



European Journal of Educational Research

Volume 8, Issue 4, 1039 - 1051.

ISSN: 2165-8714

<http://www.eu-jer.com/>

Anxiety toward Math: A Descriptive Analysis by Sociodemographic Variables

Nemesis Larracilla-Salazar*
Universidad Cristobal Colon, MEXICO

Elena Moreno-Garcia
Universidad Cristobal Colon, MEXICO

Milka Elena Escalera-Chavez
Universidad Autonoma de San Luis Potosi,
MEXICO

Received: July 20, 2019 • Revised: September 6, 2019 • Accepted: September 11, 2019

Abstract: The following analysis provides evidence from the comparative levels of anxiety towards mathematics of the variables from the categories presented by the AMARS and sociodemographic variables as well. A sample of 381 economics students in Mexico answered the survey. For data analysis, descriptive statistics (\bar{x} , Sd.) was carried out and to identify if there are significant differences of means in the sociodemographic variables, the ANOVA analysis was carried out. Although in general the anxiety towards mathematics presented in Mexican economics students is "very little", in the dimension of mathematical evaluation the results of the descriptive analysis show that economics students from the south of Mexico have more anxiety than students from other regions. Regarding gender, women feel more anxiety than men towards mathematics evaluation. Likewise, students from public institutions show greater anxiety towards mathematics in the evaluation processes than those belonging to private. Finally, ANOVA test showed that the variable Region showed values less than 0.05 in two of three dimensions (ANXTASK and ANXCOUR). The ANXEVAL dimension showed values < 0.05 in the variable Gender as the ANXEVAL and ANXCOUR showed values < 0.05 in the variable University, this because there is a difference in means.

Keywords: *Anxiety towards mathematics, economics students, gender, region, type of university.*

To cite this article: Larracilla-Salazar, N., Moreno-Garcia, E., & Escalera-Chavez, M. E. (2019). Anxiety toward math: A descriptive analysis by sociodemographic variables. *European Journal of Educational Research*, 8(4), 1039-1051. <http://doi.org/10.12973/eu-jer.8.4.1039>

Introduction

The logical-mathematical experience is an individual process of sensory-motor, intuitive operations, among others, whose cognitive act involves integrating the knowledge of an object into structures that make sense and their meaning (Iglesias, 1972).

According to Piaget's studies (as cited in Iglesias, 1972), the cognitive structure in an adult develops from the evolution of the assimilatory and accommodative schemes of his childhood; which is due to the cognitive organization that is the assimilation and transformation of data according to the signifier / meaning relation that these have on the individual, that is to say, that according to the social, cultural influences, among other aspects of the environment, the deployment of such structure will be conditioned.

However, if mathematics is seen as a set of data without connection whose learning leads to mechanization and memorization of details, they produce boredom among students, leaving aside their fundamental structure.

Since 2000, the Programme for International Student Assessment's have been applied to evaluate the reading, mathematics and science competencies of students who complete the final stage of their compulsory education so that the results provide an approximation of the intellectual capital that a country possesses.

This test, in the area of mathematics, seeks to identify the development of mathematical reasoning, its interpretation and its effective and successful use in daily life. Reason for which the last results in the test applied during the year 2015 are discouraging since Mexican students are 92 points below the Organization for Economic Cooperation and Development average. So that almost 60% of these do not manage to obtain the level 2 (basic level of competences), that is to say, that these do not reach to size the utility of the mathematical knowledge and its application beyond the classroom (Organization for Economic Cooperation and Development, 2016).

* Corresponding author:

Nemesis Larracilla-Salazar, UCC Business School, Universidad Cristobal Colon, Veracruz 94271, Mexico. ✉ larracilla.n@gmail.com



In 2012, when the focus of this test was on mathematics and its analysis was carried out more closely in that area, the results showed that Mexican students reported having high levels of anxiety towards mathematics. What led to highlight two major concerns: short-term, the decline in mathematical performance and long-term, the shortage of professionals specialized in this area (Organization for Economic Cooperation and Development, 2012).

Nevertheless, even though students choose a distant major from the mathematical area, the tools and reasoning that mathematics provides are essential to their performance. Of course, those majors that are systematized through mathematics will require further development of numerical skills and their foundations will be indispensable for learning.

Economics programs are included in this group and any student must acquire understanding and practice of mathematics, because the knowledge of economic phenomena as well as the construction of abstract information from empirical data is part of the mathematical task (Benetti, 1999).

Literature Review

The mathematical learning seen through the brain functioning proposed by Tobias (as cited in Mato, 2006) is displayed in three parts: the Input, the Memory Bank and a Link Way. In general terms, the information is assimilated or taken from the memory bank, but, by intervening the emotional reaction of anxiety that generates an activation by itself in the organism. This process can be interrupted in a way that damages the self esteem of the individuals who experience it, especially because when faced with similar situations, they assume a negative attitude that is reinforced, which evokes a more intense and recurrent blockage in time.

