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

https://doi.org/10.23913/ride.v13i25.1295

Artículos científicos

Estrés y ansiedad semiótica por las matemáticas: medición en estudiantes

Semiotic Stress and Semiotic Anxiety About Mathematics: Measurement in Students

Estresse semiótico e ansiedade devido à matemática: mensuração em estudantes

Alicia Solís Campos
Universidad Juárez del Estado de Durango, México
alicia.solis@ujed.mx
https://orcid.org/0000-0002-6573-4633

Alicia López Betancourt
Universidad Juárez del Estado de Durango, México
abetalopez@gmail.com
https://orcid.org/0000-0002-3447-2503

Concepción del Socorro Medrano Madriles
Secretaría de Educación del Estado de Durango, Centro de Investigación e Innovación para el Desarrollo Educativo, México
concepcion.medrano@durango.gob.mx
https://orcid.org/0000-0001-7580-8707

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

Resumen

El estrés y la ansiedad por las matemáticas tienen signos y códigos que permiten ser estudiados a través de la semiótica; estos son una de las causas de la reprobación. El objetivo de este estudio fue diseñar y validar un instrumento que mida el estrés y la ansiedad semióticas por las matemáticas en estudiantes de secundaria. Se realizó un diseño no experimental, de tipo descriptivo, con análisis de convalidación lógica, validación de expertos, análisis de confiabilidad del alfa de Cronbach, dos mitades, una prueba exploratoria del análisis factorial y coeficiente de omega. Se realizaron dos aplicaciones en distintos momentos, una prueba piloto de 30 y una aplicación de 244 alumnos, con un muestreo determinado por grado escolar, turno matutino o vespertino de dos instituciones educativas. Se corroboró un instrumento válido y confiable para medir el estrés y la ansiedad semiótica en estudiantes de educación secundaria y en específico para matemáticas, con pruebas consistentes en sus resultados de las dos aplicaciones. El instrumento presentó validez y confiabilidad en su totalidad, y cuando se realizaron estudios factoriales exploratorios, fue posible precisar los componentes para los signos y síntomas físicos, psicológicos y conductuales. El instrumento se enfocó en dos momentos que generan estrés o ansiedad por las matemáticas: las clases y los exámenes. Debido a que no se encontró un instrumento que mida las dos variables: estrés y ansiedad por las matemáticas, se aportó un instrumento que contribuye de forma confiable y válida en su medición.

Palabras clave: ansiedad, estrés, estudiantes, matemáticas, semiótica.

Abstract

Stress and anxiety about mathematics have signs and codes that allow them to be studied through semiotics; these are one of the causes of failing math. The objective of this study was to design and validate an instrument that measures semiotic stress and anxiety caused by mathematics in middle school students. A non-experimental, descriptive design was conducted, with logical validation analysis and expert validation; a reliability analysis was made using Cronbach's Alpha, split-half methodology, a factor analysis exploratory test and omega coefficient. Two applications were performed at different times; a pilot test of 30 and an application of 244 students, with a sampling determined by school grade, by morning or evening shift, and from two educational institutions. A valid and reliable instrument to measure stress and semiotic anxiety in secondary school students, and specifically for

mathematics, is confirmed. Consistent results were obtained from both applications. The instrument presented validity and reliability in its entirety, and when exploratory factorial studies were carried out, it was possible to specify the components for physical, psychological and behavioral signs and symptoms. This is because signs and semiotic codes that generate stress and anxiety about mathematics are very similar to each other. The instrument focuses on two moments that generate stress or anxiety about mathematics: classes and exams. No instrument was found in the literature to measure the two variables, i.e. stress and anxiety about mathematics. An instrument that contributes in a reliable and valid way to its measurement is provided.

Keywords: anxiety, stress, students, mathematics, semiotics.

Resumo

Estresse e ansiedade em relação à matemática possuem signos e códigos que podem ser estudados por meio da semiótica; estas são uma das causas da reprovação. O objetivo deste estudo foi projetar e validar um instrumento que mede o estresse semiótico e a ansiedade relacionados à matemática em estudantes do ensino médio. Foi realizado um desenho não experimental, descritivo, com análise de validação lógica, validação por especialistas, análise de confiabilidade do alfa de Cronbach, duas metades, teste exploratório de análise fatorial e coeficiente ômega. Foram feitas duas aplicações em horários diferentes, uma prova piloto de 30 e uma aplicação de 244 alunos, com amostra determinada por série escolar, turno matutino ou vespertino de duas instituições de ensino. Foi confirmado um instrumento válido e confiável para medir estresse semiótico e ansiedade em alunos do ensino médio e especificamente para matemática, com testes consistentes nos resultados das duas aplicações. O instrumento apresentou validade e confiabilidade em sua totalidade, e quando foram realizados estudos fatoriais exploratórios, foi possível especificar os componentes para os sinais e sintomas físicos, psicológicos e comportamentais. O instrumento se concentrou em dois momentos que geram estresse ou ansiedade em relação à matemática: aulas e exames. Devido ao fato de não ter sido encontrado um instrumento que medisse as duas variáveis: estresse e ansiedade devido à matemática, foi fornecido um instrumento que contribui de forma confiável e válida na sua mensuração.

Palavras-chave: ansiedade, estresse, alunos, matemática, semiótica.

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

Fecha Recepción: Marzo 2022 **Fecha Aceptación:** Septiembre 2022

Introduction

The Ministry of Public Education [SEP] (2011, 2017) establishes in the 2011 and 2017 study plans for basic education the training field Mathematical Thinking, which is developed through the subject of Mathematics. In secondary education, the student must move, with the support of the teacher, "from intuitive reasoning to deductive reasoning" (SEP, 2011, p. 49). This in an average of five hours per week determined in the study program.

Secondary education in Mexico has variation in the hourly loads dedicated to mathematics, due to the fact that they are assigned according to the type of support: state or federal; modality: general, technical, telesecundaria; o Participation in programs: full time. Based on the variants, students receive a minimum of five 50-minute class modules per week and a maximum of six (SEP, 2011, 2017). Special mention is the Telesecundaria modality, in which the number of hours to be dedicated to the subject of Mathematics is left to the decision of the schools.

In international and national evaluations of education, mathematics is focused on as an instrumental subject, since it allows or hinders the learning of other contents; For this reason, since the creation of the National Institute for the Evaluation of Education (INEE) in 2013, various types of evaluation have been carried out, focusing on:

> Mastery of mathematical learning (...), as well as the ability to use and transform them into tools that allow students to understand, interpret, analyze and solve different problems in their environment and in other disciplinary fields, using different methods and procedures: arithmetic, algebraic, graphical, geometric, variational, statistical and probabilistic (INEE, 2018, p. 16)

The results of the evaluations developed by the INEE (2018) were issued in four levels of achievement: level I or insufficient, level II or sufficient, level III or satisfactory and level IV or outstanding. Thus, it was found that 3.1% of high school students were positioned at level IV and 7.5% at level III, which implied that 89.4% of the students evaluated were placed between levels I and II (INEE, November 12 of 2018). The evaluations reported by the teachers of the subjects were of totally different qualifications, since in secondary school the percentage of failure was very low.

