How to Cite
Loor-Mera, M. F., & Yánez-Balarezo, F. A. (2022). Cognitive stimuli in the learning of mathematics in seventh grade children of basic secondary education. *International Journal of Physics & Mathematics*, *5*(1), 34-46.
https://doi.org/10.21744/ijpm.v5n1.1923

Cognitive Stimuli in the Learning of Mathematics in Seventh Grade Children of Basic Secondary Education

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Abstract---*The research was based on the analysis of cognitive stimuli for learning mathematics in seventh-grade students of basic secondary education of the Magaly Masson de Valle Carrera Educational Unit of the Chone canton, the results are presented through a Kendall matrix, allowing to quantify the levels of assertiveness of the variables found, the problem of mathematical learning that refers to low academic performance demands the identification of techniques and methods that allow students to be stimulated efficiently, to For this purpose, through documentary research, the stimuli applied to the mathematical field were classified and through the analysis, 48 were identified that are closely related to the subject. In this context, the objective was to determine the most efficient for mathematical performance, the research has an exploratory and documentary approach using the use of qualitative, quantitative, and analytical tools such as expert criteria, and the result was the identification of the 25 most incident stimuli, recreational activities, puzzle games and riddles turned out to be determining variables, sequential and transcription stimulation occupies second place, finally the application of new technologies and ICT together with the identified stimuli offer a wide range of tools for teachers inside and outside the classroom, concludes that efficiency is relative to the experience and mystique of work with which the teacher teaches his students, however, the application of the stimuli defined in this study contribute significantly to academic performance.*
Keywords---*cognitive stimulation, mathematical learning, mathematical methods, seventh-grade children*

Introduction

Throughout history, humanity has shown the ability to adapt to the conditions that the environment demanded, tolerance to cold, heat, water, and droughts, we learned to live in deserts and populate swamps, and we developed the ability to turn the night into the continuity of the day and all these thanks to the perseverance, ingenuity, and creativity of those who preceded us; however, the current results show us more advanced communities and human groups, more developed cities and even countries with better living conditions, this suggests that the passing of the years benefited those who had a greater capacity to adapt.

In this context, we identify that the development of cognitive abilities goes hand in hand with the human ability to adapt, the societies that are best prepared to develop capacities that result in well-being and development; this reality motivates several concerns: What did these societies do to be better prepared? de Guzman Ozamiz (2003) in his work on mathematics and society, analyzes the publication What happening in the mathematical sciences, shows how mathematics is related to all sciences and links social development with its application, on the other hand. , Proenza & Leyva (2008), suggest that mathematical thinking is enhanced through the knowledge, skills, and abilities that are used daily in solving everyday problems, this evidences that the learning process is continuous and in both

ISSN 2632-9417
Submitted: 27 May 2022 |Revised: 18 June 2022 | Accepted: 09 July 2022

directions, Mathematics drives the development of scientific knowledge and at the same time these develop mathematical knowledge.

However, despite the fact that it has been shown that the application of mathematics ensures better options for the development of science and therefore achieves the development of societies, there is resistance to the use and learning of this science, generally, he is afraid of it in school or university classroom practices; This situation leads us to ask ourselves: At what point do we begin to feel apathy and/or suspicion towards mathematics? According to the study carried out by Tamayo et al. (2019), on dyscalculia as a specific mathematics learning disorder, they identify that "in Primary Education, schoolchildren often have difficulty understanding and performing mathematical calculations (...) ", based on this analysis, we set our sights and attention to the school process to the methodologies and how this science is approached in the initial stage of schooling, it is inevitable to link the resistance to mathematical learning with the methodologies used in training processes in primary education.

According to Peñaherrera & Armas (2020), the main problem in the teaching-learning process of mathematics lies in the ways that the educational system uses pedagogical mediation, lacking methods, didactics and reflection, a situation that causes students memorizing formulas, trying to to understand them through graphic examples in the classroom, without reasoning and analysis that allow us to discover the principles and causes of the phenomena and mathematical logics; In this scenario, cognitive stimulation is essential in the school training process, considering the statement by Bacusoy Ramírez (2022) about recreational activities, which is everything related to play, recreation, leisure, entertainment or fun (Meanings), and development of cognitive skills that are the mental processes that allow us to receive, process and elaborate information (NeuronUP, 2021), in the field of logical-mathematical relationships for children from 4 to 5 years old, suggests the implementation of a set of techniques and tools in order to stimulate creativity and mathematical reasoning at an early age.