In conclusion, the cognitive process is interrupted by the emotional reaction that does not necessarily have to do with the intellectual capacity and yet it has a certain influence since the lack of skills to solve mathematical problems and evade mathematical anxiety is growing silently until it is not possible to ignore it in the university period. That is why they limit their choices of major studies.

Nowadays, it is difficult to conceive a study in economics without mathematical and statistics due to the mathematization of this science.

According to Barragan (2003), mathematical methods have been introduced into economic science for approximately three centuries. This author divides the introduction of mathematical knowledge for economic theory and practice in three periods: the marginalist period of 1838 to 1947, where the formation of economic models is based on a classical mathematical analysis; the linear-modelling period from 1948 to 1959 in which there are changes in applied mathematical techniques when introducing set theory, topology, input-output models, as well as linear programming and the theory of games between other advances. Finally, the integration period from 1960 to date, where all the branches of mathematics play a role of high importance for the explanation and development of economic problems and the obtaining of results, as the mathematical theories recently applied to the field of economics: Chaos theory, Catastrophe theory and Blurred Sets theory.

For all this, it is not difficult to imagine that those who study economics need a broad mathematical background and skills that have been thoroughly developed throughout their studies.

The math skills acquired before college produce a positive effect on economic studies since the mastery of basic algebra helps improve student performance (Ballard & Johnson, 2004). On the other hand, poor mathematical preparation can overshadow success during the first year of college. However, intrinsic motivation can move students forward to obtain better performance in this area. This variation between success and failure is identified from the knowledge acquired during high school (Arnold & Straten, 2012; Gunderson, Park, Maloney, Beilock & Levine, 2018).

Also, authors like Lagerlof and Seltzer (2009) agree that the performance of economics students can be affected if their mathematical background acquired at the secondary level is deficient. Although their study focuses on knowing the effect of corrective courses in this situation, they noted that the positive effect is minimal.

On the other hand, it has been detected that women who study economics experience math anxiety differently than men. Specifically, when it comes to the evaluation of the subject, they experience more such phenomenon (Moreno-Garcia, Garcia-Santillan, Larracilla-Salazar & Escalera-Chavez, 2019).

Anxiety towards mathematics is problematic for students as it reduces their potential. Given the lack of skills required for learning, their academic training is carried out poorly and without fluency, which generates greater anxiety towards mathematics and in turn, anxiety towards mathematics becomes the result of having poor mathematical skills. In other words, the lack of mathematical skills is the cause and result of anxiety towards mathematics (Ramirez, Shaw & Maloney, 2018).

Other studies on the attitude that students of economics have in this regard demonstrate as a main component to Liking-Enjoyment, followed by Confidence, Utility, Anxiety Towards Mathematics and Motivation; so that if all these components follow a positive trend, the anxiety towards mathematics also does it (Rojas-Kramer, Escalera-Chavez,

Moreno-Garcia & Garcia-Santillan, 2017). The foregoing would point to the fact that if students form positive perceptions concerning mathematics, the anxiety towards mathematics decreases.

Negative perceptions towards mathematics generate avoidance behaviors, taking measures to counteract this behavior can be the key to reducing anxiety towards mathematics (Choe, Jenifer, Rozek, Berman & Beilock, 2019).

For all the above, this study is relevant as it provides a descriptive analysis that identifies the key trends of economics students in Mexico according to their sociodemographic features and the relationship with the dimensions of anxiety towards the mathematics studied by the Abbreviated version Math Anxiety Rating Scale (AMARS) developed by Alexander and Martray (1989).

Then, the research questions are:

Is there a difference between the levels of anxiety towards mathematics of the economics students in Mexico according to their sociodemographic features?

What is the level of anxiety towards mathematics of economics students in Mexico concerning the dimensions of the AMARS scale?

Therefore, the hypotheses are:

H0: $\mu_1 = \mu_2 = \dots = \mu_k$ Population means are equal

H1: At least two population means are different

The following section explains how the data was obtained and how it was processed.

Methodology

Data collection instrument

To obtain the information about anxiety towards mathematics among students in Mexico, a survey consisting of 25 items was applied using a Likert scale, where the value 1 = nothing, 2 = very little, 3 = some, 4 = enough and 5 = a lot. The study was based on the Spanish version of the AMARS (Alexander & Martray, 1989), modified by Nunez-Pena, Suarez-Pellicioni, Guilera and Mercade-Carranza (2013). For this research, items 2, 3, 5, 6, 10, 11, 12 and 23 were adapted to Spanish spoken in Mexico. The scale is grouped in three dimensions, the items on anxiety towards mathematics are: anxiety towards evaluation, anxiety towards numerical tasks and anxiety towards the mathematics course.

