



Original article

## Attitudes towards mathematics in high school students: presentation and description of results

Actitudes hacia las matemáticas en estudiantes de secundaria: presentación y descripción de resultados

Atitudes frente à matemática em alunos do ensino médio: apresentação e descrição dos resultados

Rosario Araceli Esquivel Mejía <sup>1</sup>



<https://orcid.org/0000-0001-6469-1128>

<sup>1</sup> César Vallejo University-Lima-Peru.



[resquivelm@ucvvirtual.edu.pe](mailto:resquivelm@ucvvirtual.edu.pe)

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### ABSTRACT

The difficulty that students present towards learning mathematics, and that is evidenced in the low results obtained in standardized evaluations, makes it necessary to know the attitudes that students manifest towards this subject. This article aimed to present and describe the results of the attitudes shown by high school students towards mathematics. To carry out this study, the Auzmendi Scale

of Attitudes towards Mathematics, 1992, was used. This instrument has five factors: utility, anxiety, confidence, liking and motivation. The sample consisted of 212 high school students from a Peruvian public educational institution. For the development of this research, a simple descriptive design was used. The applied instrument has a high internal consistency and an important validity criterion with respect to each factor. The results obtained showed that the majority of students show a medium level in the factors of anxiety, liking and usefulness, while the low level predominates in the motivation factor and the high level for the trust factor. For this reason, we conclude that most students show a medium level on the scale of attitudes towards mathematics.

**Keywords:** attitudes towards mathematics; utility; anxiety; trust; pleasure and motivation.

### RESUMEN

La dificultad que presentan los estudiantes hacia el aprendizaje de las matemáticas, y que se evidencia en los bajos resultados obtenidos en las evaluaciones estandarizadas, hace necesario conocer las actitudes que manifiestan los estudiantes hacia dicha materia. Este artículo tuvo como objetivo presentar y describir los resultados de las actitudes que muestran los estudiantes de secundaria hacia las matemáticas. Para la realización de este estudio se utilizó la Escala de actitudes hacia las matemáticas de Auzmendi, 1992. Este instrumento cuenta con cinco factores: utilidad, ansiedad, confianza, agrado y motivación. La muestra estuvo conformada por 212 estudiantes del nivel secundaria de una institución educativa pública peruana. Para el desarrollo de esta investigación se utilizó un diseño descriptivo simple. El instrumento aplicado tiene una alta consistencia interna y un criterio de validez importante respecto a cada factor. Los resultados obtenidos mostraron que la mayoría de estudiantes muestran un nivel medio en los factores de ansiedad, agrado y

utilidad, mientras que en el factor de motivación predomina el nivel bajo y para el factor confianza el nivel alto. Por ello concluimos que la mayoría de los estudiantes evidencian un nivel medio en la escala de actitudes hacia las matemáticas.

**Palabras clave:** actitudes hacia las matemáticas; utilidad; ansiedad; confianza; agrado y motivación.

### RESUMO

A dificuldade que os alunos apresentam na aprendizagem da matemática e que se evidencia nos baixos resultados obtidos nas avaliações padronizadas torna necessário conhecer as atitudes que os alunos manifestam face a esta disciplina. Este artigo teve como objetivo apresentar e descrever os resultados das atitudes demonstradas por alunos do ensino médio em relação à matemática. Para a realização deste estudo, foi utilizada a Escala de Atitudes em relação à Matemática de Auzmendi, 1992. Este instrumento possui cinco fatores: Utilidade, Ansiedade, Confiança, Agradável e Motivação. A amostra foi composta por 212 alunos do ensino médio de uma instituição pública de ensino peruana. Para o desenvolvimento desta pesquisa, foi utilizado um desenho descritivo simples. O instrumento aplicado possui alta consistência interna e importante critério de validade em relação a cada fator. Os resultados obtidos mostraram que a maioria dos alunos apresenta um nível médio nos fatores de ansiedade, gosto e utilidade, enquanto o nível baixo predomina no fator motivação e o nível alto no fator confiança. Por esta razão, concluímos que a maioria dos alunos apresenta um nível médio na escala de atitudes face à matemática.

