

LEVELS OF REPRESENTATION IN THE RESOLUTION OF QUANTITY PROBLEMS, IN ELEMENTARY STUDENTS IN PANDEMIC COVID-19

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ABSTRACT

The objective of the research was to determine the influence of the implementation of the "Forms of Representation" program on the resolution of quantity problems in fourth graders in I.E., 1171 - UGEL 05, 2020. It was a quantitative approach research, of quasi-experimental design, worked with two research groups one control and one experimental in order to compare the results was applied type because it focused on the search for solving the problem in developing mathematical competence capabilities. The study had a sample of 36 students from the control group and of equal quantity for the experimental group, whose instrument applied was an evaluation test as a pre test/post test of 20 questions adapted from Minedu, validated instrument with an acceptable reliability of 0.68 according to the calculation of KR-20. Descriptive results showed that 94.4% of the students in the control group were placed at the featured achievement level and the statistical test conducted using the U-Mann-Whitney statistical test, because the data were not distributed as normal, $p-0.000 < 0.05$, with those in the experimental group having the highest levels of achievement, concluding that the implementation of the program significantly influences the resolution of quantity problems in students of the fourth grade of primary education

KEYWORDS: Forms of representation, Problem solving, primary education.

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INTRODUCTION

At the international level it is a challenge to teach mathematics in primary school students and teachers make great efforts to improve their proposals for strategies in class practice so that schoolchildren are motivated and take an interest in assimilating (Etchepare, GC, Pérez, C., Bolaños, JAC, & Ruiz, 2017).

In Latin America, the third LLECE regional study was applied to 15 countries in 2013 to students from third to sixth grade of primary school in reading and math skills; Approximately 9950 students from 297 educational institutions in Peru were evaluated and the results revealed that our country was among the last three places in the mathematics test (UNESCO, 2014). Results that continue to be of concern because students do not achieve proficiency in mathematics.

In Peru, Minedu (2007) through the National Educational Project (PEN) as a national policy established in its objective two that students achieve relevant and quality learning; In this sense, the (ECE) Census Evaluations are carried out for elementary students to measure the skills in mathematics applied by the Quality Measurement Unit. The results of the ECE 2019, provided by the UMC (2020) in the area of mathematics, showed that 51.1% of the second grade students were at the

Beginning level and only 17% were at the satisfactory level. For the 4th. grade, the highest percentage was the process level with 42%; These results continue to be of concern because 8.1% were at the level prior to the start (Minedu, 2020). At the level of Metropolitan Lima it was evidenced that 45.1% were located at the process level.

It should be noted that Regular Basic Education is organized in cycles (Law 28044, Art. 28) and that 4th grade students are placed in 4th cycle, a period in which they improve their mathematical calculation skills and develop their competencies with the influence of their contexts and the stimuli of educational agents (Minedu, 2009, p. 14). Likewise, students are expected to achieve the Graduate Profile, one of them being: "interprets reality and makes decisions based on mathematical knowledge" and mathematics, as a human activity, is focused on problem solving (Minedu, 2016b, p. 232).

Faced with such a situation, the research was developed through the application of a program in forms of representation to achieve mathematical competence and the general objective was stated: Determine the influence of the application of the program "Forms of representation" in solving quantity problems in Fourth grade students, IE 1171, UGEL 05 - 2020. The specific objectives were: (1) To determine the influence of the

application of the program "forms of representation" in the development of capacity: it translates quantities into numerical expressions. (2) Determine the influence of the application of the program "forms of representation" in the development of the capacity: Communicate your understanding of numbers and operations. (3) Determine the influence of the application of the program "forms of representation" on capacity development: Uses estimation and calculation strategies and procedures. (4) Determine the influence of the application of the program "forms of representation" in the development of capacity: Argues statements about number relationships and operations.

It was proposed as a general hypothesis: The application of the program "forms of representation" significantly influences the development of the ability to solve quantity problems in fourth grade students, IE 1171, UGEL 05 - 2020. The specific hypotheses were: 1) The application of the program "forms of representation" significantly influences the development of capacity: it translates quantities into numerical expressions. (2) The application of the program "forms of representation" significantly influences the development of capacity: It communicates your understanding of numbers and operations. (3) The application of the program "forms of representation" significantly influences the development of capacity: Uses estimation and calculation strategies and procedures. (4) Determine the influence of the application of the program "forms of representation" significantly influences the development of capacity: Argues statements about number relationships and operations.

MATERIALS AND Y METHODS

Kind of investigation

According to Concytec (2019, Art. 5) the "original works carried out to acquire new knowledge, fundamentally directed towards a specific practical objective" is an applied type research. Likewise, according to Reyes (2019), it was an applied-type study because it was aimed at solving a problem, whose objective was to determine the effect or influence of the program in solving quantity problems.

According to the temporal scope, it was longitudinal because the data were collected in two moments. By its nature it was quantitative because observation was made and statistical tests were applied to analyze the collected data. (UCV, 2016, p. 20).

Research design

The design was quasi-experimental, because it worked with two groups and a Pre Test and Post

Test were applied to both the experimental group and the control group.