Table 1 presents the items corresponding to each dimension:

Table 1. AMARS Dimensions

Code	Dimensions	Items
ANXEVAL	Anxiety toward evaluation	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15
ANXTASK	Anxiety toward math tasks	16, 17, 18, 19, 20
ANXCOUR	Anxiety toward math courses	21, 22, 23, 24, 25

Source: Alexander & Matray, 1989.

This scale replicated in this study has a high internal consistency ($\alpha = .96$), as well as for the test-retest ($\alpha = .90$) (Alexander & Martray, 1989). In the case of the present study, AMARS reliability was again validated through the Cronbach alpha coefficient whose individual and grouped result is shown in table 2:

Table 2. Cronbach's alpha (α) reliability analysis.

ANXEVAL, ANXTASK, ANXCOUR		Individual	Grouped
Number of cases	381	0.957	0.697
	%	100%	100%
Excluded cases	0	0	0
	%	0.0%	0.0%
Total Items	25		3 dimensions

Source: Own.

Therefore considering the 25 items the value of the Cronbach's alpha coefficient is 0.957 and 0.697 considering the three dimensions proposed by the authors. And because the values are within the acceptable ranges this allows good reliability of the instrument.

Participants

The methodological design of this work is non-experimental and cross-sectioned. Three inclusion criteria were considered: economics students in Mexico; undergraduate students; and students enrolled in the 2016-2017 course.

The type of sampling was non-probabilistic, so that out of a population of 27,857 students of economics according to the National Association of Universities and Institutions of Higher Education in Mexico, 381 answered the survey through an electronic format whose answers were recorded in Google drive. Only one of the universities also required the written form of the survey.

The sample under study consisted of 200 men and 181 women. For the study, fifteen Mexican universities were invited to participate. Only ten accepted. The age of the participants ranged between 17 and 29 years of age. Table 3 shows the percentages corresponding to the sociodemographic features of the participants, that is, percentages about gender, region of origin, type of university, age and grade.

Table 3. Sociodemographic features of the participants

Variables	%
Gender	
Female	47.5
Male	52.5
Ages	
17 - 18 years	21.2
19 - 20 years	38.3
21 - 22 years	20
> 22 years	20.5
Type of institution	
Public	80
Private	20
Year of study	
Freshmen	33.07
Second year	31.49
Third year	14.69
Fourth year	9.71
Fifth year	11.02
Region of origin	
North	15.5
South	17.3
East	33.9
West	13.9
Center	19.4

Source: Own.

Data analyzing

Besides the questions of the AMARS scale, each of the respondents was asked for information about their age, semester, gender, university and region of origin.

According to the instrument used, students' anxiety level is classified based on the following scale: Nothing, 1.00 a 1.49; very little, 1.50 a 2.49; some, 2.50 a 3.49; enough, 3.50 a 4.49; a lot, 4.50 a 5.00

For data analysis, descriptive statistics (μ , Sd.) was carried out and to identify if there are significant differences of means in the sociodemographic variables (gender, age, region, semester and university), the ANOVA analysis was carried out. Thus, to know the average values so that they can be contrasted with the values of the scale, the arithmetic mean of the sample ($N = 381$) is calculated in each of the 25 items.

Once the data was collected, the coding of all the variables with numerical notation was performed and the data was processed with the IBM SPSS Statistics v23 software.

Results

The descriptive analysis allows knowing the population characteristics by their sociodemographic variables. Tables 4 to 10 show the average values of each of the 25 items from the calculation of the arithmetic mean of the sample:

Table 4. Average values by item in relationship to gender male (N = 200), female (N = 181)

Item	ANXEVAL				ANXTASK				ANXCOUR			
	Mean (\bar{x})		SD		Mean (\bar{x})		SD		Mean (\bar{x})		SD	
	M	F	M	F	M	F	M	F	M	F	M	F
1	2.92	3.238	1.1135	1.0614								
2	2.82	3.011	1.1681	1.1055								
3	3.07	3.249	1.0728	1.0796								
4	3.56	3.829	1.1014	1.0742								
5	2.33	2.437	1.1295	0.9959								
6	3.04	3.193	1.1511	1.0172								
7	2.67	3.022	1.1958	1.1497								
8	3.28	3.613	1.2244	1.1807								
9	3.49	3.867	1.2681	1.1615								
10	2.66	2.652	1.3907	1.289								
11	2.53	2.591	1.1428	1.0948								
12	2.84	3.199	1.2619	1.2668								
13	2.62	2.757	1.2178	1.0416								
14	2.73	2.972	1.2111	1.0564								
15	3.17	3.553	1.1523	1.2082								
16					2.08	1.978	1.2374	1.1641				
17					2.135	1.961	1.2468	1.142				
18					1.78	1.702	1.1216	0.9715				
19					1.795	1.774	1.0904	1.0742				
20					1.99	1.934	1.1474	1.1235				
21									1.91	1.774	1.1145	1.069
22									2.31	2.326	1.2088	1.1347
23									2.22	2.155	1.2191	1.1296
24									2.18	2.182	1.171	1.0827
25									2.27	2.365	1.3128	1.3702