Given these results, it is worth asking what are the reasons why students fail these evaluations? The answer to this question is multifactorial, although factors such as irresponsibility, motivation, teaching, learning or even psychological factors such as stress or anxiety are probably intermingled. These elements cause low academic performance in mathematics evaluations (Espinoza, cited in Corzo and Reyes, 2017; Luna, 2003).

However, when finding elements that indicate that mathematics generates stress or anxiety in students and that they are a cause of failure (Castañeda and Álvarez, 2004; Espinoza, cited in Corzo and Reyes, 2017; Pérez et al., 2009), began a search for instruments that measure stress in mathematics, but none of those found do so specifically for this subject, but instead measure what they call academic stress, and can be applied to both students and teachers. regardless of the subject taught (Berrio and Mazo, 2011).

Instruments that exclusively measure anxiety were also found (Spielberger, Gorsuch, & Lushene, 2015); others specific to children (Reynolds and Richmond, 1997); others in adolescents and adults (English, Méndez, Hidalgo, Rosa and Orgilés, 2002), and others that measure anxiety about mathematics (Pérez *et al*., 2009)

Stress and anxiety can be confused by the symptoms or signs that occur in both students and teachers, since the difference between the two is given in terms of function (American Psychiatric Association [APA], 2014; Amigo, 2000; Pérez et al., 2009), which led to the following research question: is there a valid and reliable instrument that measures math stress and anxiety at the same time? The search showed that there is no instrument to identify if the student has stress due to mathematics or if the symptoms he refers to are due to anxiety.

The semiotic signs that arise derived from both stress and anxiety are physical and intellectual manifestations that range from sweaty hands to confused thinking and you can even experience blurred vision; These signs make it difficult for students to solve problems with basic operations, such as adding, subtracting, multiplying or dividing, since stress or anxiety become a barrier to learning. And if it is considered that semiotic learning is given by that which is "achieved by means, with help, with support and fundamentally focused on signs" (Solís, 2013, p. 149), then it is important to identify the signs of stress and the anxiety that this barrier could generate in learning mathematics. For all of the above, the objective of the research was: to design and validate an instrument that measures anxiety and semiotic stress due to mathematics in secondary school students.

This article contains the following sections: a) review of the literature, where important concepts related to stress, anxiety and the semiotic signs of each of these are addressed, since the design of the instrument was based on these; b) methodology, where the process that was carried out for the design of the instrument is reported; c) results, where the various analyzes to which the instrument was submitted are presented; d) discussion, and e) conclusions reached in this instrumental research.

Literature review

Because they are necessary topics in the construction of the instrument, a section is made exclusively for stress, another for anxiety and another to identify the semiotic signs that generate stress and anxiety due to mathematics.

Stress

Stress is a well-studied topic, since there are more than 15,000 reports on the Internet, among which they address the concept of work and academic stress, from the perspective of teachers, students, workers, managers, its effects, factors, among others.

The physiologist Walter Cannon in 1911 introduced this term in health, but it was Hans Seyle, after 1926, who made it popular to "mean the psychophysiological changes that occur in the body in response to an unpleasant situation" (Amigo, 2000, p. 13), which implies that being in stressful situations increases the risk that the body contracts or accelerates the pathological process of some diseases such as acne, drug addiction, alcoholism, insomnia, migraines, nightmares, obsessions, tremors, among others (Amigo, 2000, p. 16).

Stress is defined as "a state of physical or mental tension resulting from factors that tend to alter the balance of the organism" (Hinkle, 1974, cited in Gutiérrez and Ángeles, 2012, p. 31). It is a:

> Comprehensive response of the organism that entails a physiological and cognitive (or cognitive and physiological) activation prior to a sudden motor and behavioral activity, resulting from an evaluation and weighting (a fortiori subjective) of the potential control and the willingness to have its own resources and support to face stressors (physical, social or symbolic demands perceived as challenges or threats), in order to maintain current or future balance (Gutiérrez y Ángeles, 2012, p. 32).

Stress is considered a physiological, physical or psychological reaction to external stimuli related to events of daily life (Mason, cited in Barraza, 2007a). Lazarus and Folkman (cited in Barraza, 2007a) conceive it as a relationship between the environment and the person. This is how stress arises from an external stimulus, which is considered a stressor, and the reactions to that stimulus, present in all areas of daily or school life, such as classes and exams, which affect detrimental to both the physical health and the school performance of students (Berrio and Mazo, 2011).

Among the theories found on stress, it was possible to identify various positions. For this study, the following were considered: a) physiological theories, where stress is postulated as an independent variable of external forces that cause physical reactions; b) psychological theories, which group those that emphasize cognitive factors that mediate between stressful agents and their physiological responses, and c) psychosocial theories, which bring together those approaches that incorporate environmental, psychological and social aspects considered as determinants for the health and diseases of stress.

Hans Seyle's theory describes the body's response to what he calls a three-stage general adaptation syndrome. In the first phase, an alarm reaction is produced, which manifests itself with an initial mobilization of psychophysiological and behavioral factors (such as energy mobilization, increased heart rate, respiratory rate, and blood pressure, paralysis of digestion, as well as decreased sex drive and inhibition of immune system activity) that help you deal with what you see as a threat; the second phase is resistance, it occurs when the pressure continues and the body adapts to this event; Finally, the exhaustion phase arrives, it appears when the previous phase cannot be maintained indefinitely and at that moment various psychosomatic, cardiovascular or gastrointestinal alterations occur, among others (Amigo, 2000; Gutiérrez and Ángeles, 2012).

For its part, the classification of external sources or stressors from a psychosocial perspective includes:

- Psychosocial factors. All those that affect or compromise emotional cognitive balance, or economic and social affective security, in which case it stops at a certain time such as birth, death, marriage, breakups, dismissals.
- Environmental factors. Everything that threatens the internal functioning of any organism, such as cold, noise, heat, vibration.

- Biological factors. Everything derived from eating disorders, ingestion of toxins, drugs, tiredness, hunger (Gutiérrez y Ángeles, 2012, pp. 50-51).

Anxiety

Anxiety, the second variable of this work, is highly studied. The search that yielded 400,000 results, a wide variety of investigations that have to do with children, adolescents, adults or simply historical or conceptual investigations, which, for the most part, have been developed with "two fundamental problems: conceptual ambiguity of the anxiety construct and the methodological difficulties to address it" (Sierra, Ortega and Zubeidat, 2003, p. 12).

