Therefore, it is stated that all the objectives established in the study have been verified and that the findings have important implications for financial education and the training of young people to manage their finances, especially in a context in which decision-making Proper financial decisions are becoming more important for everyday life. However, it is important to highlight that this study has a limitation because the sample consists only of young university students from a specific educational institution, which restricts the generalization of the results on a larger scale.

Therefore, part of the findings are consistent with previous studies that have found that as mathematical skills increase, the level of financial literacy is higher (Amagir *et al* ., 2020; Cárdenas *et al* ., 2019; Kaiser *et al* ., 2016; OECD, 2017; Safronova *et al* ., 2020; Villagómez Amezcua and Hidalgo Everardo, 2017). For this reason, various works highlight the importance of having prior training in financial issues to acquire the necessary skills to understand issues related to the economy in general (Agarwal *et al* ., 2013; García-Mata, 2021; Lusardi and Michell, 2014 ; Muyo Yildirim and Vardari , 2020).

Likewise, it should be emphasized that the young university students who participated in this study presented a low level of financial literacy, which is consistent with other research that has shown that financial literacy in Mexico is low in the general population, including young people (National Banking and Securities Commission [CNBV], 2020a; National Institute of Statistics and Geography [Inegi], 2019). In this sense, it has been noted that the limitations of education in the country, particularly in areas such as mathematics and finance, have been criticized for its restricted focus and lack of development of practical skills (CNBV, 2019). . These deficiencies are considered one of the main factors that contribute to the lack of financial literacy in the young population.

In turn, the results of this research have considerable implications for analyzing the proposals and strategies implemented in the design of educational programs and public policies focused on improving mathematical and financial skills in young people, with the aim of strengthening their ability to manage informed and responsible manner situations associated with their personal finances, their professional career and their participation in the country's economy because, despite the efforts of the Mexican Government to improve financial education, the expected positive effects have not yet been identified. in the level of financial literacy of the population (CNBV, 2020a).

Thus, the findings of this study, which indicate low levels of financial literacy among young university students, find support in information provided by the National Monte de Piedad and the Center for Competitiveness Studies of ITAM, where various deficiencies are identified in the existing financial education in Mexico (CNBV, 2020b), which could partly explain the lack of significant advances in financial literacy at the national level.

Firstly, it stands out that most of the financial education programs detected focus on the dissemination of concepts, but lack effective teaching dynamics; This means that the way in which the content is presented does not facilitate the change of financial behaviors, which limits its real impact on the development of financial skills in the population. Another deficiency identified is the limited application of behavioral tools in the programs, which constitute strategies based on psychology and behavioral economics to influence the financial behaviors of students.

Furthermore, there is little personalization of the programs, which indicates little adaptation to the particular needs and characteristics of certain groups of the population so that they understand and apply financial knowledge. Likewise, the lack of resources and communication instruments in the identified programs stands out, as well as the limited availability of digital tools, interactive games or teaching guides that could facilitate the effective transmission of the topics.

Additionally, it can be noted that most financial education programs have very low enrollment and completion rates, which suggests a lack of commitment and continuity on the part of the participants. This raises the need for attractive and motivating strategies for the target population. Finally, it is evident that less than 10% of the programs carry out monitoring actions, which makes it difficult to identify possible improvements and measure the real impact on increasing financial literacy. In other words, the absence of systematic monitoring and evaluation restricts the ability of programs to adapt and improve based on the changing needs of young people.

The above demonstrates that although financial education programs have been implemented in Mexico, there are significant deficiencies that are limiting their effectiveness and reach. The actions carried out so far have not achieved the necessary scale to comprehensively address the problem of the low level of financial literacy in the country. It is essential , therefore, that these irregularities be taken into account when designing future programs, public policies and more effective teaching strategies and practical tools that focus on the development of specific financial skills so that young people are able to address complex financial problems. daily life, and to face challenges and opportunities posed by the current economic environment.

Likewise, the importance of strengthening the teaching and learning of skills in these areas of knowledge from an early age is highlighted, since it has been shown that these skills are essential for the academic and professional training of students; Furthermore, there is a need to include in university education courses and programs that address these topics in a more in-depth and specialized manner, especially in careers other than economic-financial areas; Likewise, periodically evaluate financial education policies to ensure that the desired results are being obtained.

At an economic and social level, it is suggested that the lack of financial and mathematical capabilities of the young population can have negative impacts on their financial future and on the economic development of the country, since it can lead them to omit financial planning, increase the overextension of credit, excessive debt, lack of adequate savings for emergencies and for retirement, among other problems that can affect both the individual and collective level. In this sense, a country whose population lacks these skills may have a lower capacity to manage and respond to an economic crisis, a greater tendency to make inappropriate financial decisions and a lower capacity to innovate and develop broader and more competitive financial industries. . This, in turn, can accentuate the gap between the richest and the poorest, resulting in growing economic instability.

