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Statistical attitude towards graduate students and undergraduate Health area in the city of Durango

Actitud hacia la Estadística en estudiantes de posgrado y pregrado del área de la Salud en la ciudad de Durango

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Abstract

The Attitude towards Statistics is essential for the achievement of learning in the classroom, Attitude Becomes a problem When the desirable learning are not Achieved Objectives. Knowing the different factors That Strengthen and weaken the Attitude towards Statistics, is a challenge for the specialist in educational sciences and the teacher specialized in statistical Methodologies. Through a descriptive and correlational study, the reliability and validity of the instrument of Attitudes towards Statistics Auzmendi was designed by Determined, applied in a convenience sample of 131 undergraduate and postgraduate students in the area of Health in the city of Durango. The objective was to validate and determine the factors That differentiate the Attitudes Toward Statistics in undergraduate and postgraduate students in the Health area. The instrument presented good properties Both in Its reliability and validity in ITS and Its use in this type of population is adequate. The results Indicated anxiety, agrarity factors and usefulness of the statistical methods, differentiable in the levels of study and type of sex in the Population Studied.

Attitudes, Statistics, Undergraduate, Postgraduate, Health

Resumen

La Actitud hacia la Estadística es fundamental para el logro del aprendizaje en el aula, la Actitud se convierte en un problema cuando no se logran los objetivos deseables del aprendizaje. Conocer los diferentes factores que fortalecen y debilitan la Actitud hacia la Estadística, es un reto del especialista en ciencias de la educación y del docente especializado en metodologías estadísticas. A través de un estudio descriptivo y correlacional se determinó la confiablidad y validez del instrumento de Actitudes hacia la Estadística diseñado por Auzmendi aplicado en una muestra por conveniencia de 131 estudiantes de pregrado y posgrado del área de la Salud en la ciudad de Durango. El objetivo fue validar y determinar los factores que diferencian las Actitudes hacia la Estadística en estudiantes de pregrado y posgrado del área de la Salud. El instrumento presentó buenas propiedades tanto en su confiabilidad como en su validez y es adecuado su uso en este tipo de población. Los resultados indicaron factores de Ansiedad, Agrado y Utilidad de los métodos estadísticos, diferenciables en los niveles de estudio y tipo de sexo en la población estudiada.

Actitudes, Estadística, Pregrado, Posgrado, Salud.

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Introduction

The comprehensive study of the field of Statistics carries a great challenge specialist who may or may not prior training in the areas of mathematics, statistics and probability. The challenge is to learn and understand that by teaching and classroom communication (channel information) based on new knowledge for student learning on statistical methodology is obtained.

The student or student who manages to meet the learning objectives on issues of statistics, is due to several factors that include the teaching and learning in the classroom, such factors include, among others, the preparation of teaching both the knowledge of the subject (disciplinary specialization) and in the forms for the transmission of knowledge (teaching), pro-active and pro-positive student expectations face new issues of knowledge (Attitude), and the learning environment in the classroom (anthropological , social and cultural).

Also, the attitude is applied in a context both the teacher and the student. A teacher without teaching attitude becomes a leaderless process that generates knowledge and a student without attitude is not attainable ultimate purpose or not realizable knowledge empowerment. Attitude becomes a problem when the desirable learning goals are not achieved. Knowing the different aspects that strengthen and weaken Attitude is a challenge for specialists in science education or educational research.

Consequently, there have been several proposed methodologies that try to highlight the main features that leads to attitude. Attitude seen from approach the student as a pro expectation - active and pro - positive student facing new issues that lead to understand and comprehend the statistics, it is knowledge that every teacher of the same subject must identify and understand the different aspects about attitudes towards statistics has undergraduate and graduate Health area, and in this case, applied to a sample of the city of Durango, Dgo., Mexico.

Justification

Build an instrument to measure attitude toward statistics is a challenge for researchers in science education, however, consider the attitude in the perspective of the teacher it is also a challenge when it is critical eye and involved in the study. Attitude towards statistics is essential for the achievement of learning in the classroom, considering the environment and working conditions in developing for the construction of ideas, thoughts and statistical approaches, extending the search for factors that provide and promote learning, but also need to identify other factors may inhibit students' attention, participation and desire to learn a statistical methodology when it is alien to training in the area of basic sciences, as in the case of this research work is dimensioned and describe the factors that lead the attitude towards Statistics and validation of same applied to undergraduate (BA) and graduate Health area in the city of Durango.