The Royal Spanish Academy [RAE] (2017) defines it as a "state of agitation, restlessness or anxiety of mind, (...) usually accompanies many diseases, in particular certain neuroses and that does not allow patients to calm down" (para. . 1). It is also understood as "a personality trait in some individuals" (Reynolds and Richmond, 1997, p. 4).

It is considered as "an emotional state closely linked to fear in anticipation of a danger or threat" (García, 1997, p. 113). It is necessary to comment that despite this closeness that anxiety has with fear, they differ because while fear is related to a disturbance that manifests itself with present stimuli, anxiety is related to the "anticipation of future dangers, indefinable and unpredictable (Marks, 1986, cited in Sierra et al., 2003, p. 15), which is why it has also been confused with anguish; While in anguish there is a predominance of physical symptoms and in anxiety, psychological symptoms, it is currently more difficult to find their differences, since the concept of anxiety includes both mental or cognitive symptoms as well as behavioral and physical ones (Sierra *et al*., 2003).

Although fear is considered an adaptive response to any threat, anxiety can be harmful for the person to have an effective functioning, since it can make inappropriate decisions, since it interferes with rational, logical thought processes, in this way it is it becomes a clinical problem and then requires professional therapy for resolution (Reynolds & Richmond, 1997).

Suárez (1995, cited in Sierra et al., 2003) states that anguish is considered synonymous with anxiety, since both refer to "unpleasant psychological states frequently accompanied by physiological symptoms, described as painful expectation or restlessness in the face of danger imprecise" (Sierra et al., 2003, p. 13).

Anxiety can be conceptualized as a state or as a trait (Spielberger et al. (2015). State-anxiety is a “transient emotional condition of the human organism, characterized by subjective, consciously perceived feelings of tension and apprehension, as well as due to hyperactivity of the autonomic nervous system” (p. 10).

In a definition closer to mathematics, it can be said that it is "an affective factor present in students, especially in evaluative situations or when facing subjects that are especially difficult for them, such as mathematics" (Pérez et al., 2009 , page 24). And Wood (1988) determines mathematical anxiety "as a way of talking about the general lack of comfort that someone might experience when required to perform mathematically, and the ramifications of such a disposition in an elementary teacher" (p. 11), that is, the lack of comfort that someone could experience when required to perform in mathematics, especially, it is worth adding, when required by basic education teachers.

Stress and semiotic anxiety for mathematics

When searching the academic network, among the studies on semiotic stress or anxiety due to mathematics, despite the nearly 14,000 reported publications, no instrument was found that allows measuring both variables, only the emotions that this variable is mentioned. subject causes them (Gómez and Borrachero, 2013). However, some symptoms have been identified that can be considered as semiotic signs of stress, these are classified into five types of symptoms: behavioral, emotional, psychophysiological, cognitive and social.

Behavioral symptoms include task avoidance, difficulty sleeping, finishing work, tremors, tense face, clenched fists, watery eyes. Emotional symptoms include feelings of constant worry, inability to relax, irritability. The psychophysiological symptoms include tense muscles, teeth grinding, sweating, dizziness, constipation, a racing heart, among others (APA, 2014; Berrío and Mazo, 2011; Maturana and Vargas, 2015). In cognitive symptoms, having catastrophic thoughts, difficulty concentrating or remembering events. In social symptoms, while some look for people, others avoid them, and the quality of their interpersonal relationships changes when they are in this condition (Berrío and Mazo, 2011; Gómez and Borrachero, 2013; Gutiérrez and Ángeles, 2012).

In addition to the above, other consequences exposed by Gutiérrez and Ángeles (2012) are considered, classified into three levels of expression in relation to stress:

- On a physical level. It includes sweaty hands, palpitations, dry mouth, indigestion, heartburn, ulcers, cramps, stuttering, tension, premenstrual problems in women or impotence in men.
- On a psychological level. Feeling of resentment, rejection, anxiety, tension, anger, lack of concentration, apathy, depression to low self-esteem, difficulty sleeping, feelings of isolation, incompetence, memory problems.
- At the behavioral level. Conflictive behaviors, proclivity towards the consumption of alcohol, tobacco, drugs, dietary changes (lack or excess of hunger), reduction of physical and social activities, among others (p. 10)

Anxiety in children "can be expressed by crying, tantrums, freezing, or clinging" (APA, 2014, p. 131). For his part, Krause (1961, cited in Reynolds and Richmond, 1997) mentions that anxiety can be inferred considering the following: "a) self-reports, b) physiological signs, c) behavior (such as body posture, speech, restlessness), d) task performance, e) clinical intuition and f) response to stress" (p. 4).

Given the above, semiotic anxiety for mathematics presents with signs such as terror, tension, nerves, nervousness, worry, restlessness, irritability, impatience, confusion, fear, mental block, mental disorganization, series of feelings of anxiety, symptoms physical, panic, helplessness and paralysis (Pérez et al., 2009). Therefore, when analyzing instruments that measure anxiety or stress, it was concluded that both have the same semiotic signs.

The difference between stress and anxiety is determined functionally, that is, from the context and condition in which they occur, because the symptoms between the two are very similar, thus stress is referred to as "the set of changes that occur observed in the organism in the face of a real over-demand of the environment, while anxiety (...) refers to the psychophysiological disorder that is experienced in anticipation of a threatening situation, whether it is more or less likely" (Amigo, 2000, p. 18).

Methodology

An instrumental study was carried out that consisted of the design and adaptation of the research tests or instruments, as well as the analysis of their properties (Ato, López and Benavente, 2013; Montero and León, 2002).

It was developed in five phases: design, validation and reliability, application and sample selection.

Design

The first phase consisted of identifying the semiotic signs that authors such as Amigo (2000), APA (2014), Barraza (2017c), Gómez and Borrachero (2013), Pérez et al. (2009), Reynolds and Richmond (1997), among others who designed instruments to measure stress or anxiety, considered for their studies, and the coincidences between them; Later, those that were related to mathematics or to different subjects were searched for, a total of 44 semiotic signs; finally, three types of ways in which these signs are presented were determined: physical, psychological and behavioral (see table 1).

Table 1. Classification of semiotic signs for both stress and anxiety in its first version

Físico	Psicológico	Conductual
1) Agruras	*1)* Apatía	*1)* Falta de apetito
2) Boca seca	*2)* Baja autoestima	*2)* Exceso de hambre
3) Calambres	*3)* Depresión	*3)* Agresividad
4) Corazón acelerado	*4)* Dificultad para concentrarse	*4)* Comportamientos conflictivos
5) Estreñimiento	*5)* Dificultad para dormir	*5)* Consumo de alcohol
6) Indigestión	*6)* Incapacidad para relajarse	*6)* Consumo de drogas
7) Mareo	*7)* Incompetencia para hacer tareas	*7)* Consumo de tabaco
8) Músculos tensos	*8)* Irritabilidad	*8)* Evitar relacionarse con otros
9) Problemas premenstruales	*9)* Miedo	*9)* Evitar hacer tareas
10) Rechinar los dientes	*10)* Pensamientos de que algo malo va a pasar	*10)* Puños apretados
11) Sudoración de manos	*11)* Preocupación constante	*11)* Reducción de actividades físicas
12) Tartamudeos	*12)* Problemas de memoria	*12)* Reducción de actividades sociales
13) Dolor de estómago		*13)* Relaciones interpersonales.