In the local environment, the learning of mathematical sciences is limited to the existing curricula, be they from the Ministry of Education or SENESCYT, both in public and private institutions; In this aspect, the difference lies in the fact that in public educational units, protocols established centrally by the governing body are followed, and in private educational units, the procedures and methods are more adapted to the type of existing demand, however, they do not it can be established which of the two types of education has better results, however, greater success is recognized in the practices of private educational units, referring to this situation Pereira (2008), in his publication on the fragmentation of the educational offer in Latin America, it refers to the academic conditions of public versus private education, identifies that the greatest student coverage is located in the public sector, however, the private sector applies more efficient methodologies, these methods favor stimulation and strategies methodological and didactic methods used to improve academic performance (Schwinger & Wild, 2012; Chen, 2003; Tonazzini et al., 2019).

To change this reality that affects the development of cognitive abilities of children who attend public educational units, studies are required to analyze, deduce, and infer what would be the most efficient cognitive stimuli for learning mathematics; In this context, this research is carried out in the Magaly Masson de Valle Carrera educational unit in the Chone canton. Qualitative and quantitative methods were used in the development of this study, with a documentary and exploratory scope, the information is complemented with the opinions of the students, teachers, and authorities of the institution, as well as with the contribution of experts on the subject; the results obtained show the strengths and weaknesses of the cognitive stimuli applied in different measures and times (Berteletti et al., 2014; Rodríguez-García & Reye-Meza, 2022; Whitenack & Knipping, 2002).

Materials and Methods

This study focused on the identification of efficient cognitive stimuli for learning mathematics at school age, taking seventh-grade students of basic education, aged between 9 and 10 years, as the universe of study; The conceptual basis was built through documentary research, previous studies were reviewed to identify which stimuli have been used in learning mathematics, their efficiency, practical and theoretical scope in the development of mathematical logic.

For the quantitative analysis of this study, a satisfaction survey was applied to 30 students at the indicated ages, an interview with the director, and another with the teachers of the educational institution; The processing of these quantitative data and their respective analysis allowed us to identify the different kinds of stimuli used in the daily life of the classroom. To process the information provided by teachers with more than 10 years of experience in the area of mathematics, the tool developed in 1960 by Olaf Helmer and the RAND Corporation called Mendoza (2021), expert criteria was used for analysis and weighting. The Kendall method was used, it was evidenced in the results,

that the most efficient stimuli used for learning mathematics in children in the seventh year of basic education of the Magaly Masson Educational Unit of Valle Carrera.

Analysis and Discussion of Results

When analyzing the information processed because of the student satisfaction surveys, the interview with the director, the teachers, and the information provided by experts, we find the following results. Regarding the level of student satisfaction, we find that 37.5% of students enjoy their math classes, 37.5% like it to a certain extent and 6.3 indicate that they dislike it. The results are encouraging in favor of the learning processes that are generated in the classrooms, however, we found that a significant percentage of students fully enjoy the classes and a marginal percentage express that they greatly dislike the classes, this situation faces the question: why do most of the students surveyed enjoy this science? The teachers respond that children have fun and learn better through the application of participatory cognitive tools, ergo participation and therefore the use of didactic resources and playful methodologies has a proportional impact on the satisfaction of learning. that can be triggered in students (Schifter & Simon, 1992; Levy & Goldfarb, 2021; Geary et al., 2009).

In relation to the levels of satisfaction of the students with the classroom practices of their teachers, we found that 68.8% indicate that they like very much how the teachers teach their classes, 31.3% indicate that they moderately like how the teachers teach their classes; Given these results, the director expresses that these answers would have been very different 10 years ago, because teachers now teach their subjects in a more participatory way, with didactic resources, supported by psychological support on learning mathematics, as opposed to the long days, where the common denominator was the memorization of formulas and the tasks with many abstract exercises to solve, as we can see in Figure 1.

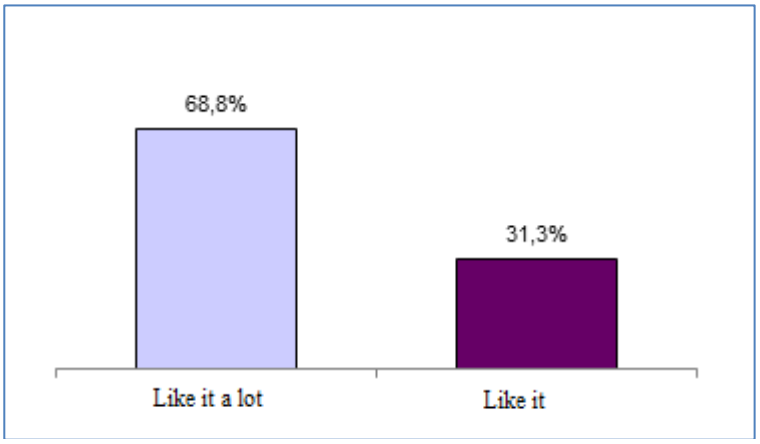

Figure 1. Levels of satisfaction with teaching

In relation to student participation In classes, we find that 37.5% of the students express that they like to participate in classes a lot, 31.3% indicate that they consider like to participate in classes, and the remaining 31.3% express that they do it if they have to do it; In this sense, the teachers state that the participation is linked to the type of topic that is being treated, the methodologies and the resources that are used, they emphasize that when they use dynamics, games, ludic activities and didactic methods, participation in the majority, they also state, that the confidence that can be given to students is important, motivating them to improve when a student makes a mistake.