Source: Own

Table 4 shows the phenomenon of anxiety towards mathematics by comparing results by gender. It is possible to observe that women show more anxiety towards mathematics in the evaluation dimension than men, except for item 10 (realizing that it is necessary to study a certain number of mathematics classes to meet the academic requirements) in which the average is practically the same for men and women. The rest of the means of all the items of this dimension are greater in the female gender.

For both men and women, anxiety towards the evaluation of mathematics is greater than anxiety towards the mathematics courses or towards numerical tasks. In these last two dimensions, not only do the average values of the items fall in the range of "very little" anxiety towards mathematics, but also the results between both genders are closer. It is also observed that in the anxiety dimension towards numerical tasks, male anxiety is greater than that of women.

About the type of university, it means, if the students belong to public or private institutions, Table 5 shows the following results:

Table 5. Average values by item in relationship to public school (N = 305) and private school (N = 76)

Item	ANXEVAL				ANXTASK				ANXCOUR			
	Mean (\bar{x})		SD		Mean (\bar{x})		SD		Mean (\bar{x})		SD	
	Public	Private	Public	Private	Public	Private	Public	Private	Public	Private	Public	Private
1	3.121	2.8684	1.098	1.0874								
2	2.954	2.7368	1.166	1.0246								
3	3.253	2.7632	1.051	1.106								
4	3.761	3.3816	1.075	1.131								
5	2.456	2.0658	1.066	1.0242								
6	3.154	2.9474	1.088	1.0942								
7	2.944	2.3947	1.195	1.0466								
8	3.544	3.0132	1.189	1.2274								
9	3.728	3.4342	1.228	1.2257								
10	2.787	2.1316	1.356	1.1471								
11	2.653	2.1711	1.143	0.9294								
12	3.105	2.6316	1.25	1.315								
13	2.738	2.4737	1.143	1.1012								
14	2.905	2.5921	1.124	1.202								
15	3.444	3	1.163	1.2543								
16					2.125	1.6579	1.2371	0.9737				
17					2.082	1.9342	1.218	1.1235				
18					1.777	1.6053	1.1015	0.8178				
19					1.823	1.6316	1.1098	0.95				
20					1.997	1.8289	1.1485	1.0757				
21									1.931	1.4868	1.126	0.8717
22									2.315	2.3289	1.153	1.2585
23									2.249	1.9342	1.213	0.9844
24									2.21	2.0526	1.154	1.0184
25									2.393	1.9868	1.365	1.1831

Source: Own

The results show that economics students from public universities have a higher level of anxiety in all the dimensions than economics students from private universities. In 24 out of 25 items, the average of students from public universities was higher than the average of the results of students from private universities. Only in item number 22, which refers to seeing the teacher work on an algebraic equation on the blackboard, the result was slightly higher among students at private universities.

The difference between the results of the students from both universities is remarkable, especially in the dimension that refers to anxiety towards evaluation, since the results of the students from private universities indicate that their level of anxiety in this dimension is "Nothing" (the averages were between 1.05 and 1.35) while the averages of the economics students from public universities were between 2.45 and 3.76, that is, they show "Some" anxiety in this dimension and for some items such as 4 or 9 (thinking about the final math exam or thinking about the test they will present in an hour) the anxiety level is "Enough".

Tables 6-10 show the results obtained from the sample according to the region of origin, that is, they show the average values of the respondents by area of the country (belonging to the north, south, center, Pacific and Atlantic), to describe the phenomenon of anxiety towards mathematics experienced by economics students in Mexico.

Thus, Table 6 shows the average values of the students from the Autonomous University of Nuevo Leon (UANL) and the University of Monterrey (UDEM), belonging to the northern area of the country:

Table 6. Average values by item from the north zone of the country (N = 59)

Item	ANXEVAL		ANXTASK		ANXCOUR	
	Mean (\bar{x})	SD	Mean (\bar{x})	SD	Mean (\bar{x})	SD
1	3.2034	1.14138				
2	2.8136	1.27947				
3	3.4915	1.11993				
4	3.9153	1.08736				
5	2.3559	1.09486				
6	3.2034	1.12617				
7	3.0339	1.36415				
8	3.6271	1.21624				
9	3.6102	1.28676				
10	2.7458	1.43351				
11	2.7119	1.21841				
12	3.4237	1.26223				
13	2.4915	1.22295				
14	2.8814	1.08413				
15	3.2373	1.14980				
16			1.8305	1.21984		
17			1.6780	0.99031		
18			1.5085	1.00641		
19			1.4915	1.05655		
20			1.6610	1.07656		
21					1.4576	0.91580
22					1.8644	1.07411
23					1.8305	1.08521
24					1.9492	1.10522
25					1.8983	1.15512

Source: Own.