14) Ganas de llorar	*13)* Sentimiento de rechazo de los compañeros *14)* Sentimiento de rechazo del maestro *15)* Sensación de estar enojado	*14)* Temblores *15)* Cara tensa

Source: self made

When reviewing the existing theory, two phases were identified where stress or anxiety about mathematics occurred in students: during class and in exams (APA, 2014; Barraza, 2007b, Barraza 2007c, Castañeda and Álvarez, 2004; Luna , 2003; Maturana and Vargas, 2015, Pérez et al., 2009). For this reason, and considering the difference between stress and anxiety that was proposed in the literature review, two specific moments for anxiety and two moments for stress were designed for each stage in the process, which are the following:

- For the phase "During the class", the moments were specified:
  - Stress
    - When the math teacher passes me to the blackboard (P1ClaseE[1])
    - When the math teacher asks questions (P2ClaseE)
  - Anxiety
    - To imagine that it happens to me on the blackboard (P1ClaseA)
    - To imagine that you ask me (P2ClaseA)
- For the phase "The exams" the moments were specified:
  - Stress
    - During the math exam (P1ExamE)
    - When I get my math test scores (P2ExamE)
  - Anxiety
    - To imagine the math exam (P1ExamA)
    - To imagine the grade I will get in mathematics (P2ExamA).

[1] Cada momento está en el instrumento y por cuestión de espacio se denota en el artículo (PiFaseMomento) referente a la pregunta i, de la Fase Exam o Clase, del momento Estrés o Ansiedad

Subsequently, a first version of the instrument was elaborated with the integration of the semiotic signs for each one, as a table (see table 2), which initially contained 352 items, 44 for each moment, in addition it was requested that the students could write how much they felt the sign or symptom for each of the questions.

Table 2. Instrument design, first version

Signos o síntomas	Clase de matemáticas				Exámenes de matemáticas			
	Momentos de estrés		Momentos de ansiedad		Momentos de estrés		Momentos de ansiedad	
	P1ClaseE	P2ClaseE	P1ClaseA	P2ClaseA	P1ExamE	P2ExamE	P1ExamA	P2ExamA
Agruras								
Boca seca								

Source: self made

Validation and reliability

The first construct validation that was carried out on the instrument was that of logical validation, which is about "common sense" (Schmelkes, 2005, p. 143). For this first attempt, the instrument was used with 10 students of the third semester of the Applied Mathematics degree so that they could share their opinion regarding the questions with the symptoms, if each and every one of the stress and anxiety questions can be linked with their semiotic signs or symptoms. These students were chosen because a) they are mathematics students, b) during their career in most subjects they are exclusively mathematics and c) we were interested in their initial perception as students and first approach to the instrument, so that it was possible to eliminate the bias that the design team itself might present. High school students (children of our friends) were also asked to read it and ask us questions that were not clear on the instrument; identified that symptoms such as the reduction of physical or social activities could not be considered during the exam or during the class in the stress phase, but they could be combined in anxiety, since the reduction of these activities and the fact that the students imagined the results could be given during the class or outside of it, so adjustments were made to that instrument.

Another of the construct validations that was carried out was that of consulting experts, based on the recommendation of Barraza (2007b), namely, requesting a minimum of five and a maximum of 10 professionals from the disciplinary field and preferably with studies graduate students who were doing research for their support to validate each of the questions related to the semiotic signs or symptoms that were presented in the instrument.

For the instrument, the College of Psychologists of the state of Durango was asked to suggest members of the community who are conducting research on stress and anxiety and who wish to participate in the research during the construct analysis. In addition, authors of recognized prestige who were not from the state were also sought to avoid bias in the research and who wished to support the validation. In this way, the instruments were shared with nine experts: five Mexicans, members of the aforementioned association and four foreigners: two Spaniards and two Colombians, all considered experts for working on anxiety and stress issues.

In accordance with the methodology of Barraza (2007b), the experts validated the items with a score of zero to three, considering zero as those that do not belong to the study dimension and three as those that do belong. The scores of each one were pooled and an average per item was obtained. Those who obtained a score greater than 2.6 (strong validity) and from 2.1 to 2.5 (acceptable validity) remained on the instrument, but those who obtained a score lower than 2.1 were eliminated (see Table 3). In total, 303 items remained, distributed in 34 for P1ClaseE, 35 for P2ClaseE, 38 for P1ClaseA, P2ClaseA and P1ExamE, 39 for P2ExamE, 40 for P1ExamA and 41 for P2ExamA.

Table 3. List of results of construct validation by experts

Fases	Momentos	Cantidad de ítems por momento Etapa1	Ítems eliminados (cantidad)
Clase de matemáticas	P1ClaseE	44	Estreñimiento, Problemas premenstruales, Apatía, Baja autoestima, Depresión, Sentimiento de rechazo de los compañeros, Consumo de alcohol, Consumo de drogas, Consumo de tabaco, Evitar relacionarse con otros (10)
	P2ClaseE	44	Estreñimiento, Problemas premenstruales, Apatía, Baja autoestima, Depresión, Sentimiento de rechazo de los compañeros, Consumo de alcohol, Consumo de drogas, Consumo de tabaco (9)
	P1ClaseA	44	Problemas premenstruales, Apatía, Baja autoestima, Depresión, Sentimiento de rechazo de los compañeros, Consumo de drogas (6).
	P2ClaseA	44	Problemas premenstruales, Apatía, Baja autoestima, Depresión, Sentimiento de rechazo de los compañeros, Consumo de drogas (6).
Exámenes de matemáticas	P1ExamE	44	Problemas premenstruales, Baja autoestima, Depresión, Sentimiento de rechazo de los compañeros, Consumo de alcohol, Consumo de drogas, Consumo de tabaco (6).

	P2ExamE	44	Problemas premenstruales, Baja autoestima, Depresión, Consumo de alcohol, Consumo de drogas (5).
	P1ExamA	44	Problemas premenstruales, Apatía, Baja autoestima, Sentimiento de rechazo de los compañeros (4).
	P2ExamA	44	Problemas premenstruales, Apatía, Baja autoestima (3).