Regarding the level of satisfaction that students have with the tasks they have to do at home, we found that 37.5% of the students like very much that they leave tasks for the house, and 62.5% of the students indicate that they like it up to a certain point; the teachers express that the tasks that are sent during these ages are minimal and do not represent greater complexity unlike higher years, they also point out that a stimulus that works for the fulfillment of the tasks are the additional points that allow them to improve their grades.

Regarding the weighting results of the Kendall matrix, we find that 62.5% of the students indicate that they would like to learn mathematics through games and dynamics, 31.3% comment that they would like it to a great extent, and 6. 3% are indifferent; the teachers highlight the percentage of acceptance, affirming that the positive results are the result of using didactic, playful, and effective stimulation, as we can see in figure 2.

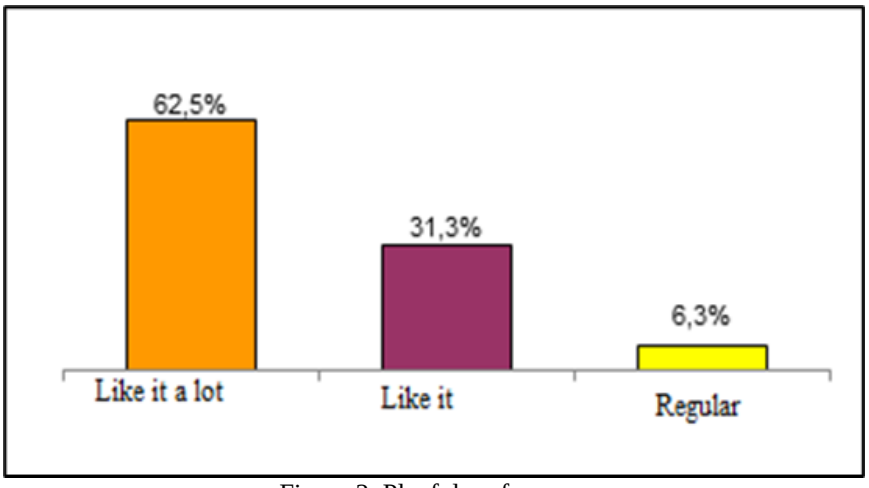

Figure 2. Playful preferences

Regarding the use of technology in the learning processes of mathematics, we find that 31.3% of the students state that they would like to receive part of their classes through the telephone or computer, 37.5% indicate that they partially like the idea, and 31.3% The remaining % express that they are indifferent to how the subjects are taught; Teachers comment that before the pandemic the desire to receive classes through digital media was greater, but later that desire decreased considerably, emphatically pointing out that students prefer face-to-face classes, as we can see in Figure 3.

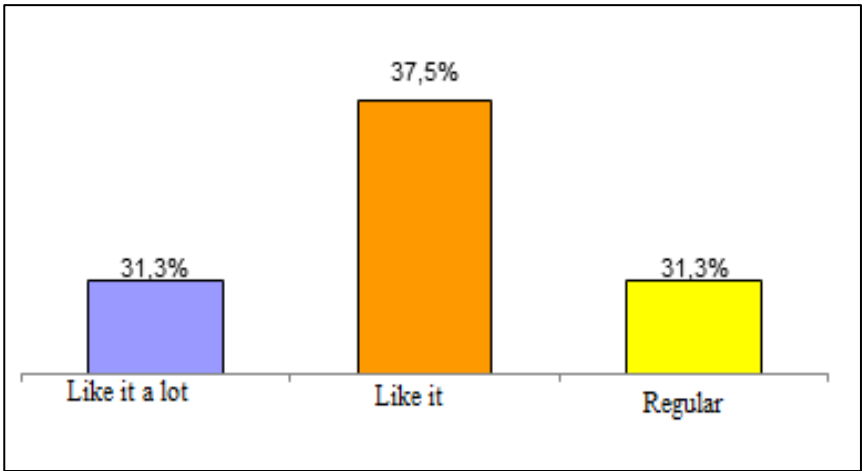

Figure 3. Digital preferences

These results confirm the hypothesis about the importance of cognitive stimulation to favor the learning of mathematics; According to Bitbrain, 12 segments used by teachers in classroom practices with students are identified, classified, and analyzed: attention, perception, comprehension, memory, language, processing speed, orientation, reasoning, praxis, gnosis, executive control, and calculation these practices are the variables that will be analyzed later with the expert criteria tool and weighted through the Kendall matrix.