Problem

The problem of statistical teaching is based on the activity of disclosure thereof, with problems in teaching already identified in the process of transmission of knowledge and activity in learning, some already identified as the lack of trained teachers in subject areas of mathematics and statistics, the lack of knowledge of teaching techniques in a playful way the applicability of matter and finally, students, principal objects of study for setting up the process of teaching and learning, with students no attitude and no enthusiasm for learning due to ignorance itself of matter in its applicability, terminology and a deficiency in theoretical basis of the area of mathematics, probability and statistics, as well,classroom context characterized by social and cultural attitudes.

Statistics is considered by some as a teaching tool for troubleshooting and applying statistical methods and processes. This framing of the individual who considers statistics as a tool is due to factors occurring in groups of schools with profiles of different training sciences basic area: lack of multidisciplinary support of a specialist trained in statistics or mathematics for collaborative work or, another important factor is the great confidence to dispense with the statistician by the researcher responsible for the area of Health.

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While the latter factor identifies a definite attitude response specialist to do without the skilled person, the consequence is imminent in the impact that analysis, The attitude towards statistics in area students Health at levels of study undergraduate (bachelor) and graduate becomes a pressing need to identify the most predominant factors that are displayed as problems for teaching and learning it are matter, coupled with the characteristics of the context and homogeneity of students who do not have training in areas of basic sciences.

Hypothesis

Factors sized attitude towards students Statistics in the area of health are different levels of undergraduate study (Bachelor) and graduate in the city of Durango.

The instrument attitude towards Statistics prepared by Azmendi (1992), has a high reliability and external validity consistent with the factors explored.

Objectives

General Purpose

Validate and determine the factors that differentiate attitudes towards Statistics in undergraduate and graduate Health area in the city of Durango

Specific Objectives

- Determining the level of reliability of instrument attitude towards Statistics prepared by Auzmendi 1992.
- Determining factor validity instrument attitude towards Statistics prepared by Auzmendi 1992.
- Identify factors that differentiate attitudes towards statistics by levels of students study in the city of Durango.

Theoretical Framework

Today there are different methodologies to measure the attitude towards statistics, with different measurement scales and different application contexts leading professionals out of educational sciences as Robert and Bilderbark (1980) who obtained a scale to measure attitudes students by teachers of Statistics.

Inventory of Attitudes toward Statistics (SAS) of Robert and Bilderback contains 34 items Likert type with 5 types of response was applied to students from Penn State University in a course in introductory statistics in a study design Cohort between 1978 and 1979, identifying high reliability through Cronbach's alpha of between 0.93 and 0.95 in the different periods of the instrument, (Roberts, D. Bilderback, E., 1980)

In 1982 Robert and Saxe re-applied the questionnaire adding covariates to identify their possible relationship to the score obtained the instrument, finding scores on averages significantly related to course notes, basic math skills, previous statistical knowledge, level of study, sex satisfaction by carrying out statistics, choice of course, use of calculators and teacher assessment (Roberts, D. Saxe, J., 1982).

Scale of Attitudes toward Statistics (ATS) Wise was applied to students of Basic Statistics. Wise (1985) makes critical the SAS instrument based on the observation on measurements aimed to knowledge of matter, measuring actual yields rather Attitude towards matter. Wise methodology used by the ATS instrument is focused on the attitude of course they are doing at that time and also on the attitudes of students towards the use of statistics in their field of study.

The ATS Wise (1985) contains 29 items Likert 5 answer possibilities (20 items measuring the attitude towards the field of statistics and 9 items for Attitudes toward course). Originally the ATS Wise containing 40 items, but was eliminating several of them for validity, correlation and external evaluation (Wise, S., 1985).

Validation although it is a process to identify the confidence you have the instrument leading to measure what is to be measured, it is important to consider that the first precursors to measure validation were in the work of Hoyt in 1941 and Guttman in 1945 on the first methods to validate items in ordinal scales measurement. Subsequently, the Alpha method of Cronbach emerged in 1951 discovered by the same author who determines a measurement scale reliability of Likert type and which is currently used in a number of research areas of psychology, medicine and the social area.