Source: self made

Once the first version of the instrument was obtained, the pilot test was applied to 30 high school students, for which an educational institution was asked to help us with students from the different school grades, preferably, it was suggested, they were 10 of the first year, 10 of the second year and 10 of the third year, with the intention of avoiding a bias by school grade and that with the results a statistical reliability could be obtained. The institution expressly requested to integrate the students in a room to make the application, so these students were asked for support to identify if they understood the instructions, as well as some questions to answer it. In this application, problems were observed in the writing of the instructions and some concepts that showed conflict according to the questions. It should be noted that the time spent answering the instrument was 30 minutes on average.

As a result of this application, an adjustment was made to the instructions. Along these lines, an example of how to fill out the instrument was added so that it could be self-administered. Likewise, because it was found in this pilot test that four signs or symptoms presented conflict to understand each other, some adjustments were made, the one for "Interpersonal relations" was left as "Reduction in interpersonal relations", the one for "Inability to relax" was as “Unable to relax”, “Incompetence to do homework” was as “Unable to do homework” and “Lack of appetite” was as “Not hungry”.

The students mentioned that three signs or symptoms were understood as repeated, so it was decided to eliminate them, namely: "Irritability", as it was confused with "Feeling of being angry", "Aggressiveness", as it was confused with "Conflict behaviors" and “Memory problems”, since it was confused with “Difficulty concentrating”.

Among the findings of the first application in the pilot test, problems were recognized in the appearance of some signs or symptoms during classes such as: Constipation, Indigestion, Difficulty sleeping, Incompetence to do homework, Lack of appetite, Excessive

hunger, Consumption of tobacco, Alcohol use, Drug use, Avoid interacting with others, Avoid doing homework, Reduce physical activities and Reduce social activities, which were also removed to perform the Cronbach's alpha analysis with SPSS version 20 software, which which resulted in a value of 0.986 for the entire instrument. When analyzing it by parts, the following results were obtained:

- Math class $\alpha = 0.979$.
- Exams $\alpha = 0.979$.
- Stress $\alpha = 0.981$.
- Anxiety $\alpha = 0.976$.
- Symptoms or physical signs $\alpha = 0.957$.
- Psychological symptoms or signs $\alpha = 0.971$.
- Behavioral symptoms or signs $\alpha = 0.978$.

Therefore, it was considered a valid and reliable instrument to be applied.

Application, sample selection and information processing

The selection of the sample led to the application in a high school that met the following criteria: a) that allowed us to apply the instrument and b) that had students in two shifts: morning and evening; The institution was requested ex officio to allow us to apply the instrument to do more reliability tests on it, regarding the stress and anxiety that its students presented for mathematics through semiotic signs or symptoms, they were given a spreadsheet informed consent so that parents and students could sign it, where it was specified that the confidentiality of the students would be maintained, since at no time would they be asked for their name on the instrument. It was requested that they be applied to at least 300 students distributed as follows: 150 from the morning shift and 150 from the evening shift, considering 50 students per school grade.

The school determined the hours in which it could be attended, as well as the groups in which it could be applied, so the classrooms were entered with the permission of the teacher on duty. Each group was explained about the confidentiality of the instrument, in addition to the importance of their answers, and it was mentioned that those who did not wish to answer it were exempt from doing so, they only had to say so and the instrument was not given to them; As for those who agreed to answer it, they were asked to read the instructions, in addition to the fact that it was important to answer all the questions, they were also told

that if they did not understand any, they should ask before answering. Finally, for information processing, SPSS version 22 software, R Studio and its MBESS library were used to estimate the confidence intervals of the omega coefficient.

Results

Of the students and time to finish the instrument

For the study, 244 instruments were initially applied based on the authorization of the selected institution, of which 36 had to be eliminated, because most of the questions were not answered and the information provided was inconsistent. It was applied to 95 women and 113 men, of which 105 students were from the morning shift and 103 from the evening shift, 54 were in first grade, 79 in second and 75 in third, on average it took 18 minutes to answer it.

From correlational analysis

The information was processed using SPSS version 20 software to make correlations between the variables and identify those that were strongly correlated. Following Hernández, Fernández and Baptista (2007), those that had a low correlation, between -0.4 and +0.4, were eliminated. The instrument was as follows:

- For the “Mathematics classes” phase, 13 items were eliminated in Stress and five items in Anxiety.
- For the “Mathematics exams” phase, 15 items were eliminated in Stress and four items in Anxiety.

From the analysis of Cronbach's alpha, Guttman's two halves and omega coefficient

From the elimination of the variables, Cronbach's alpha was measured with results of 0.984, in the first half = 0.967 and second half = 0.975. In this application, two reliability tests were obtained: Cronbach's alpha and two Guttman halves, but by variable, moments and signs or symptoms with the results presented in Table 4.

Table 4. Instrument reliability tests (Cronbach's alpha and two halves)

Variable	Fases	Signos o síntomas
Ansiedad	Clase de matemáticas	Físicos
		α = 0.933
α = 0.974	α = 0.959	1.ª mitad = 0.895
1.ª mitad = 0.958	1.ª mitad = 0.930	2.ª mitad = 0.870
2.ª mitad = 0.949	2.ª mitad = 0.926	
		Psicológicos
		α = 0.952
	Exámenes	1.ª mitad = 0.923
	α = 0.945	2.ª mitad = 0.905
	1.ª mitad = 0.927	
	2.ª mitad = 0.883	Conductuales
		α = 0.937
		1.ª mitad = 0.904
		2.ª mitad = 0.907
Estrés	Clase de matemáticas	Físicos
		α = 0.919
α = .966	α = 0.935	1.ª mitad = 0.866
1.ª mitad = 0.946	1.ª mitad = 0.872	2.ª mitad = 0.868
2.ª mitad = 0.935	2.ª mitad = 0.875	
		Psicológicos
		α = 0.938
		1.ª mitad = 0.874
	Exámenes	2.ª mitad = 0.927
	α = 0.935	
	1.ª mitad = 0.883	Conductuales
	2.ª mitad = 0.902	α = 0.909
		1.ª mitad = 0.855
		2.ª mitad = 0.897

Source: self made

Because Cronbach's alpha may be biased for ordinal scales, it was considered necessary to incorporate the omega (w) coefficient, since it is the most recommended (Ventura & Caycho, 2017) (see Table 5).