The main exercises that allow the development of attention, identified in the methodological practices of teachers, are:

- E1 Memory for a numerical sequence in the same order and reverse.
- E2 Memory based on a previously read text, question and answer exercise
- E3 Memory is based on a drawing that must be reproduced exactly.
- E4 Memory is based on a word bank for its reproduction and identification.

The main exercises used by teachers that allow the development of children's perception of mathematical notions are:

- E5 Exercise of perception of similar images, but of different sizes.
- E6 List of sounds with a sequence of blows generated by a person, identifying them amid more sounds.
- E7 Recognition of a previously seen symbol, presented in a set of more symbols.
- E8 Digital identification of previously seen objects, all on one screen along with more distracting objects.

The skills that teachers develop in children through the use of cognitive stimuli that allow the development of comprehension skills are:

- E9 Reading comprehension of a previously read text.
- E10 Reaction to the issuance of sequential dispositions, it is verified if it follows the established order.
- E11 Relationship of words versus concepts.
- E12 Playful activities, solving puzzles and riddles.

The skills that teachers develop through practical exercises with students for memory development are:

- E13 Memorization of a specific image and subsequent recall of its component parts.
- E14 Exercise to remember the same cards in a deck.
- E15 Reading a set of words, after a brief moment you are asked to remember the words read.
- E16 Reminder of cards and ascending placement when they are face down.

The resolution of propositions that teachers develop through tasks aimed at the development of a logical understanding of language are:

- E17 Locate synonyms and antonyms to a set of words.
- E18 Series of increasingly complex reading exercises that must be carried out exactly.
- E19 Breaking down a word by letters and forming a new word with the same letters.
- E20 Conformation of sentences with disordered words.

The exercises for the development of logical-spatial skills that teachers use to develop problem processing speed are:

- E21 Recognition of previously presented models as soon as possible and with a low margin of error.
- E22 Digital exercise whose purpose is to select the largest number of figures in the shortest possible time.
- E23 Quick recognition of a symbol within a set.
- E24 Crossing out geometric figures, following specific orders in color and time.

The space-time exercises that teachers develop through didactic activities in the classroom with students for the development of orientation are:

- E25 Reading a text and subsequent questions that must be answered with specifications of order and time such as previous dates and later.
- E26 Location exercise in an unknown place using a map.
- E27 Visualization of exercise routine and subsequent exact reproduction in front of a mirror.
- E28 Geometric figures with a certain orientation are located in columns, later reproduced in rows in the same sequence and space.

The exercises that teachers use through different cognitive stimuli and the resolution of tasks for the development of logical semantic and logical-mathematical reasoning are:

- E29 Identification of a word out of context in a group of words.
- E30 Identification of words correlated with each other.
- E 31 Deduction of answers based on a statement.

- E32 Solving mathematical equations whose total is solved, but parts are missing so that the stipulated results are given.

The neurological exercises that teachers use for the development of praxis "... in their activities so that students can organize, plan and carry out efficiently to solve a problem", are:

- E33 Making exact drawings and attached to reality.
- E34 Figure cutting exercise to fit them later in the same area in order to see the margin of error when pasting them.
- E35 Mimic reproduction of actions requested orally.
- E36 Exercise of complementing figures with elements of other figures so that they are the same.

The exercises for the development of gnosis, which according to Rehametrics (2020), is the ability of the brain to recognize information previously learned through the senses: sight, hearing, smell, taste, or touch, are:

- E37 Identification correlational of photographs with the same elements, but from different perspectives.
- E38 Identification of objects and instruments through sound.
- E39 Identification of objects by touch.
- E40 Food identification by smell.

The exercises that teachers develop for the development of the skills necessary for executive control are:

- E41 Relationship or differentiation of paired words.
- E42 Logical sequence with elements.
- E43 Reaction to situations that could happen and reasoning for actions.
- E44 Sequence ordering of actions after reading and analysis.

The exercises that teachers develop to develop the necessary skills for calculation processes are:

- E45 Mathematical exercises of ordering, grouping, and scaling.
- E46 Subtraction in ranges of 7 from a number greater than 300.
- E47 Opposite transcription of quantities in digits and letters, if the quantity is (20) it must be transcribed in letters (twenty).
- E48 Solution to mathematical problems posed textually.

The variables identified in the text above are qualified by applying the expert criteria tool and weighted in a Kendall matrix. The principle used by the experts in the use of stimuli for mathematical learning, considering that some stimuli are more efficient for other academic branches and not necessarily the learning of mathematics, see Table 1.