In this scenario, it is important to highlight that young university students are the next generation of leaders and workers, so an increase in their mathematical-financial knowledge can increase the possibility of working in high-tech and scientific fields, to boost their capacity. to compete in the global economy and increase prosperity for the general population. By having a solid foundation in these areas of knowledge, they will be able to perform more efficiently in diverse professional roles and adapt to a constantly evolving work environment, promoting innovation, creativity and entrepreneurship. To achieve this, it is essential to promote collaboration between educational institutions, government agencies and private sector actors to design more effective and practical programs and strategies. Only through these efforts can economic development, financial stability and prosperity for future generations be promoted .

Conclusions

Based on the findings of this research, it can be stated that the objectives and hypotheses were met in their entirety, since a significant relationship was found between the variables under study, which highlights the importance of prior training in areas economic-financial strategies for the development of financial literacy. The proposed statistical model, for its part, shows adjustments admitted by correlational statistics, which contrasts with the predictive model and suggests the design of a novel methodology for its implementation in future lines of study.

Regarding the determinants of financial literacy, it is confirmed for the students of the Autonomous University of Baja California, Tijuana campus, that mathematical skills and prior knowledge allow the development of financial skills. In this sense, its importance and usefulness lie in the opportunity to improve their necessary capacities to facilitate savings, retirement planning, the administration of their resources and the adequate management of their debt levels with the objective of achieving a state of prosperity and sustainable economic progress, which includes the reduction of poverty and inequality for the benefit of all of society.

Consequently, these demonstrations have significant implications for financial education in Mexico and other developing countries, as they enrich the existing body of literature on the lack of mathematical skills and financial literacy in university students. Furthermore, they suggest the need for financial education more focused on the development of practical skills and the formation of a financial culture in the population from an early age. This approach, therefore, helps to improve the understanding and application of financial and mathematical concepts in the daily lives of young people, as well as to foster a more responsible and critical attitude and perception towards financial decision-making in the future. Indeed, by developing solid foundations in these fields from early stages, students can not only more

effectively assimilate the most complex knowledge at a professional level, but also gain a significant advantage when facing more challenging financial situations, since they will have a broad understanding of underlying principles and concepts.

Finally, it is important to highlight that public policies and university training programs can take these results into account to promote more complete curricular maps focused on generating holistic skills to prepare young people for their future as leaders in a global economy. This study also provides a solid basis for future research and for the design of training programs that address these limitations and promote mathematical and financial education in young university students.

Future lines of research

To improve the financial literacy of young people, it is recommended to investigate the effectiveness of different educational interventions. For example, teaching programs could be designed that promote the development of mathematical skills and financial knowledge from an early age, and then evaluate their impact on long-term financial literacy. Likewise, longitudinal research with larger and more representative samples of the population could offer a more solid perspective on the most effective educational strategies to strengthen the financial skills of new generations, with the purpose of providing them with the necessary tools for responsible and successful economic management in his adult life.

References

Agarwal, S., Amromin , G., Ben-David, I., Chomsisengphet , S., & Evanoff , D.D. (2013). The financial crisis and college enrollment: How have students and their families responded? *Journal of Financial Stability* , *9* (4), 492-505.

Alexander, K. L. and Pallas, A. M. (1984). Curriculum Reform and School Performance: An Evaluation of the "New Basics." *American Journal of Education* , *92* (4), 391-420. https://www.journals.uchicago.edu/doi/epdf/10.1086/443767

Amagir , A., Groot, W., van den Brinkc , H.M. and Wilschutd , A. (2020). Financial literacy of high school students in the Netherlands: knowledge, attitudes, self-efficacy, and behavior. *International Review of Economics Education* , *34* . https://doi.org/10.1016/j.iree.2020.100185

Antonio-Anderson, C., Peña-Cárdenas, MC and López-Saldaña, C. (2020). Determinants of financial literacy. *Administrative Research* , *49* (125). https://www.redalyc.org/articulo.oa?id=456061607014

Arceo-Gómez, EO and Villagómez, FA (2017). Financial literacy among Mexican high school adolescents. *International Review of Economics Education* , *24* , 1-17. https://doi.org/10.1016/j.iree.2016.10.001

Ato, M. and Vallejo, G. (2011). The effects of third variables in psychological research. *Annals of Psychology* , *27* (2), 550-561. https://revistas.um.es/analesps/article/view/123201/115851