Table 5. Omega coefficient (w) and the corresponding intervals (CI) for physical, psychological and behavioral semiotic signs for semiotic stress and anxiety for mathematics

Signos semióticos	IC para estrés			IC para ansiedad		
	w	Inferior	Superior	w	Inferior	Superior
Físicos	0.841	0.836	0.862	0.574	0.561	0.593
Psicológicos	0.843	0.833	0.868	0.879	0.852	0.894
Conductuales	0.896	0.889	0.917	0.163	0.141	0.184

Source: self made

From the exploratory test of factor analysis

The construct validity analysis was also performed in the factorial analysis, since the original scale is ordinal, a goodness-of-fit test was applied, which was valid. The Kaiser-Meyer Olkin criteria were verified, obtaining a value of 0.885, and the Bartlett sphericity test, which was statistically significant, $\rho < 0.0001$. This analysis showed a structure with a rotated matrix with the Varimax method and convergence in seven iterations, of three factors that, following the Kaiser criteria, exceeded eigenvalues greater than one, which explained 40.2% of the total variance of the results. The factorial load of each item in the factors was satisfactory with a value greater than 0.40 in factor one, corresponding to the dimension of 11 physical symptoms and factor two of the 11 psychological symptoms and in the third factor, nine items of the symptoms Behavioral components had factorial load less than 0.40, however, they presented factorial load greater than 0.40 in other components (see table 6). It is worth mentioning that with these results Cronbach's alpha was 0.917.

Table 6. Matrix of rotated components in the signs and symptoms of stress and anxiety

Signos o síntomas	Componentes para estrés			Componentes para ansiedad		
	1	2	3	1	2	3
Agruras	0.401			0.407		
Boca seca	0.538			0.352		
Calambres	0.405			0.403		
Corazón acelerado	0.708			0.324		
Estreñimiento	0.403			0.304		
Mareo	0.469			0.416		
Músculos tensos	0.481			0.247		
Sudoración de manos	0.639			0.283		
Tartamudeo	0.551			0.111		
Dolor de estómago	0.552			0.111		
Ganas de llorar	0.468			0.122		
Depresión		0.663			0.676	
Dificultad para concentrarse		0.411			0.592	
Dificultad para dormir		0.757			0.348	
Sin poder relajarse		0.566			0.686	
Sin poder hacer tareas		0.494			0.591	
Miedo		0.423			0.642	
Pensamientos de que algo negativo va a pasar		0.526			0.617	
Preocupación constante		0.467			0.653	
Sentimiento de rechazo de los compañeros		0.635			0.654	
Sentimiento de rechazo del maestro		0.460			0.532	
Sensación de estar enojado		0.456			0.669	
No sentir hambre			0.348			0.128
Exceso de hambre			0.251			0.156
Comportamiento conflictivo		.442	0.349			0.035
Consumo de alcohol			0.690			0.676

Consumo de drogas			0.655			0.685
Consumo de tabaco			0.740			0.661
Evitar relacionarse con otros			0.531			0.324
Evitar hacer tareas		0.415	0.336			0.295
Puños apretados	0.491		0.005			0.062
Reducción de actividades físicas			0.206			0.077
Reducción de actividades sociales		0.624	0.208			0.140
Temblores	0.590		0.026			0.128
Cara tensa	0.606		0.094			0.156

Source: self made

Of the structure of the instrument

At the end of all the analyses, there is an instrument with 177 items, distributed in the questions of stress (76 items) and anxiety (101 items); for the time of the "Mathematics class" 96 items, distributed in 40 of stress and 56 of anxiety; for "Mathematics exams" 81 items, distributed in 36 stress and 45 anxiety (see table 7).

Table 7. Structure of the instrument for high school students

Preguntas	Signos o síntomas semióticos		
	Físicos	Psicológicos	Conductuales
P1ClaseE	Agruras Boca Seca Corazón acelerado Músculos tensos Sudoración de manos Tartamudeo Dolor de estómago Ganas de llorar	Sin poder relajarse Miedo Pensamientos de que algo malo va a pasar Preocupación constante Sentimiento de rechazo Sensación de estar enojado	No tener hambre Exceso de hambre Evitar hacer tareas Puños apretados Temblores Cara tensa
P2ClaseE	Agruras Boca Seca Corazón acelerado Músculos tensos Sudoración de manos Tartamudeo Dolor de estómago Ganas de llorar	Sin poder relajarse Miedo Pensamientos de que algo malo va a pasar Preocupación constante Sentimiento de rechazo Sensación de estar enojado	No tener hambre Exceso de hambre Evitar hacer tareas Puños apretados Temblores Cara tensa
P1ClaseA	Agruras Boca Seca Calambres Corazón acelerado Mareo Músculos tensos Sudoración de manos Tartamudeo Dolor de estómago Ganas de llorar	Dificultad para concentrarse Dificultad para dormir Sin poder relajarse Sin poder hacer tareas Miedo Pensamientos de que algo malo va a pasar Preocupación constante Sensación de estar enojado	No tener hambre Exceso de hambre Consumo de alcohol Consumo de tabaco Evitar relacionarse con otros Evitar hacer tareas Reducción de actividades físicas Reducción de actividades sociales

			Cara tensa
P2ClaseA	Agruras Boca Seca Calambres Corazón acelerado Estreñimiento Músculos tensos Sudoración de manos Tartamudeo Dolor de estómago Ganas de llorar	Dificultad para concentrarse Dificultad para dormir Sin poder relajarse Sin poder hacer tareas Miedo Pensamientos de que algo malo va a pasar Preocupación constante Sensación de estar enojado	No tener hambre Exceso de hambre Consumo de alcohol Consumo de tabaco Evitar relacionarse con otros Evitar hacer tareas Reducción de actividades físicas Reducción de actividades sociales Cara tensa
P1ExamE	Agruras Boca Seca Corazón acelerado Músculos tensos Sudoración de manos	Sin poder relajarse Miedo Pensamientos de que algo malo va a pasar Preocupación constante Sentimiento de rechazo del maestro Sensación de estar enojado	No tener hambre Exceso de hambre Evitar hacer tareas Puños apretados Temblores Cara tensa
P2ExamE	Agruras Boca Seca Corazón acelerado Músculos tensos Sudoración de manos Ganas de llorar	Sin poder relajarse Miedo Pensamientos de que algo malo va a pasar Preocupación constante Sentimiento de rechazo de los compañeros Sentimiento de rechazo del maestro Sensación de estar enojado	No tener hambre Exceso de hambre Evitar hacer tareas Puños apretados Temblores Cara tensa

P1ExamA	Agruras Boca Seca Calambres Corazón acelerado Estreñimiento Mareo	Depresión Dificultad para concentrarse Dificultad para dormir Sin poder relajarse Sin poder hacer tareas Miedo Pensamientos de que algo malo va a pasar Preocupación constante Sensación de estar enojado	Comportamientos conflictivos Consumo de alcohol Consumo de drogas Consumo de tabaco Evitar relacionarse con otros Evitar hacer tareas Reducción de actividades físicas Reducción de actividades sociales Cara tensa
P2ExamA	Agruras Boca Seca Ganas de llorar	Depresión Dificultad para concentrarse Dificultad para dormir Sin poder relajarse Sin poder hacer tareas Miedo Pensamientos de que algo malo va a pasar Preocupación constante Sentimiento de rechazo de los compañeros Sensación de estar enojado	Comportamientos conflictivos Consumo de alcohol Consumo de drogas Consumo de tabaco Evitar relacionarse con otros Evitar hacer tareas Reducción de actividades físicas Cara tensa

Source: self made

Discussion

The search for an instrument that allows measuring anxiety and stress by mathematics in one was very complex, since the review of the literature showed the existence of instruments that measure stress and others that measure anxiety, separately; some are even specific to students based on their school level: preschool, primary, high school, bachelor's degree or a specific degree; Others aimed at teachers and workers in general were identified to measure work stress; however, only anxiety instruments measured math anxiety.