Table 1
Expert criteria and Kendall Matrix

		Tool Weighting													
VARIABLE		E 1	E 2	E 3	E 4	E 5	E 6	E 7	E 8	E 9	E 10	T	≥ = ≤	%	INCIDENCE
1	Stimulus 1	5	5	5	5	4	4	5	5	4	5	47	>41.8	12.35	2.34
2	Stimulus 2	4	4	4	4	3	4	4	4	3	4	38	<41.8	-9.16	1.89
3	Stimulus 3	5	4	5	5	4	4	5	4	5	5	46	>41.8	9.96	2.29
4	Stimulus 4	4	3	4	4	4	4	4	4	4	5	40	<41.8	-4.38	1.99
5	Stimulus 5	5	4	4	4	3	4	4	3	4	4	39	<41.8	-6.77	1.94

6	Stimulus 6	4	4	3	4	3	4	4	4	4	4	38	<41.8	-9.16	1.89
7	Stimulus 7	4	4	3	4	4	4	4	3	4	4	38	<41.8	-9.16	1.89
8	Stimulus 8	5	5	4	4	4	5	4	4	4	5	44	>41.8	5.18	2.19
9	Stimulus 9	5	4	5	4	4	4	4	4	4	4	42	>41.8	0.40	2.09
10	Stimul or 10	4	5	4	4	4	4	4	4	4	5	42	>41.8	0.40	2.09
11	Stimulus 11	5	4	4	4	4	4	5	4	4	5	43	>41.8	2.79	2.14
12	Stimulus 12	5	5	5	5	4	5	5	4	5	5	48	>41.8	14.74	2.39
13	Stimulus 13	5	4	4	4	5	4	4	4	4	5	43	>41.8	2.79	2.14
14	Stimulus 14	5	4	4	4	5	4	4	5	5	4	44	>41.8	5.18	2.19
15	Stimulus 15	5	4	4	4	4	4	4	4	4	5	42	>41.8	0.40	2.09
16	Stimulus 16	4	4	4	4	3	4	4	4	4	5	40	<41.8	-4.38	1.99
17	Stimulus 17	4	4	4	4	3	4	4	5	4	4	40	<41.8	-4.38	1.99
18	Stimulus 18	5	4	4	4	4	4	4	5	4	5	43	>41.8	2.79	2.14
19	Stimulus 19	5	5	4	5	4	5	4	4	4	5	45	>41.8	7.57	2.24
20	Stimulus 20	5	5	4	4	4	5	4	4	4	4	43	>41.8	2.79	2.14
21	Stimulus 21	5	4	4	4	3	4	4	4	4	4	40	<41.8	-4.38	1.99
22	Stimulus 22	5	5	4	4	4	5	5	5	4	5	46	>41.8	9.96	2.29
23	Stimulus 23	4	4	4	4	3	4	4	4	4	4	39	<41.8	-6.77	1.94
24	Stimulus 24	5	5	4	4	5	4	4	4	4	5	44	>41.8	5.18	2.19
25	Stimulus 25	4	4	4	4	3	4	4	4	3	4	38	<41.8	-9.16	1.89
26	Stimulus 26	5	5	4	4	5	4	4	5	4	5	45	>41.8	7.57	2.24
27	Stimulus 27	5	4	4	4	4	3	4	4	4	5	41	<41.8	-1.99	2.04
28	Stimulus 28	5	4	4	5	4	4	5	4	4	5	44	>41.8	5.18	2.19
29	Stimulus 29	4	4	4	3	4	3	4	4	4	4	38	<41.8	-9.16	1.89
30	Stimulus 30	4	5	4	3	5	4	4	4	3	5	41	<41.8	-1.99	2.04
31	Stimulus 31	4	4	3	5	4	4	4	4	4	4	40	<41.8	-4.38	1.99
32	Stimulus 32	5	4	4	4	5	4	4	4	4	5	43	>41.8	2.79	2.14
33	Stimulus 33	4	4	4	4	3	4	4	4	3	4	38	<41.8	-9.16	1.89
34	Stimulus 34	4	4	4	5	4	3	4	5	4	4	41	<41.8	-1.99	2.04
35	Stimulus 35	5	5	4	4	5	4	4	5	4	5	45	>41.8	7.57	2.24
36	Stimulus	4	4	3	4	4	4	3	4	3	3	36	<41.8	-13.94	1.79

36															
37	Stimulus 37	4	4	4	4	4	3	3	4	4	4	38	<41.8	-9.16	1.89
38	Stimulus 38	4	3	4	4	4	4	4	3	4	5	39	<41.8	-6.77	1.94
39	Stimulus 39	4	3	5	4	3	4	4	4	4	5	40	<41.8	-4.38	1.99
40	Stimulus 40	4	4	4	3	4	3	4	4	4	4	38	<41.8	-9.16	1.89
41	Stimulus 41	5	4	4	5	4	4	5	4	4	5	44	>41.8	5.18	2.19
42	Stimulus 42	4	3	4	4	4	4	3	4	4	4	38	< 41.8	-9.16	1.89
43	Stimulus 43	4	4	5	4	5	3	4	4	4	5	42	>41.8	0.40	2.09
44	Stimulus 44	5	4	4	5	4	4	4	3	4	4	41	<41 .8	-1.99	2.04
45	Stimulus 45	5	5	4	5	5	4	4	5	4	5	46	>41.8	9.96	2.29
46	Stimulus 46	5	5	4	5	4	5	4	5	4	5	46	>41, 8	9, 96	2.29
47	Stimulus 47	5	5	5	4	5	5	4	5	4	5	47	>41.8	12.35	2.34
48	Stimulus 48	5	5	4	4	5	4	5	4	4	5	45	>41.8	7.57	2 .24
										TOTAL Σ		2008 41.8			