Avendaño, WR, Rueda, G. and Velasco, BM (2021). Financial perceptions and skills in university students. *University Training* , *14* (3), 95-104. http://dx.doi.org/10.4067/S0718-50062021000300095

Cabrera-Baquedano, A., Huincahue , J. and Gaete-Peralta, C. (2022). Transitions when adjusting interdisciplinary mathematical models: the case of financial literacy. *Uniciencia* , *36* (1), 1-20. https://dx.doi.org/10.15359/ru.36-1.45

Cárdenas, M., Criado, JI and González-Molero, I. (2019). Financial literacy among Spanish university students: an exploratory study. *Journal of Financial Advice and Planning* , *30* (1), 105-116.

National Banking and Securities Commission [CNBV]. (2019). *National Financial Education Strategy 2019-2024.* https://www.cnbv.gob.mx/CONVIVE/Paginas/ENEF.aspx

National Banking and Securities Commission [CNBV]. (2020a). *National Financial Inclusion Survey 2018* . https://www.cnbv.gob.mx/CONVIVE/Paginas/ENIF.aspx

National Banking and Securities Commission [CNBV]. (2020b). *Quarterly financial inclusion bulletin.* https://www.gob.mx/cms/uploads/attachment/file/593492/Boletin_IF_4T_2020.pdf

Diez- Martinez , E. (2016) . Socioeconomic and financial literacy of Mexican adolescents of the 21st century. *Electronic Journal of Educational Research* , *18* (2), 130-143. https://redie.uabc.mx/redie/article/view/861

Galindo-Domínguez, H. (2019). Moderation analysis in the socio-educational field through the Process macro in SPSS Statistics . *REIRE Revista d'Innovació i Recerca en Educació* , *12* (1), 1-11. http://dx.doi.org/10.1344/reire2019.12.122356

García-Mata, O. (2021). Financial literacy among millennials in Ciudad Victoria, Tamaulipas, Mexico. *Management Studies* , *37* (160), 399-412. https://doi.org/10.18046/j.estger.2021.160.4021

García-Mata, O., Zorrilla del Castillo, AL, Briseño García, A. and Arango Herrera, E. (2021). Financial attitude, financial behavior and financial knowledge in Mexico. *Cuadernos de Economía* , *40* (83), 431-457. https://doi.org/10.15446/cuad.econ.v40n83.83247

Hernández Mejía, S., García-Santillán, A. and Moreno-García, E. (2022). Financial literacy and its relationship with sociodemographic variables. *Economics and Sociology* , *15* (1), 40-55. doi:10.14254/2071-789X.2022/15-⅓

Huston, S.J. (2010). Measuring Financial Literacy. *Journal of Consumer Affairs* , *44* (2), 296-316. https://doi.org/10.1111/j.1745-6606.2010.01170.x

National Institute of Statistics and Geography [INEGI]. (2019). *National Financial Inclusion Survey*. https://www.inegi.org.mx/programas/enif/2018/

Kaiser, T., Menkhoff , L., and Schmidt, U. (2016). Financial literacy and savings behavior: Evidence from a randomized controlled trial among low-income branchless banking customers in India. *World Development* , *77* , 311-327.

Kappler, L., Lusardi, A. and van Oudheusden , P. (2015). *Financial Literacy Around the World: Insights From the Standard & Poor's Ratings Services Global Financial Literacy Survey*. https://gflec.org/wp-content/uploads/2015/11/Finlit_paper_16_F2_singles.pdf

Lusardi, A. and Mitchell, O.S. (2014). The Economic Importance of Financial Literacy: Theory and Evidence. *Journal of Economic Literature* , *52* (1), 5-44. http://dx.doi.org/10.1257/jel.52.1.5

Lusardi, A., Mitchell, OS and Curto, V. (2010). Financial literacy among the young. *Journal of Consumer Affairs* , *44* (2), 358-380. https://doi.org/10.1111/j.1745-6606.2010.01173.x

Mancebón , MJ, Ximénez, DP, Mediavilla, M. and Gómez, JM (2019). Factors that influence the financial literacy of young Spanish consumers. *International Journal of Consumer Studies* , *43* (2), 227-235. https://doi.org/10.1111/ijcs.12502

Mena-Campoverde, CL (2022). Financial literacy in young people in Ecuador: measurement model and its determining factors. *Information Technology* , *33* (1), 81-90. http://dx.doi.org/10.4067/S0718-07642022000100081

Montaña, V. and Ferrada, LM (2021). Financial literacy: a pending challenge in higher technical education. *Journal of Studies and Experiences in Education, 20* (44), 126-148. https://doi.org/10.21703/0718-5162.v20.n43.2021.008