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Reliability Cronbach is based on correlations of items with marginal instrument scale (Cronbach, LJ, et al. 1972). ATS and SAS tools were made and applied to populations of the American union and was not it until 1992 when Auzmendi created the scale and instrument applied to populations of Spanish, instrument applied to determine the attitude for both mathematics and for Statistics. The instrument Auzmendi in words of the author is considered a tool to identify specific aspects differentiable, including factors Utility, Anxiety, Confidence, Liking and Motivation (Auzmendi, E., 1992) found.

Auzmendi instrument that identifies attitudes toward mathematics or statistics, only with a simple change in each item was applied to a population of college students and high school students. The instrument consists of 25 items with five categories Likert, which obtained as a result high reliability with a correlation with the instrument SAS Roberts at a level of 0.86, showing good measure of the construct Attitude Statistics.

Authors such as Schau, Stevens, and Dauphine (1995) considered the attitude towards Statistics should have several key characteristics: include important components of the attitude, have application instrument constant and unchanged in the different times hard a statistics course, short measuring instruments under items towards negative answers and positive, validate instruments internally and externally, and results analysis with techniques that constitute the dominant factor in terms conclusive (Schau, C., Stevens, J., Dauphine, T., Del Vecchio, A., 1995).

On the above description by the same authors carried out the creation of an instrument of attitudes towards Statistics (SATS) based on approaches used by experts in the field, participating students and teachers outside thereof; The instrument is constructed to perform the attitude towards statistics with 28 items with response levels seven categories representing together Afectividad factors, Competition Cognitive value of the study and the difficulty thereof. As a result determined by the authors reliability through significant correlation between the ATS of Wise instrument level factors and generally the construct,Wise, S., 1985).

Cazorla et al (1999) conducted the design of an instrument using the initiative Aiken (1974) translated and adapted to Brazil by Brito (1998) on a scale measuring attitudes toward mathematics, merely affective, and presenting as high internal consistency results with items relevant for the statistical valid in the country of origin itself. It contains 20 items with the instrument response with four categories Bidimensional, Affective and Eigenvalue factors. As results obtained a consistency through Cronbach of 0.95 and a factor analysis confirmed that the scale is unidimensional justifying the dominant factor for 51% of variance explained (Cazorla, et. al, 1999).

Estrada (2002) identified the need for the question of the attitude towards Statistics from the perspective of teachers considering the combination of SAS and Bilderback Robert scale with ATS Wise scale, together with the Spanish Auzmendi scale. attitude towards statistics of teachers in training and exercise: A other application of the instrument in two different contexts considered. As results identified several components of the attitude: the anthropological component and the educational component.

The instrument consists of 25 items (14 concurring with 11 negative) on a scale of 5 Likert response categories. Result in the application of the instrument in two different contexts population (Spanish and Peruvian) was performed, item 22 only materialize adhesion of anthropological and educational components using factor analysis. Peru's population did not reach the highest matching items concerning the understanding of statistical process considering having a difficulty in the application and validation of it by different cultural structures (Estrada, A., 2002).

Research Methodology

A descriptive, comparative non-probabilistic and correlational study for driveability and validity of the application of the instrument Attitudes toward Statistics (Auzmendi, 1992) in undergraduate and graduate students in the area of Health was conducted. Aconvenience sample of a total of 131 undergraduate (bachelor) and graduate Health area in the city of Durango was obtained.

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Undergraduate students were of Psychology and Therapy degree in Human Communication, and graduate were Biostatistics specialty of the Master's in Health Sciences and Medical Sciences belonging to the Faculty of Medicine and Nutrition, and expertise in Public Health**ustification** Institute for Scientific Research, between 2015 to 2017 programs undergraduate and graduate belonging to the Juárez University of Durango State.

The instrument used to determine the attitude towards Statistics was prepared by AUZMENDI in 1992 a total of 25 items and was adapted for the population applied undergraduate and graduate Durango City. The instrument applied was intended to demonstrate the relationship between demographic variables and factors Attitude toward statistic in the study population and identify the consistency of the instrument through the reliability and validity by Exploratory Factor (AFE) Analysis. The age range of the studied population is between 19 and 50 years for graduate and undergraduate students in the city of Durango, applying the instrument at the beginning of the first class of the field of statistics on a single occasion.