In the Kendall matrix, the ratings given by the experts to the identified stimuli can be seen, the variables with the highest rating are those that present better adaptability and application to mathematical learning processes, these being:

1. E1 Memory for numerical sequence.
2. E3 Memory based on a drawing.
3. E8 Digital identification of previously seen objects.
4. E9 Reading comprehension.
5. E10 Reaction to the issuance of sequential provisions.
6. E11 Relationship of words versus concepts.
7. E12 Playful activities, solving puzzles and riddles.
8. E13 Memorization of a specific image and subsequent recall.
9. E14 Same cards reminder exercise.
10. E15 Reading and remembering a set of words.
11. E18 Series of increasingly complex reading exercises.
12. E19 Breaking down a word by letters and forming a new word.
13. E20 Conformation of sentences with disordered words.
14. E22 Digital exercise to select the largest number of figures.
15. E24 Crossing out geometric figures, following specific orders.
16. E26 Location exercise using a map.
17. E28 Geometric figures placed in columns and reproduced in rows.
18. E32 Solving mathematical equations with the location of missing elements.
19. E35 Mimic reproduction of actions requested orally.
20. E41 Relationship or differentiation of paired words.
21. E43 Reaction to situations that could happen and reasoning for actions.
22. E45 Mathematical exercises of ordering, grouping, and scaling.
23. E46 Subtraction in ranges of 7 from a number greater than 300.
24. E47 Opposite transcription of quantities in digits and letters.
25. E48 Solution to mathematical problems posed textually

The 25 stimuli identified as efficient for learning mathematics exceeded the weighting of the arithmetic means established for this analysis, that is, 41.8, see figure 4.

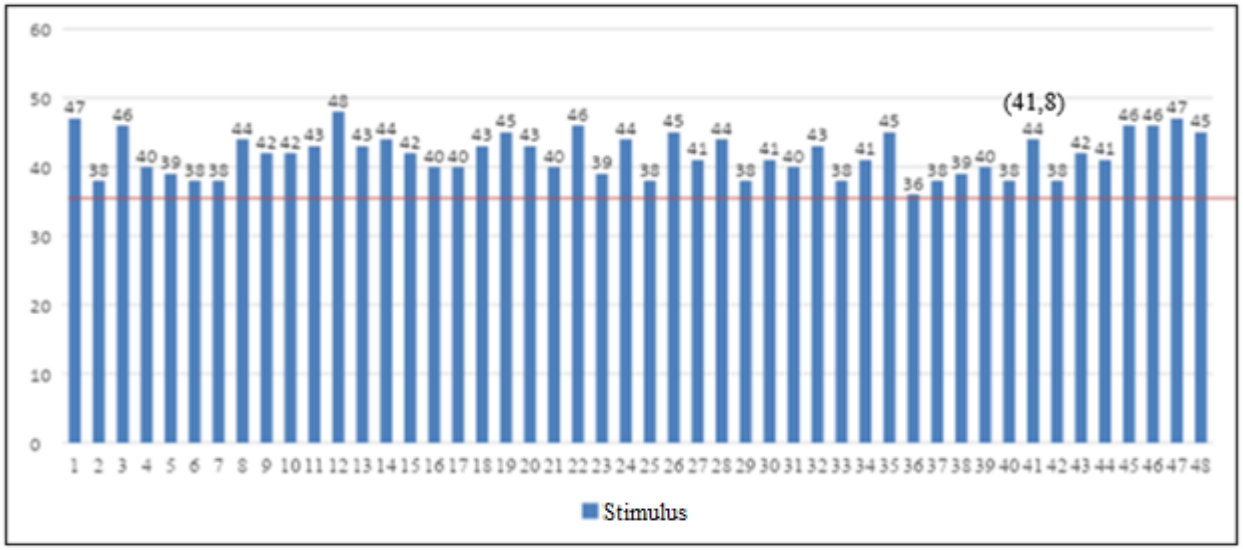

Figure 4. The weighting of the Kendall Matrix

Of the 25 stimuli identified by the experts as the most efficient for the stimulation of the learning of mathematics, 3 obtained the highest qualification:

- E1 memory for a numerical sequence in the same order and inverse, 47%.
- E12 recreational activities, resolution of puzzles and riddles, 48%.
- E47 is the opposite transcription of quantities in digits and letters, 47%.