Moreno-Herrero, D., Salas-Velasco, M. and Sánchez-Campillo, J. (2018). Factors that influence the level of financial literacy among young people: The role of parental engagement and students' experiences with money matters. *Children and Youth Services Review* , *95* , 334-351. https://doi.org/10.1016/j.childyouth.2018.10.042

Muñoz-Murillo, M., Álvarez-Franco, PB and Restrepo-Tobón, DA (2020). The role of cognitive abilities on financial literacy: New experimental evidence. *Journal of*

Behavioral and Experimental Economics , 84 , 1-21. https://doi.org/10.1016/j.socec.2019.101482

Muyo Yildirim, M. and Vardari , L. (2020). Mathematical and financial literacy: A research with prizren University students. *Cypriot Journal of Educational Science, 15* (6), 1574-1586. https://doi.org/10.18844/cjes.v15i6.5318

Organization for Economic Cooperation and Development [OECD]. (2017). *G20/OECD INFE report on adult financial literacy in G20 countries.* https://www.oecd.org/daf/fin/financial-education/G20-OECD-INFE-report-adult-financial-literacy-in-G20-countries.pdf

Rodríguez, M., and Mendivelso, F. (2018). Cross-sectional research design. *Sanitas Medical Journal , 21* (3), 141-146. https://doi.org/10.26852/01234250.20

Safronova , T., Chernousova , N. and Safronova , M. (2020). Financial Literacy and Financial Capability: Interdependence of Concepts and Possibilities to Form Them in a School Course of Mathematics. *Purposes and Representations , 8* (3). http://dx.doi.org/10.20511/pyr2020.v8n3.504

Villagómez Amezcua, A. and Hidalgo Everardo, JA (2017). Financial Literacy and Mathematics: A Study among Young Mexican High School Students. *Mexican Journal of Economy and Finance , 12* (2), 1-22. https://www.scielo.org.mx/pdf/rmef/v12n2/2448-6795-rmef-12-02-00001.pdf

Villagómez, FA (2016). Financial literacy in young high school students in the Metropolitan Area of the Valley of Mexico. *The Economic Quarter , 83* (331), https://doi.org/10.20430/ete.v83i331.215

Appendix 1.

Table 8 . Information collection survey

ASK	CODE AND RESPONSE
Name and surname	Open answer
Age	1. 18-20 years 2. 21-22 years 3. 23-24 years 4. 25-26 years 5. 27-28 years 6. 28-30 years
Sex	1. Masculine 2. Feminine
PREVIOUS TRAINING	
Has received some type of previous training related to economic-financial areas.	1. I have not taken courses related to economic-financial areas. 2. If I have taken any course, but I did not study, nor did I study, any career in the economic-administrative areas. 3. I studied or am studying a career in the economic-administrative areas.
FINANCIAL LITERACY	
Q1. Suppose you have a considerable amount of money, what is safer?	1= Correct (Put all your money in various businesses or investments). 0= Incorrect (Put all your money in one business or investment/ I don't know).
Q2. Suppose that in the next 10 years the price of the products you usually buy doubles. If your income in that same period also doubles, how many of those products will you be able to buy then?	1= Correct (The same). 0= Incorrect (More products/ Fewer products/ I don't know).
Q3. Suppose you receive a loan of 1000 pesos, what is best for you?	1= Correct (1000 plus 3% interest). 0= Incorrect (Pay 1050 pesos/ I don't know).

Q4. Let's say you deposit money in a bank account for two years and the bank will pay you 15% net annual interest without taxes or fees. How much will the bank pay you the second year compared to what it paid you the first?	1= Correct (More). 0= Incorrect (Less/ Same/ I don't know).
Q5. Suppose you have 10,000 pesos in a bank account that gives you 10% annual net interest and that they do not charge you taxes or commissions. How much will you have in your account 5 years later if you do not make any additional deposits or withdrawals?	1= Correct (More than 15,000). 0= Incorrect (15,000/ Less than 15,000/ I don't know).
MATHEMATICAL SKILLS	
Q6. If the probability of contracting a certain disease is 10%, how many people would be expected to get sick in a population of 1,000?	1= Correct (100) 0= Incorrect (1,100/ 10/ I don't know).
Q7. If 5 people are winners, in equal shares of the first prize of a drawing and the prize is 2,000,000 pesos, how much will each of them get?	1= Correct (400,000) 0= Incorrect (2,000,000/ 500,000/ I don't know).

Source: Own elaboration with information provided by Kappler *et al* . (2015) and García-Mata (2021)

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