Table 7 shows the average values of the students from the University of Quintana Roo (UQROO) that represent the southern zone:

Table 7. Average values by item from the south zone of the country (N = 66)

Item	ANXEVAL		ANXTASK		ANXCOUR	
	Mean (\bar{x})	SD	Mean (\bar{x})	SD	Mean (\bar{x})	SD
1	3.1364	1.05081				
2	3.1970	1.05568				
3	3.3182	1.01009				
4	3.7879	1.00023				
5	2.6515	1.01515				
6	3.3333	1.07178				
7	2.8636	1.12162				
8	3.5909	1.14995				
9	3.8636	1.18823				
10	2.7879	1.19634				
11	2.7121	0.97294				
12	3.0758	1.29271				
13	3.0152	0.95261				
14	2.9091	1.09161				
15	3.4545	1.11192				
16			2.4545	1.29117		
17			2.2273	1.23781		
18			1.9091	1.17313		
19			2.1061	1.19136		
20			2.1061	1.12494		
21					2.1061	1.00963
22					2.5152	0.99603
23					2.4242	1.13762
24					2.1970	1.04100
25					2.6667	1.41784

Source: Own.

The average values of the students from the Autonomous Metropolitan University, campus Iztapalapa and the College of Mexico that belong to the central zone are shown in Table 8:

Table 8. Average values by item from the central zone of the country (N = 74)

Item	ANXEVAL		ANXTASK		ANXCOUR	
	Mean (\bar{x})	SD	Mean (\bar{x})	SD	Mean (\bar{x})	SD
1	3.1486	1.01607				
2	3.1486	1.16669				
3	3.1757	1.03841				
4	3.6757	1.07408				
5	2.3514	1.05249				
6	3.1081	1.04117				
7	2.8649	1.10198				
8	3.3919	1.21427				
9	3.6622	1.19677				
10	3.0405	1.32871				
11	2.7027	1.16724				
12	3.0405	1.24349				
13	2.6216	1.01634				
14	3.0135	1.10408				
15	3.4189	1.15873				
16			2.2973	1.15545		
17			2.3108	1.20417		
18			1.8784	1.03305		
19			1.9324	1.10207		
20			2.0405	1.07829		
21					1.9865	1.14069
22					2.4324	1.15961
23					2.2838	1.26621
24					2.3649	1.17711
25					2.4865	1.36736

Source: Own.

Table 9 shows the average values of the students from the University of Colima and the University of Guadalajara which belong to the Pacific area:

Table 9. Average values by item from the Pacific area of the country (N = 53)

Item	ANXEVAL		ANXTASK		ANXCOUR	
	Mean (\bar{x})	SD	Mean (\bar{x})	SD	Mean (\bar{x})	SD
1	3.0566	1.26210				
2	2.8302	1.22059				
3	3.1321	1.27155				
4	3.6226	1.28940				
5	2.4717	1.23419				
6	3.0189	1.20081				
7	3.0000	1.33012				
8	3.5283	1.28008				
9	3.5849	1.35070				
10	2.6038	1.48505				
11	2.4906	1.28036				
12	2.7547	1.20744				
13	2.7170	1.37809				
14	2.9245	1.25344				
15	3.4906	1.29530				
16			1.9811	1.27838		
17			2.1887	1.48138		
18			1.8113	1.27183		
19			1.7925	1.14956		
20			2.0189	1.33720		
21					2.1887	1.45518
22					2.2453	1.31421
23					2.4340	1.42112
24					2.3396	1.39977
25					2.5283	1.46240

Source: Own.

In addition in table 10 shows the average values of students of the Atlantic area from Cristobal Colon University and Veracruzana University:

Table 10. Average values by item from Atlantic area of the country ($N = 129$)

Item	ANXEVAL		ANXTASK		ANXCOUR	
	Mean (\bar{x})	SD	Mean (\bar{x})	SD	Mean (\bar{x})	SD
1	2.9380	1.08074				
2	2.7054	1.02624				
3	2.9147	0.98450				
4	3.5581	1.06732				
5	2.2248	1.00188				
6	3.0000	1.06066				
7	2.6434	1.10254				
8	3.2636	1.20882				
9	3.6357	1.20505				
10	2.3488	1.26028				
11	2.3488	1.02050				
12	2.8760	1.28700				
13	2.6279	1.12548				
14	2.6589	1.16924				
15	3.2558	1.23288				
16			1.7752	1.06243		
17			1.9302	1.09106		
18			1.6589	0.89701		
19			1.6667	0.94648		
20			1.9612	1.09974		
21					1.6589	0.92277
22					2.3876	1.20746
23					2.0698	1.02459
24					2.1008	1.01431
25					2.1318	1.24612

Source: Own.