Being the stimulus E12 is the one with the highest frequency 48/50, that is to say, that it becomes the determining variable with the highest percentage of incidence 96% (2 points above the immediate lower ones), the methodology used allows determining the incidence of the variables On the total percentage, it is evident in graph 7 that stimulus 12 has an incidence percentage of 2.39% of the final weight, a result that can be verified in the data of Figure 4 and 5.

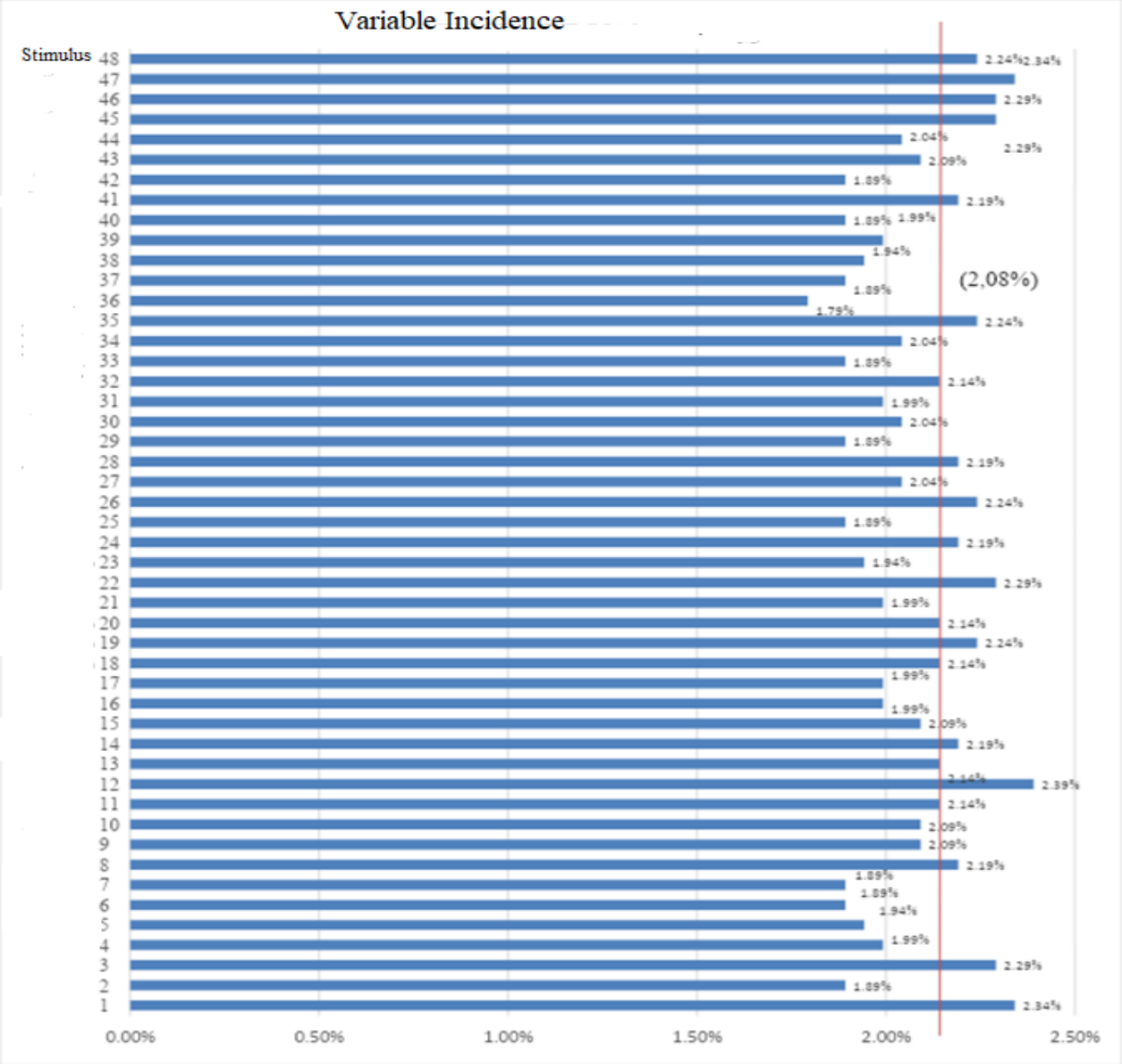

Figure 5. Incidence on the weight total/100

The 48 stimuli initially identified have to improve learning processes and because their application can be considered as universal, they are susceptible to be applied experimentally for the development of learning processes in all sciences, however, it can be inferred that from the 25 stimuli that exceeded the arithmetic mean in the Kendall matrix, are those that present a higher percentage of efficiency in the learning procedures of mathematical rudiments, the sine qua non we can affirm that their application allows to adequately stimulate the cognitive stimulation of the learning of mathematics.