**Palavras-chave:** atitudes face à matemática; utilidade; ansiedade; confiança; gosto e motivação.

## INTRODUCTION

Low performance in areas such as mathematics is a latent problem within the Peruvian educational system, as well as in other Latin American countries. According to the results obtained in the last PISA evaluation carried out in 2018, in the area of mathematics, Peru was at level 1, well below the OECD average; being Uruguay and Chile the only countries with the best results, although below level 2 (Ministry of Education, 2022).

In this context, and taking into account that mathematics is present in each of the current scientific advances and technological innovations (Osuna *et al.* 2020), we sought to know and understand if the attitude shown by students towards the area is relevant for good or poor school performance in mathematics. The study of mathematics is essential due to its application in many labor fields; however, most students have difficulty developing mathematical skills and this is largely due to the anxiety generated by learning the area (Maldonado, 2021).

It is imperative to recognize that, when referring to attitudes, the field of subjectivity is being entered, where the personal part, interest, emotions, aptitudes are what will determine if students show a willingness to study mathematics, according to the utility they find in their daily life (Orjuela *et al.*, 2019).

Attitude, as a term, is understood as a constant evaluation towards an object and its symbols, which are essentially built through experience (Stelzer *et al.*, 2020). In turn, attitudes towards mathematics are conceived as a set of dispositions that the individual manifests to accept or not, become familiar or not, with certain contents (Ramos *et al.*, 2018). This, in turn, will differ according to the degree of specificity or generality attributed to it in determining the behavior, the type of object to which it corresponds (physical or social) and the

relative importance given to its components: affective, cognitive and reactive action (Rodríguez, 2017). In addition, if a more operational explanation is desired, the attitude towards mathematics can be considered as an underlying predisposition to react positively or negatively to the mathematical object (Rodríguez, 2017).

Attitudes present properties such as direction, which is the positive, negative or neutral estimate that the subject confers on the attitudinal object; there is also the intensity, which refers to the level of evaluation, whether favorable or unfavorable, of the object and, finally, the magnitude that is the union of direction and intensity (Ursini et al., 2019). Based on what has been stated, it is pointed out that when referring to attitudes, the fundamental thing to take into account will be emotions, feelings and what the person who knows about the subject of study believes, in this case mathematics (Zamora-Araya, 2020).

It is also important to determine that people's attitudes will influence their behavior in the face of any situation or object of study that is presented to them, in this case, mathematics. The attitude towards mathematics deals, above all, with the affective component; here reference is made to the assessment, appreciation and liking of mathematics. Mathematical attitudes are more related to the cognitive domain, since it has to do with the abilities that students develop to seek to solve mathematical problems (critical, reflective thinking, open-mindedness and flexibility to seek solutions). For this reason, the investigation of attitudes towards mathematics is very useful to analyze and evaluate if the teaching-learning process is effective and, in this way, decisions can be made that affect improving the way in which the area is approached and greatly improve the perception that students have regarding mathematics and its importance in their integral development (Pineda-Ramírez et al., 2021).

For a better knowledge of attitudes towards mathematics, it was necessary to analyze aspects or factors such as: anxiety, which is related to the fear that students have of mathematics; the liking, which is a factor that indicates the taste or satisfaction for mathematics. Another of the factors considered is utility, which refers to the importance that students give to mathematics, as well as the feeling that students have regarding the benefits that their learning will provide for their professional and work life. An important factor that was considered is motivation, which is the stimulus that the student feels for learning mathematics, as well as for its application in different fields of their daily life. Finally, confidence, which refers to the security that a student who has mathematical skills will feel (Auzmendi, 1992).

The objective of this study was to present and describe the results of the students' attitudes towards mathematics, as well as to know the significant differences in the factors of the scale of attitudes towards mathematics in high school students. The results obtained will be useful so that teachers can know how students perceive mathematics and, based on this, propose strategies that allow them to improve factors such as: motivation, liking and usefulness, where a low and medium level of perception of the students was evidenced.