As we can see in the different areas that integrate Mexico: north, south, central, Pacific and Atlantic, there are differences and similarities. For example, in the five areas, most of the items that make up the anxiety dimensions towards mathematics courses and numerical tasks (items 16 to 25) are classified in the "very little" anxiety range, with the exception of item 25 which refers to "entering a math class" and that in the Pacific and south areas reached the level of "some" anxiety. It is also observed that in all areas the highest averages belong to the dimension of anxiety towards evaluation.

The southern zone has the highest averages of all the zones in 12 of the 25 items, with values ranging from 1.9 to 3.8 present in the three dimensions. It is followed by the northern zone, with 6 of the highest averages, present only in the anxiety towards evaluation dimension. The lowest means were in the Atlantic zone.

Finally, in order to testing hypotheses of means differences, we carried out the ANOVA test of one sample.

As part of the descriptive study, we seek to determine if there are means differences between the variables: anxiety for evaluation (ANXEVAL), anxiety for numerical tasks (ANXTASK) and anxiety for math courses (ANXCOUR) all this based on gender, age, semester in which they are enrolled, the university and the region to which they belong.

The contrast hypotheses are as follows:

H0: $\mu_1 = \mu_2 = \dots = \mu_k$ Population means are equal

H1: At least two population means are different

Therefore, the decision criterion will allow us to reject the null hypothesis in all cases if: Calculated $F > \text{Critical } F$ (tables); otherwise, it is not rejected, that is, if $F_{\text{calculated}} < F_{\text{tables}}$. As a first step we calculate the Levene statistic to test the hypothesis of equality of population variances, then, we apply the theoretical criterion that states that: If the critical level (sig.) is less than or equal to 0.05, we must reject the equality hypothesis of variances, If it is greater, we accept the hypothesis of equality of variances.

A summary of the values of the Levene statistic with its corresponding statistical significance for each dimension (sig.) ANXEVAL, ANXTASK and ANXCOUR is shown in Table 11 and figure 1:

Table 11. Homogeneity variances by Region, Gender, University, Age, Semester, grouped by dimension

Variable	Measures	ANXEVAL	ANXTASK	ANXCOUR
Region	Levene statistical	2.390	1.878	4.407
	Significance	0.050	0.114	0.002
Gender	Levene statistical	1.156	1.418	2.245
	Significance	0.283	0.234	0.135
University	Levene statistical	0.001	2.097	2.657
	Significance	0.976	0.148	0.104
Age	Levene statistical	1.520	0.929	1.628
	Significance	0.209	0.427	0.182
Semester	Levene statistical	0.865	0.740	0.741
	Significance	0.505	0.594	0.594