Chero et al. (2014), detail the efficiency in the learning of mathematics by students when the stimuli that have been analyzed in the previous tables are applied; support the importance and effectiveness of the application of these stimuli, in the qualitative aspects of mathematical learning, on the other hand, De León (2020), argues that the learning process begins at home and continues at school, through a correlational analysis between groups of students whose parents performed daily activities applying mathematics and another who did not, the results showed that stimulation at home is effective in developing skills for learning mathematics.

The stimulus number 12 refers to playful activities, solving riddles and riddles, with a frequency of 48% and a weighting of 96%, is recognized by Rupérez & García (2020), as fundamental to motivate the learning of

mathematics in a dynamic and fun way, achieving as its main effect to capture the attention and interest of students. On the other hand, Suarez & Puerto (2017), defines motivation as an important psychological category so that learning can be more efficient and useful in people's lives, permanent motivation strengthens learning processes and conclude these purposes that the use of puzzles turns out to be a highly effective tool in the classroom.

Stimulus 1 on memory for number sequence in the same order and inverse and stimulus 47 on the opposite transcription of quantities in digits and letters, obtained second place with a weighting of 94%, both variables have a high percentage of efficiency at the time of their application in mathematical learning processes. Regarding stimulus 1, Fernandez Escalona (2016), defines the numerical sequence as a type of series that can be generated from ordinal logical relationships and suggest a series of mechanisms to be used within the classroom, evidence, in addition, that the sequence encourages the analysis and mental construction of calculation processes in students due to the logical relationships that this process entails, in this context Zapatera Llinares (2018), proposes that the sequence not only be numerical in specific exercises but also that basic, systematic, sequential and gradually applied algebraic processes are considered, suggests that these alternatives develop the learning abilities of mathematics in students.

Regarding stimulus 47, Alvarado & Ferreiro (2000), based on their experiment with children aged 4 and 5 years on the transcription of numbers into digits and words, discovers that requesting the writing of numbers outside a counting context is beneficial for numerical analysis independently of the established quantity, this leads us to the fact that textual interpretation, which a school-level student can give to a figure, contributes considerably to the learning of mathematics due to the relationship with other learning processes.

The application of stimuli marks a before and after in the school process, the use of efficient tools establish the beginning of a career in search of academic excellence, stimulation as we know it today has gone through a series of transformations due to new findings in cognitive matter, new technologies are part of the current processes, in this context Batista (2006), concludes that NTs are a valuable resource and a right for students in their educational stage, their high efficiency is due to the great adaptability to the different modalities of study, the variety of options and easy access, however, this resource must respond to an academic planning and structure to obtain favorable results; on the other hand, Mendoza (2018), for stimulation through technological resources suggests the use of ICTs that mean Information and Communication Technologies, which are resources and tools that are used in the process of administration and distribution of information through technological equipment, Universidad Latina de Costa Rica (2020), taking into account that most homes have a computer, cell phone or some digital means, in special cases where households do not have these resources, the equipment of educational institutions is used that if they have the required means, Medellín's suggestion focuses on the use of equipment and teacher training, the combination of these resources constitutes a strategic action for the integral cognitive development of the student (Toala-Bailón & Ávila-Rosales, 2022; Padilla & Ryan, 2020; Matias-Guiu et al., 2016).

Conclusions

The 25 stimuli identified are specifically taxed to the processes of mathematical learning, their application does not require further planning, however, the development of an intervention plan with indicators and a measurement system allows us to always obtain better results and control of the learning process. Playful stimulation turns out to be the most efficient tool at the time of teaching classes, games and riddles encourage creativity and always maintain the student's attention, this situation hand in hand with experienced teachers can generate a healthy environment of competition inside the classrooms. The exercises of number sequences and transcription of numbers in digits and words present high-efficiency rates, these tools in contrast to the playful activities generate dynamic alternatives and allow the creation of new fun and efficient games.

The use of new technologies and ICT allows the evolution of many historically used tools, openness to the digital world is a viable and easy option to perform, and tasks turn out to be more attractive with an equal degree of efficiency because most students in school and school stage have daily access to digital and intelligent media, it is suggested to identify mathematical applications according to the process that the student is carrying out at that moment, that is, the degree of difficulty and the type of applications must be according to the level or stage in which the student is. Cognitive stimulation is a viable alternative to increase performance in learning processes; however, it is necessary to investigate more in topics related to new methodologies, studies to determine the degree of efficiency of stimuli, and the development of comprehensive programs based on academic objectives and the application of cognitive stimulation.

Acknowledgments
Thanks to the editors for allowing this paper to be published in their journal.

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