The methodology used for the contrast of the homogeneity of the sample was through tests Goodness of Fit through the Kolmogorov - Smirnov and Shapiro - wilk. Descriptive statistics was used by the mean and standard deviation, and statistical comparison to test the relationship between the attitude and variables sex and educational level was with the statistical t-student. On the correlational statistics for reliability Cronbach's alpha we were used and for validity by the AFE with main components and Varimax orthogonal rotation.

Type of Research.

It is a comparative study descriptive, correlational reliability and Factorial Exploratory (AFA) Analysis.

Theoretical methods.

The instrument which determines the attitude towards Statistics (Auzmendi, 1992) in undergraduate and graduate students in the area of Health in the city of Durango was used. The instrument measures factors Attitude toward Statistics, as factors Usefulness of Liking, Confidence, Anxiety and Motivation.

The measuring range for the instrument 25 is Likert items: 1.-Strongly disagree, 2. Disagree, 3. Neutral, neither agree or disagree, 4. According, 5. Totally in agreement.

Software development process

SPSS version 24 software was used originally licensed for processing and data analysis.

Results

Sample characteristics

With a sample of 131 undergraduate and graduate programs in the area of Health in the city of Durango, composed of 90 (68.7%) females and 41 (31.3%) male, with a range of minimum age 19 years and a maximum of 51 years. Sample 30 (22.9%) students are undergraduate and 101 (77.1%) are graduate students Juárez University of Durango State.

Internal consistency of the scale

Validation of the instrument based on the items of responses on a total of 131 students interviewed were 121 valid and 10 excluded on 25 items in response Likert instrument that measures the attitude towards statistics (Auzmendi, 1992), had as measured internal consistency of 0.909 (Cronbach's alpha) and 0911 by the alpha reliability based on standard elements, with high reliability. The analysis of Cronbach's Alpha if the item is deleted, identified the item 9 with a minimum correlation of 0.903 and a maximum correlation of 0.909 in item 10. The statistical scale as the average was 88.57 with a standard deviation of 15.75. Statistical measurement Keise Meyer Olkin was 0.832 being a remarkable extent and Bartlett sphericity test was statistically significant (p = 0.

Validity

Before performing the validity directionality of the items was made, codifying the response of the items in reverse because the original negative description of these. Those were recoded are items 2, 5, 7, 10, 12, 15, 16, 17, 22 and 25.

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The validity of the instrument exploratory factor analysis (AFE) was used to using the Principal Component Analysis with Rotation 5 Varimax orthogonal components (communalities) were obtained, with 60.18 of the total variance explained with rotation accumulated squared loads, among which the following are described: 1. component ANXIETY with items 7, 12, 13, 17, 18 and 22 with a 7.17 total variance explained accumulated, Component 2. AGRADO with items 1,3, 6, 11, 21 and 23 with 30.34 total cumulative variance explained, Component 3. - CONFIDENCE with items 4, 8, 9 and 14 with 40.58 total variance explained accumulated, motivation 4. Component items 2, 5, 10, 16, 25 with a 50.45 total variance explained accumulated, and Component 5. - UTILITY with items 15, 19, 20 and 24 with a 60.18 total variance explained accumulated; see Table 1 below.

	Component				
	one	two	3	4	5
iTEM 1		.764			
iTEM 2				.505	
iTEM 3		.380			
item 4			.727		
item 5				.513	
item 6		.697			
item 7	.748				
item 8			.491		
item 9			.686		
item 10				.546	
item 11		.732			
item 12	.774				
item 13	.699				
item 14			.623		
item 15					.732
item 16				.822	
item 17	.737				
item 18	.486				
item 19					.481
item 20					.629
item 21		.450			
item 22	.751				
item 23		.813			
item 24					.573
item 25				.689	
Extraction method: principal component analysis. Rotation method: Varimax with Kaiser normalization.					