Source: own

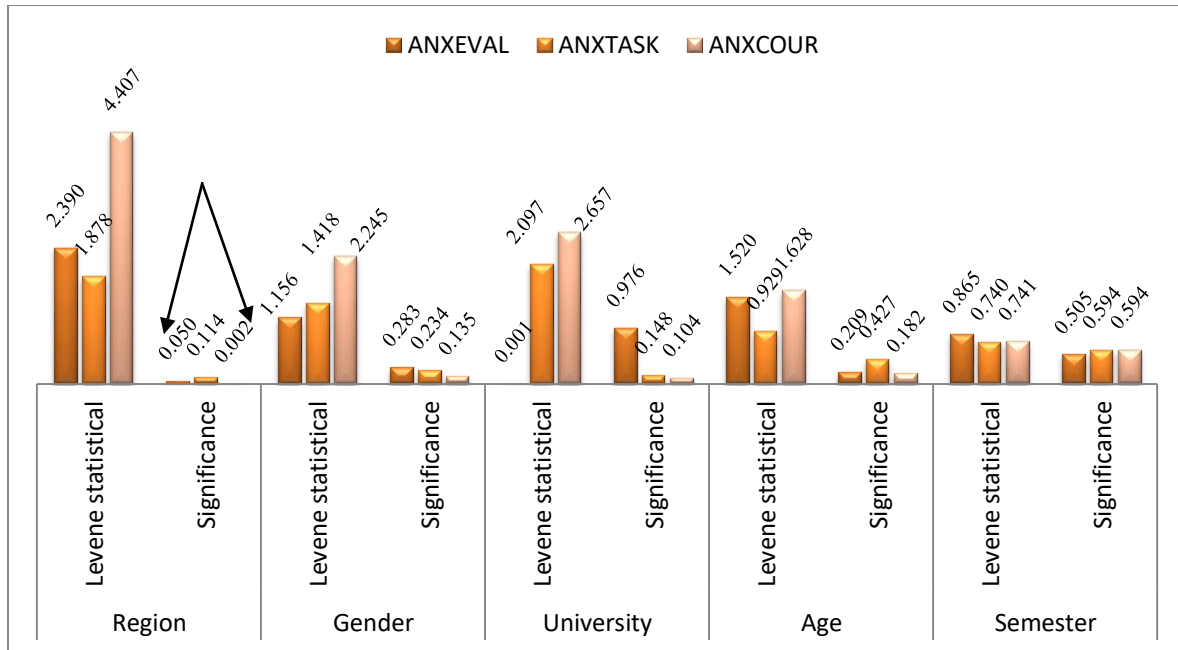


Figure 1. Homogeneity of variances by Region, Gender, University, Age, Semester, grouped by dimension (source: own)

The values of the Levene statistic and the statistical significance described in the previous table 11 and in the Figure 1, allow us to point out that in the ANXEVAL and ANXCOUR dimensions of the “Region” variable, the hypothesis of equality of variances is rejected, not so in the rest of the dimensions of the other variables: Gender, Age, University and Semester, whose values of significance are greater than 0.05 which gives statistical evidence to accept the hypothesis of equality of variances.

The results obtained from the ANOVA procedure are shown in table 12, in which the F values are observed with their level of significance (sig.). In the same way, in this step we apply the theoretical criterion that states that: If the interclass level of significance (sig.) Is less than or equal to 0.05, we must reject the hypothesis of equality of means, if it is greater we must accept the equality of means, that is, there are no significant differences between the groups.

Table 12. ANOVA by Region, Gender, University, Age, Semester, grouped by dimension

Variable	Measures	ANXEVAL	ANXTASK	ANXCOUR
Region	F	1.857	3.420	3.927
	Significance	0.117	0.009	0.004
Gender	F	12.834	3.345	4.143
	Significance	0.010	0.391	0.894
University	F	12.834	3.345	4.143
	Significance	0.000	0.068	0.043
Age	F	0.985	1.239	1.161
	Significance	0.399	0.295	0.324
Semester	F	1.564	0.547	1.009
	Significance	0.169	0.739	0.412

Source: own

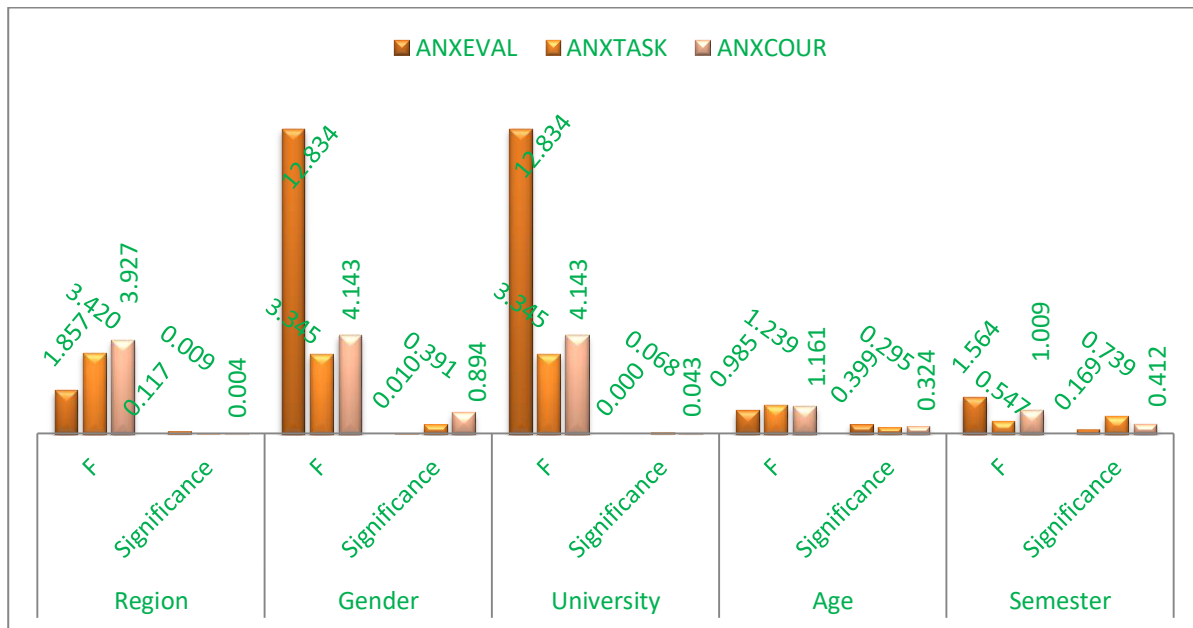


Figure 2. ANOVA by Region, Gender, University, Age, Semester, grouped by dimension (source: own)

In table 12 we can see that the groups whose means differ significantly (at the 0.05 level) are those that show statistically significant differences from each other.