Both the instruments to measure anxiety and to measure stress assimilate the same signs or manifestations: crying, nerves, sweaty hands, heartburn, stuttering, depression, among others that are interpreted for this context as semiotic signs of stress and anxiety. , since the same signs or symptoms were found in several of them. This condition became one of the first limitations, due to its impediment to clarify the difference between both variables (stress and anxiety), if they used the same signs or symptoms to assess them.

In the review for the construction of the items, it was found that their difference is determined from the context and the condition in which they are presented, so, when observing the items aimed at students, it was identified that they show anxiety or stress in different moments for math, in and out of class, and on exams.

Anxiety is associated with what the student imagines might happen and stress with something real that is happening at that moment. This situation provided the confidence to separate the stress with four key questions that triggered the construction of the instrument.

The validated instrument shows that the manifestations of stress and anxiety are associated with semiotic signs and that these in turn can be classified into physical (11), psychological (11) and behavioral (13) components with adequate consistency. Likewise, it is identified, based on the tests carried out, that its manifestation does not arise in a syncretic, global and indissoluble way in the process of mathematics classes; Contrary to this, a consolidation is found from the manifestation at different times of the class, before the exams and depending on the previous contact or not with the teacher.

As limitations of the study, it is found that the directors of the schools present resistance to the application due to the time involved, which was resolved with adjustments: from just over 30 minutes to a reduction in the application time by 18 minutes, which influenced to facilitate its application. Even so, the selection of the students was carried out

by the school director, instead of allowing the sample to be chosen randomly; however, this does not show a negative influence on the reliability and validity of the process.

In the factorial analysis applied at the end, in what corresponds to the semiotic signs of stress and anxiety, a high percentage showed values higher than 0.40, except for some semiotic signs in the behavioral category, such as clenched fists, reduction of physical activities, reduction of social activities and tremors, which allows us to recognize clarity in the conformation of a possible model.

In this case, applicators were not required, but in a massive application it is recommended that the concepts used for signs and symptoms be explained to them, and a third application with the adjustments derived from the presented factor analysis is recommended. As no other instrument was found that contains the two variables, there is no way to compare them with other studies.

Conclusions

The review of the literature allows us to conclude that there are areas of opportunity for the investigation of semiotic stress and anxiety in mathematics. Although there are neutral instruments that only investigate stress or anxiety separately, they are used to correlate them with the learning variable of mathematics in education; the present is one of the first involving the two variables.

The research gaps in the field of mathematics in secondary education allow us to affirm that we are in a position to present a consistent instrument that represents a contribution to the field of study based on the solid results of its tests.

A consistency in the results is identified between the first application in the pilot test and the application to a more extensive population, since the differences between their alphas are practically null, including the one carried out in the exploratory factorial analysis. The exposed analyzes allow to determine that the instrument is in accordance with the elements present in table 4 and 5 of the omega coefficient.

This instrument is considered valid and reliable since, in the exposed Cronbach's alpha test, levels higher than 0.9 were obtained, which is interpreted as excellent and indicates a consistency of 0.917 after the factorial analysis compared to the first analysis of 0.984, even after your first application of $\alpha = 0.986$.

It is identified that the difference between alpha is practically null, in addition to presenting consistency between the variables, signs or symptoms, and the moments that were designated for the instrument. On the other hand, the omega values are the most representative for the reliability of the proposed instrument, given the conditions of the type of response; here, 0.841 was obtained for the physical category, 0.843 for psychological and 0.896 for behavioral with their respective confidence intervals (0.836, 0.862), (0.833, 0.868) y (0.889, 0.917).

Future lines of research

Because this was an instrumental investigation, now the important thing would be to make applications at different moments, but the most important thing is that the first moment be from a teacher that the students do not know at the beginning of a school year, in the middle of the school year and at the end of the school year. end of this, to compare whether the answers among the students have to do with a teacher they do not know and they get to know him little by little, if this is generating stress or anxiety or if this changes over time.

The complete exploration of the manifestations of stress and anxiety, as well as the moments in which it is perceived, allows us to identify, through 177 items, the levels of stress and anxiety for mathematics in secondary school students. Therefore, it is possible that in future approaches, researchers can design studies that allow the manipulation of variables in quasi-experimental designs with a view to reducing semiotic signs from specific intervention processes that lead to better manifestations of academic achievement and lower levels of achievement. of perceived stress and anxiety.

It is suggested as a line of expansion the application in other educational levels and to make comparisons with those of secondary school, under the same conditions. Also, make the application after confinement due to coronavirus disease 2019 (covid-19) and compare it with the results before this pandemic.

References

American Psychiatric Association [APA]. (2014). *Guía de consulta de los criterios diagnósticos del DSM 5*. Madrid, España: Médica Panamericana.

Amigo, I. (2000). *El precio biológico de la civilización*. España: Celeste Ediciones.

Ato, M., López, J. y Benavente, A. (2013). Un sistema de clasificación de los diseños de investigación en psicología. *Anales de Psicología, 29*(3), 1038-1059. Recuperado de https://dx.doi.org/10.6018/analesps.29.3.178511.

Barraza, A. (2007a) El campo del estudio del estrés. Del programa de investigación estímulo-respuesta al programa de investigación persona-entorno. *Revista Internacional de Psicología.* *8*(2), 1-30. http://www.revistapsicologia.org/index.php/revista/article/view/48/45

Barraza, A. (2007b). La consulta a expertos como estrategia para la recolección de evidencias de validez basadas en el contenido. *Investigación Educativa Duranguense*, *2*(7) 5-14. Recuperado de http://www.upd.edu.mx/PDF/Revistas/InvestigacionEducativaDuranguense7.pdf.

Barraza, A. (2007c). El inventario SISCO del estrés académico. *Investigación Educativa Duranguense*, *2*(7), 89-93. Recuperado de http://www.upd.edu.mx/PDF/Revistas/InvestigacionEducativaDuranguense7.pdf.

Berrio, N. y Mazo, R. (2011). Estrés académico. *Revista de Psicología Universidad de Antioquía*, *3*(2), 65-82. Recuperado de https://revistas.udea.edu.co/index.php/psicologia/article/view/11369.

Castañeda, A. y Álvarez, M. de J. (2004). La reprobación en Matemáticas. Dos experiencias. *Tiempo de Educar*, *5*(9) 141-172. Recuperado de http://www.redalyc.org/articulo.oa?id=31100906.