Table 1 Matrix Rotated component (commonalities) *Source: Questionnaire Attitude towards statistics in undergraduate and graduate Health area in the city of Durango*

The following Table 2 shows the results of reliability for each determined by the AFE in the validity instrument attitude towards statistic factor.

components:	Cronbach	Cronbach's alpha standardized elements	Cronbach Alfa maximum if the item is removed
ANXIETY	0.847	0.847	0849 (item 18)
LIKING	0.772	0.790	0812 (item 3)
TRUST	0.812	0.812	0813 (item 8)
MOTIVATION	0.758	0.760	0741 (item 10)
UTILITY	0.728	0.730	0682 (item 19)

Table 2 Reliability of each factor determined by the AFE. *Source: Questionnaire Attitude towards statistics in undergraduate and graduate Health area in the city of Durango.*

Normality tests (goodness of fit)

The instrument was applied early in the course of Statistics undergraduate and graduate Juárez University of Durango State (UJED), with a total sample of 131 students (convenience sample) which was held normality tests finding resulted in a statistically significant probability in each test for goodness of fit. Statistical used both samples undergraduate and graduate and the total sample statistical Kolmogorov used - Smirnov and Shapiro - Wilk, obtaining the non-rejection of the null hypothesis that confirms that the data follows a theoretical distribution known as the normal distribution represented by marginal results of the values of Attitude toward Statistics, see table 3.

	Kolmogorov - Smirov		Shapiro - Wilk	
	Statistical	Probability	Statistical	Probability
UNDERGRADUATE	0.094	0.200 *	0.983	0.903
POSTGRADUATE	0.054	0.200 *	0.987	0.532
TOTAL SAMPLE	0.059	0.200 *	0.991	0.577

* Correction significance of Lilliefors

Table 3 Tests of normality by the goodness of fit of the total sample and the goodness of fit of samples per level of study. *Source: Questionnaire Attitude towards statistics in undergraduate and graduate Health area in the city of Durango.*

Factors Attitude towards statistics by gender and level of study

Attitude towards statistics by graduate and undergraduate UJED showed no statistically significant difference ($p > 0.05$) on marginal values of the instrument scale of Auzmendi, ie on average the scale of attitude graduate students was 89.80 with standard deviation of 16.66, while the average for undergraduate students was 84.86 and a standard deviation of 12.07.

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Considering the total sample, the average obtained from the attitude towards statistics by area students Health UJED was 88.57, with a minimum of 50 and a maximum of 123, a standard deviation of 15.75 and with a confidence interval of 95% (85.74, 91.41).

Marginal averages Attitude toward Statistics were not statistically significant between groups of sex. Averages between Female and male groups were 87.13 and 91.86, with a standard deviation of 15.27 and 16.52, respectively.

Factors that explores the instrument Auzmendi (Utility Liking, confidence, motivation and anxiety) identified only the stressor with a statistically significant difference ($p < 0.05$) between groups of female and male averaging 20.03 and 22.14 respectively see table 4 below.

	SEX	N	Half	Standard deviation	probability *
ANXIETY	Female	90	20.03	4.92	0.030
	Male	41	22.14	5.50	
LIKING	Female	90	23.94	4.54	0.323
	Male	41	24.75	3.84	
TRUST	Female	90	12.03	3.28	0.084
	Male	41	13.17	3.85	
MOTIVATION	Female	84	17.86	3.94	0.901
	Male	37	17.97	4.74	
UTILITY	Female	90	13.62	3.10	0.052
	Male	41	14.80	3.40	

* Student t-test for independent samples with equal variances.

Table 4 Comparison of Factors Statistics Attitude toward sex groups
Source: Questionnaire Attitude towards statistics in undergraduate and graduate Health area in the city of Durango

While a statistically significant difference between groups undergraduate and graduate with marginal scale values of Attitude toward statistic was not identified, it was identified as a result if a difference between some factors for level study. As a result it was found that factors Liking Utility and were statistically significant ($p < 0.05$) between groups undergraduate and graduate, other factors were not significant by level study, see Table 5.

	Study level	N	Half	Standard deviation	Probability *
ANXIETY	Postgraduate	30	21.56	3.87	0.211 **
	undergraduate	101	20.43	5.50	
LIKING	Postgraduate	30	22.80	3.48	0.044
	undergraduate	101	24.61	4.49	
TRUST	Postgraduate	30	11.53	2.45	0.060 **
	undergraduate	101	12.64	3.72	
MOTIVATION	Postgraduate	30	16.76	3.33	0.087
	undergraduate	91	18.27	4.38	
UTILITY	Postgraduate	30	12.20	2.05	0,000 **
	undergraduate	101	14.52	3.33	

* Student t-test for independent samples with equal variances. ** Student t test for independent samples with different variances.