When the F value of tables is not significant, it is concluded that the factor has no influence on the dependent variable, that is, the different levels of the factor behave in the same way as regards the dependent variable. Otherwise we can say that: if the value of F is significant, then it will be concluded that at least two levels of the factor produce different effects on the dependent variable, which would be recommended to evaluate between which levels these significant differences occur.

In the specific case of the ANXTASK and ANXCOUR dimensions of the "Region" variable whose level of significance is less than 0.05, therefore, the hypothesis of equality of means must be rejected, which allows to infer that if there is a means difference in means. Same case for the ANXEVAL dimension of the "Gender" variable, the hypothesis of equality of means must also be rejected. Finally, ANXEVAL and ANXCOUR of the "University" variable also reject the hypothesis of equality of means. The rest of the variables do not show difference of means.

Conclusion

Although the mathematical activity is inherent to the study of economics, the research reveals the existence of very little anxiety towards mathematics among economics students of these five regions of Mexico when doing numerical tasks and when taking a course of mathematics, but some anxiety is shown in situations related to the evaluation of mathematics. In all the surveyed areas, students' anxiety increases when they think about the exam they will have in an hour and when doing the final exam. Mexican economics students from the south have more anxiety than the rest of the students of economics in the country. On the other hand, students from the Atlantic region are the ones who feel less anxiety.

Regarding gender, the results reveal that women feel more anxiety than men towards evaluation, whereas men feel more anxious than women when performing numerical tasks. For both, men and women, an evaluation generates greater anxiety than solving tasks or taking math subjects.

Regarding the type of university, economics students from public institutions have higher levels of anxiety than students from private universities. The latter particularly feel very little anxiety in situations that require them to take the math book to read, think about the exam they will have in a week or be aware of the academic credits.

This makes us think about the possible applications of the results of the study with the intention that undergraduate students of economics in Mexico continue postgraduate studies in economics in high-level programs that require mastery of mathematics and statistics and that they do not discard this possibility because of the anxiety generated by their learning.

Discussions

Some results of this study are consistent with the results obtained by Rounds and Hendel (1980), this is because the economics students of Mexico have much anxiety in two situations: think about the exam that will be taken in one hour and take the final exam. This level of anxiety was also found in the same situations by these authors in American students.

Just as in this study it was observed that women experience greater anxiety towards mathematics, studies by authors such as Betz (1978) and Hembree (1990) find this same trend. For the particular case of higher-level Mexican students, the same trend is found (Escalera-Chavez, Moreno-Garcia, Garcia-Santillan & Cordova-Rangel, 2016; Escalera-Chavez, Moreno-Garcia, Garcia-Santillan & Rojas-Kramer, 2017).

Other studies carried out in the Mexican student's university context indicate that a private university first considers the numerical operations that the evaluation to explain the anxiety towards mathematics (Garcia-Santillan, Moreno-Garcia, Schnell & Ramos-Hernandez, 2016), which does not occur in the public university where anxiety towards evaluation turns out to be more important when explaining this phenomenon (Garcia-Santillan, Flores-Serrano, Lopez-Morales & Rios-Alvarez, 2014). However, it is not possible to establish a correct comparison since both studies occupy a different scale from the one used in the present work and because the samples are not focused on students of Economics. Therefore, it is necessary to carry out more specific studies with a focus on demographic aspects to carry out a more accurate comparison.

Finally, results show that there is not widespread presence that suggest significant differences in population means in the five variables (region, gender, age, university and semester). This result coincides with some studies on mathematical anxiety carried out by Jolejole-Caube, Dumlao and Abocejo (2019), but not as well as in the study by Aguero, Meza, Suarez (2017) who carried out a study in Costa Rica with 3725 students, whose results reveal statistically significant differences in the level of mathematical anxiety by gender, with women showing moderately higher levels of anxiety than men. They found differences in anxiety levels, which are determined by the educational level in which the student is enrolled. Also, differences were found among the students of the third cycle as well as those of diversified education, this latter group showed moderately higher levels of anxiety.

Suggestions

More research is needed in this context since the behavior that economics students report may allow more defined strategies to be carried out to combat anxiety towards the mathematics they present. So knowing specifically the areas to be reinforced, it will be of benefit for their prosecution both from the teachers as well as from the institutions where they receive mathematical knowledge.

The results also suggest future lines of research that have to do with the relationship that anxiety towards mathematics has with the performance of economics students. It would be worth exploring if the anxiety towards mathematics is reducing the number of students who enroll in this degree. Finally, it would be advisable to investigate whether the levels of anxiety that public universities report has to do with greater demand and rigor of mathematics in public universities or with the poor performance of their students, or both.

Acknowledgements

All authors of this article appreciate the participation of the students enrolled in the different Mexican universities that took the time to answer this survey.

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