## **MATERIALS AND METHODS**

The present investigation was framed in a quantitative approach of a descriptive type. It intended to present and describe the results of attitudes towards mathematics shown by 212 high school students from a public educational institution. Its administration was carried out online, using the Google form and also with the informed consent of the students who participated in it. The form was sent through a URL link to a

population of 760 students, obtaining a response from 212 of them, which constituted the sample. The results were processed with the statistical package SPSS Version 26.0.

Quantitative type research seeks to test the hypotheses raised, based on a problem raised, using statistics; These data, duly analyzed and processed, will make it possible to determine whether or not these possible solutions to the problem are valid (Hernández *et al.*, 2018).

The scope of the study was descriptive-transversal. This research sought to present and describe the data obtained in relation to the object of study, which in this case were the attitudes towards mathematics shown by regular basic education students.

For this research, the Auzmendi (1992) Attitude Scale towards Mathematics instrument was applied, which consists of five factors: motivation (items 5, 10 and 25), anxiety (items 2.3, 7.8, 12, 13, 17, 18 and 22), liking (items 4, 9, 14 and 24), confidence (items 11, 20 and 23) and usefulness (items 1, 6, 15, 16, 19 and 21). The 25 items are measured on a five-point Likert scale, ranging from one, indicating totally disagree, to five, indicating totally agree.

This scale has a high reliability, obtaining values of Cronbach's  $\alpha$  that oscillated between  $\alpha=0.9283$  for the total score, from  $\alpha=0.8166$  to  $\alpha=0.9115$  for the first three factors, and between  $\alpha=0.4975$  and  $\alpha=0.5604$  for factors four and five; It is worth mentioning that these two factors have three items, so the internal consistency is lower (Auzmendi, 1992).

## RESULTS

After the application of the questionnaire of attitudes towards mathematics to the students participating in the study, the data collected in the instrument were processed, obtaining the results shown below:

**Table 1-** Levels of attitudes towards mathematics

attitudes towards mathematics _					
		Frequency	Percentage	Percentage valid	Percentage accumulated
Valid	Low	13	6.1	6.1	6.1
	Half	188	88.7	88.7	94.8
	High	eleven	5.2	5.2	100.0
	Total	212	100.0	100.0	

Table 1 presented the levels of attitudes towards mathematics of secondary level students of a Public Educational Institution and it was obtained that 6.1% of the students reached a low level, 88.7% obtained a medium level and only 5.2% showed a high level. With this, it can be deduced that the medium level is the one that shows predominance.

**Table 2-** Anxiety factor levels

Anxiety					
		Frequency	Percentage	Percentage valid	Percentage accumulated
Valid	Low	22	10.4	10.4	10.4
	Half	178	84.0	84.0	94.3
	High	12	5.7	5.7	100.0
	Total	212	100.0	100.0	

Table 2 shows the levels of the anxiety factor of the secondary level students of a Public Educational Institution and it was obtained that 10.4% of the students reached a low level, 84.0% a medium level and only 5.7%

showed a high level. In this way, it can be deduced that the medium level is the one that shows predominance.

level, 61.3% obtained a medium level and 32.1% showed a high level. In this way, it can be seen that the medium level is the one that shows predominance.

**Table 3-** Pleasing factor levels

Liking					
		Frequency	Percentage	Percentage valid	Percentage accumulated
Valid	Low	3.4	16.0	16.0	16.0
	Half	101	47.6	47.6	63.7
	High	77	36.3	36.3	100.0
	Total	212	100.0	100.0	

Table 3 shows the levels of the liking factor of the secondary level students of a Public Educational Institution and it was obtained that 16.0% of the students reached a low level, 47.6% obtained a medium level and 36.3% showed a high level. With this, it is observed that the medium level is the one that has predominance.

**Table 5-** Motivation factor levels

Motivation					
		Frequency	Percentage	valid percentage	Percentage accumulated
Valid	Low	101	47.6	47.6	47.6
	Half	92	43.4	43.4	91.0
	High	19	9.0	9.0	100.0
	Total	212	100.0	100.0	

Table 5 revealed the levels of the motivation factor of the secondary level students of a Public Educational Institution and it was obtained that 47.6% of the students reached a low level, 43.4% obtained a medium level and only 9.0% showed a high level. With these results, it is evident that the low level is the one that predominates.