Corzo, C. y Reyes, C. M. (2017). Principales causas de reprobación de alumnos de los grupos de quinto semestre grupo seis y ocho de la Escuela Preparatoria Número Tres. Capítulo I Antecedentes. *Con-ciencia. Boletín Científico de la Escuela Preparatoria No. 3.* *7*(4). Recuperado de https://www.uaeh.edu.mx/scige/boletin/prepa3/n7/p1.html.

García, M. A. (1997) Trastornos de ansiedad. En Ortíz-Tallo, A. M. (coord.), *Trastornos psicológicos* (pp. 113-140). España: Ediciones Aljibe.

Gómez, R., y Borrachero, A. B. (2013). Emociones del profesor de matemáticas en la relación con los alumnos y sus familias. *International Journal of Developmental and Educational Psychology: INFAD. Revista de Psicología*, *1*(2), 362-372. Recuperado de https://dialnet.unirioja.es/servlet/articulo?codigo=4452417.

Gutiérrez, R. E. y Ángeles, Y. I. (2012). *Estrés organizacional*. México: Editorial Trillas

Hernández, R., Fernández, C. y Baptista, P. (2007). *Metodología de la investigación* (4.ª ed.). México: McGraw-Hill.

Instituto Nacional para la Evaluación de la Educación [INEE]. (2018). *Plan Nacional para la Evaluación de los Aprendizajes (Planea).* México: Instituto Nacional para la Evaluación de la Educación. Recuperado de http://planea.sep.gob.mx/content/general/docs/2018/PlaneaDocumentoRector18.pdf .

Instituto Nacional para la Evaluación de la Educación [INEE]. (12 de noviembre de 2018). Banco de Indicadores Educativos. Recuperado de https://www.inee.edu.mx/evaluaciones/indicadores-educativos/.

Inglés, C. J., Méndez, F. X., Hidalgo, M. D., Rosa, A. I. y Orgilés M. (2002). Cuestionarios, inventarios y escalas de ansiedad social para adolescentes: una revisión crítica. *Revista de Psicopatología y Psicología Clínica*, *8*(1), 1-21

Luna, M. A. (2003). *Estudio diagnóstico: factores dependientes del alumno que influyen en la reprobación en el área de matemáticas en el primer semestre de la carrera de Químico Farmacéutico Biólogo de la Facultad de Ciencias Químicas de la UANL*. (Tesis de maestría). Universidad Autónoma de Nuevo León, San Nicolás de los Garza. Recuperado de http://eprints.uanl.mx/5381/1/1020149250.PDF.

Maturana, A., y Vargas, A. (2015). El estrés escolar. *Revista Médica Clínica Las Condes*, *26*(1), 34-41

Montero, I. y León, O. G. (2002). Clasificación y descripción de las metodologías de la investigación en psicología. *Revista Internacional de Psicología Clínica y de la Salud*, *2*(3), 503-508. Recuperado de http://www.aepc.es/ijchp/articulos_pdf/ijchp-53.pdf

Pérez, P., Castro, E., Segovia, I., Castro, E., Fernández, F. R. y Cano, F. (2009). El papel de la ansiedad matemática en el paso de la educación secundaria a la educación universitaria. *PNA: Revista de Investigación en Didáctica de la Matemática*, *4*(1), 23-35. Recuperado de https://idus.us.es/xmlui/handle/11441/42231.

Real Academia Española [RAE]. (2017). Ansiedad. Recuperado de http://dle.rae.es/?id=2l0oQtn.

Reynolds, C. R., y Richmond, B. O. (1997). *CMAS-R. Escala de Ansiedad Manifiesta en Niños Revisada*. México: Manual Moderno.

Schmelkes, C. (2005). *Manual para la presentación de anteproyectos e informes de investigación. Tesis.* México.

Secretaría de Educación Pública [SEP]. (2011). *Plan de estudios 2011. Educación Básica*. México: Secretaría de Educación Pública.

Secretaría de Educación Pública [SEP]. (2015). *Una escuela de tiempo completo centrada en mejorar la calidad de los aprendizajes de las niñas y los niños. Orientaciones pedagógicas para directivos y docentes*. México: Secretaría de Educación Pública.

Secretaría de Educación Pública [SEP]. (2017) *Aprendizajes clave para la educación integral. Plan y programas de estudio para la educación básica*. Ciudad de México, México: Secretaría de Educación Pública.

Sierra, J. C., Ortega, V. y Zubeidat, I. (2003) Ansiedad, angustia y estrés: tres conceptos a diferenciar. *Revista Mal-estar e Subjetividades*, *3*(1), 10-59. Recuperado de http://periodicos.unifor.br/rmes/article/view/1159/3435.

Solís, A. (2013). *El aprendizaje semiótico, los rasgos de la personalidad y las formas de expresión del estudiante de educación básica.* (Tesis de doctorado). Universidad Autónoma de Coahuila, Saltillo.

Spielberger, C. D., Gorsuch, R. L. y Lushene, R. E. (2015). *STAI. Cuestionario de Ansiedad Estado-Rasgo. Manual* (9.ª ed.). Madrid, España: Tea Ediciones

Ventura, J. L. y Caycho, T. (2017). El coeficiente omega: un método alternativo para la estimación de la fiabilidad. *Revista Latinoamericana de Ciencias Sociales, Niñez y Juventud*, *15*, 625-627.

Wood, E. F. (1988). Math Anxiety and Elementary Teachers: What does research tell us? *For the Learning of Mathematics*, 8(1). 8-13 www.jstor.org/stable/40248135

Rol de Contribución	Autor (es)
Conceptualización	Alicia Solís Campos
Metodología	Alicia Solís Campos, Alicia López Betancourt y Concepción del Socorro Medrano Madriles, todas igual
Software	Alicia López Betancourt principal, Alicia Solís Campos, apoya y Concepción del Socorro Medrano Madriles apoya
Validación	Alicia López Betancourt principal y Alicia Solís Campos apoya
Análisis Formal	Alicia López Betancourt principal y Alicia Solís Campos apoya
Investigación	Alicia Solís Campos, principal y Alicia López Betancourt, apoya
Recursos	Concepción del Socorro Medrano Madriles principal y Alicia Solís Campos, apoya
Curación de datos	Alicia López Betancourt principal y Alicia Solís Campos, apoya
Escritura - Preparación del borrador original	Alicia Solís Campos
Escritura - Revisión y edición	Alicia Solís Campos, Concepción del Socorro Medrano Madriles y Alicia López Betancourt, todas igual
Visualización	Alicia Solís Campos
Supervisión	Alicia Solís Campos
Administración de Proyectos	Alicia Solís Campos
Adquisición de fondos	Alicia Solís Campos, Concepción del Socorro Medrano Madriles y Alicia López Betancourt todas igual