Table 5 Comparison of Factors Statistics Attitude towards intergroup study level
Source: Questionnaire Attitude towards statistics in undergraduate and graduate Health area in the city of Durango

The results indicated that presents greater anxiety in females. It was also identified that there is a difference between groups of level of study based on factors Agrado and utility, so that undergraduate showed a lower Agrado and lower utility of statistical methods as an unfavorable attitude towards statistics on the first day class in the sample studied in the city of Durango.

Considering the above result, it was held scanning each item individually throughout the sample, obtaining the following unfavorable expectations of attitude towards statistics, based on the higher frequency of individuals who answered negatively some of the items that are part of the factors for Anxiety, Confidence, Motivation and Utility.

Among the items that stand out based on the results and expectations less than expected or less presence on attitudes toward the Statistics on the Likert response are as follows: Item 2. The subject of Statistics gives me pretty bad, item 4 .- the use statistics is fun for me, item 9. I enjoy talking with other Statistics, item 13.'m calm / quiet ay / a when I face a problem of Statistics, item 14.- Statistics is enjoyable and stimulating for me, item 15. I hope to have little use statistics in my professional life, item 19. I would like an occupation in which I had to use the statistics. Items 2 and 15 responses were recoded reverse direction due to homogeneous with the other items (positive direction),

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		iTEM 2	item 4	item 9	item 13	item 14	item 15	item 19
N	Valid	131	131	131	131	131	131	131
	lost	0	0	0	0	0	0	0
Half		3.3511	2.72	2.83	3.32	3.23	3.1832	3.09
Median		3.0000	3.00	3.00	3.00	3.00	3.0000	3.00
fashion		3.00	3	3	4	3	3.00	3
Standard deviation		1.12266	1,125	1,184	1,062	1,020	1.18842	1,160
percentile s	10	2.0000	1.00	1.00	2.00	2.00	2.0000	1.20
	twenty	2.4000	2.00	2.00	2.00	2.00	2.0000	2.00
	25	3.0000	2.00	2.00	3.00	3.00	2.0000	2.00
	30	3.0000	2.00	2.00	3.00	3.00	3.0000	2.60
	40	3.0000	3.00	3.00	3.00	3.00	3.0000	3.00
	fifty	3.0000	3.00	3.00	3.00	3.00	3.0000	3.00
	60	4.0000	3.00	3.00	4.00	3.00	3.0000	3.00
	70	4.0000	3.00	3.00	4.00	4.00	4.0000	4.00
	75	4.0000	3.00	4.00	4.00	4.00	4.0000	4.00
	80	4.0000	4.00	4.00	4.00	4.00	4.0000	4.00
	90	5.0000	4.00	4.80	5.00	5.00	5.0000	5.00

Table 6 Item less presence on the attitude towards Statistics
Source: Questionnaire Attitude towards statistics in undergraduate and graduate Health area in the city of Durango

The important results above expectations found by the tool attitude towards statistics were, lack of pleasure and confidence in speaking and using statistics as a didactic methodological absence by the teacher to instill a methodological and playful discipline for the implementation of the statistics.

Other factors that influenced to determine an attitude towards statistics were nervousness, restlessness, discomfort, fear, lack of clarity at the thought of a statistical problem, and the lack of appreciation of statistics, as well as ignorance about the usefulness in professional practice with the use of statistics, are the main problems that arise at the beginning of the first day of classes for statistics in the study sample.

Conclusions.

The findings with statistical bases can achieve meet the target, the hypothesis or answer, get a good argument for describing, understanding and comprehension of the problem posed based on analysis of data collected. Not always in the field of statistics is achieved fulfill the above goals, and is due to many factors, from the stage of planning the study with statistical bases, to the extent of statistical analysis of the problem in the same context, are processes that the practitioner applied in statistical science or mathematics, identifies and provides bias in the study, since their academic and professional training had to do with attitude towards statistics in the processes of teaching and learning inside and outside the classroom.

Expectations attitude towards Statistics are the efforts made by several authors have instruments or questionnaires applied to populations of both students and teachers, to try to gauge the different aspects of the problem have about attitude.

The results found in the student population in the area of Health in the city of Durango, identify precisely this fear on the first day of class to an area that is employed in the formation of the area of Health, showing an attitude of disgust, anxiety, low income, low confidence and low motivation to face learning and acquiring new knowledge represented by the statistic.

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