**Table 4-** Levels of the utility factor

Utility					
		Frequency	Percentage	valid percentage	Percentage accumulated
Valid	Low	14	6.6	6.6	6.6
	Half	130	61.3	61.3	67.9
	High	68	32.1	32.1	100.0
	Total	212	100.0	100.0	

Table 4 shows the levels of the utility factor of the secondary level students of a Public Educational Institution and it was obtained that 6.6% of the students reached a low

**Table 6-** Confidence factor levels

Trust					
		Frequency	Percentage	valid percentage	Percentage accumulated
Valid	Low	9	4.2	4.2	4.2
	Half	49	23.1	23.1	27.4
	High	154	72.6	72.6	100.0
	Total	212	100.0	100.0	

Table 6 shows the levels of the confidence factor of the secondary level students of a Public Educational Institution and it was obtained that 4.2% of the students reached a low level, 23.1% obtained a medium level

and 72.6% showed a high level. With this, it is shown that the high level predominates.

## DISCUSSION

Regarding the objective of the article, it was determined that 88.7% obtained a medium level of perception regarding attitudes towards mathematics; on the other hand, 6.1% of the students reached a low level of perception and only 5.2% showed a high level of perception. These results are similar to the research carried out by Segarra *et al.* (2021), where 86% of students showed positive results and 14% perceive a negative attitude towards mathematics. These studies show a level of positive perception towards mathematics.

These results were contrary to the research carried out by López *et al.* (2022), where 88.1% showed an indifferent attitude towards learning mathematics.

In relation to each of the factors, it was determined that, with respect to the anxiety factor, 10.4% of the students reached a low level, 84.0% obtained a medium level and only 5.7% showed a high level. These results are similar to those obtained in the investigation by Pedrosa-Jesús *et al.* (2020), where the mean of 52,446 indicates an attitude close to neutral. Regarding the pleasant factor, it was obtained that 16.0% of the students reached a low level, 47.6% obtained a medium level and 36.3% showed a high level. These results are similar to what was achieved in the study by Segarra *et al.* (2021), where 54% of students have a positive liking for mathematics.

Regarding the utility factor, it was established that 6.6% of the students reached a low level, 61.3% obtained a medium level and 32.1% showed a high level. These results are related to what was obtained in the study by Pineda-Ramírez *et al.* (2021), where the obtained average of 14.87 is far from the theoretical average, which is 12, showing that more than half of

the students perceive mathematics as useful. Similarly, they are also related to the results of the study by Segarra *et al.* (2021), whose mean score is 3.01, which is lower than the arithmetic mean of the scale, which is 3.07, so it can be said that the students responded positively regarding the utility they give to mathematics.

The results obtained in relation to the trust factor showed that 4.2% of the students reached a low level, 23.1% obtained a medium level and 72.6% showed a high level. These are similar to those of the study by Pedrosa-Jesús *et al.* (2020), in which the mean of 71.11 indicates the positive sense in the trust factor. Similarly, the study by Segarra *et al.* (2021) shows that 79% of the students answered the questions of this factor in a positive sense. Therefore, it is stated that the perception towards this factor is positive.

On the other hand, the results regarding the motivation factor indicated that 47.6% of the students reached a low level, 43.4% obtained a medium level and only 9.0% showed a high level; being the low level the most prevalent. These results differ from those obtained by Segarra *et al.* (2021), where it was observed that 79% of the students responded positively to the questions of said factor. This difference is also observed in the results of the study by Pedrosa-Jesús *et al.* (2020), who with an average of 63,702 showed that students presented a more positive attitude towards motivation.

According to the study, it has been possible to present and describe, based on the results, the attitudes of secondary school students, appreciating that there are factors such as: anxiety, liking, usefulness and confidence where the attitudes of students are more positive, since they tend to be located at a medium and high level. However, the results obtained show a low level of perception regarding the motivation factor.

In future research, attitudes towards mathematics, the development of mathematical skills and the importance of applying methods and techniques that allow motivating students in this important area should be related.

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The author declares that she has no conflicts of interest.

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The author participated in the design, analysis of the documents and writing of the work.

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