Hernández, Fernández and Baptista (2014) call the experiments intervention studies, because the researcher generates a situation to expose how it affects the participants and compare with those who do not. In the experiments, manipulation, treatments, stimuli or interventions are done through the independent variable to show its effects on the dependent variable in a control scenario.

GE	O ₁	X	O ₂
GC	O ₁	_	O ₂

Schema:

Where:

EG = Experimental group

GC = Control group

O₁ = pre test (Measures knowledge - before)

O₂ = Post Test Measure knowledge after)

X = Treatment (application of the program)

Variables and operationalization

Variable: Forms of representation

Conceptual definition: It is the ability to understand the meaning of mathematical ideas and express them orally and in writing, using mathematical language and different forms of representation with concrete material, graphs, tables and symbols, and moving from one representation to another. Learning Paths (2013)

Operational definition: An evaluation test with 20 evaluation criteria was applied and evaluated the dimension translates quantities to numerical expressions, Communicates its understanding of numbers and operations, Uses estimation and calculation strategies and procedures, and Argues statements about numerical relationships and the operations (see annex Operationalization of the variable)

Independent variable: "Forms of representation" program

The independent variable was manipulated through the application of a program where learning sessions were developed to display the quantity problem solving competence through its capacities established as dimensions.

Dependent variable: Solving quantity problems

The Minedu Elementary Curriculum Program (2016, p. 240) establishes that the student must achieve an understanding of place value in four-digit numbers and represent them through equivalences. He also expresses his understanding of the notions of multiplication using number language and various representations.

Operationally, the competency capabilities were established as dimensions to achieve said competency as measured by the program and the instrument, see Annex 2.

Population and Sample**Population**

According to Hernández, et al (2014, p. 174) defines it as the total phenomenon to analyze where the population elements have common peculiarities. The population amounted to 450 students at the elementary level of the study EI.

Shows

The sample, according to Hernández, et al., (2014) are components that are defined by certain peculiarities of a representative need. The sample was selected for convenience for the purpose of the research, taking into account the problematic situation. It was made up of 36 students from fourth grade A for the GE and 36 from section B for the GC.

Sampling

The sampling was non-probabilistic of an intentional type, for the convenience of the proposed objective, considering all the students in the sample for having the same inclusion criteria such as age range, context, grade; therefore, no exclusion criteria were given.

Research techniques and instruments**Technique**

For Sánchez and Reyes (2015, p 56) they are procedures and rules that allow establishing the relationship with the objective or subject of the study. The technique that was used was evaluation.

Instrument

They are means to proceed to collect data that are required according to the objectives and research hypotheses (Hernández, et al., 2014, p. 199). In the present investigation, the instrument to collect the information was through a performance test / knowledge assessment (pre / post test) prepared according to the indicators established in the operationalization. See Annex 2 and its technical sheet.

The instrument applied was a written test with 20 items with questions that will allow to measure the dependent variable, taking into account the capacities established in the National Curriculum of the Minedu (2016a) and the levels considered in the

evaluation: Start, process, expected achievement and achievement outstanding.

Instrument validity

An instrument should measure the objective of the investigation; Furthermore, it must be reliable and valid (Hernández et al. 2014). In the present study, validity was performed through relevance, relevance and clarity of content (see Annex 5).

Instrument reliability

It is the degree to which its repeated application produces similar results (Hernández et al., 2014). Therefore, the reliability was checked with a sample of 30 students that was a non-sample group. Because it is a dichotomous instrument: 1 = correct - 0 = incorrect; The Kuder Richardson-20 Test was applied and the result obtained was 0.68, indicating acceptable reliability (see Annex 6).

Procedures

For the application of the study, we had the coordination and the corresponding permissions of the directors of the institution. First, the pre-test was used in the sample groups, then it was applied through the treatment of 16 sessions to promote quantity problem-solving skills through forms of representation of the data of the problems, making use of various strategies of Teaching through virtuality and also with the support of their parents or a relative at home, at the end of the planned sessions, the post-test was applied in both groups of the sample.

Data analysis method

After the application, the databases were prepared for their respective processing in the statistical program SPSS version, 25. In the descriptive analysis, the frequencies and percentages were obtained according to the levels (Start, process, expected achievement and outstanding achievement) with their respective ranges established in the operationalization.

The inferential analysis or hypothesis testing was performed using the nonparametric Mann-Whitney U test, since they are independent samples (GC and GE), this because the data do not meet the assumptions of the normal distribution.

Ethical aspects

It is based on ethical values such as: truth, justice, freedom and authenticity, since authorization was requested from the director of the EI and the teachers of the degree assuming the commitment to keep the students who participated in anonymity, since the information collected was only used in this investigation. The authorship of information was respected through the corresponding citations and references according to the APA standards (Moreno & Carrillo, 2019).

RESULTS**Descriptive analysis**

Table 1.: Achievement levels obtained in quantity problem solving competence

			Pre test		Post test	
			GC	GE	GC	GE
Quantity troubleshooting	Start	f	36	34	35	0
		%	100,0%	94,4%	97,2%	0,0%
	In process	f	0	2	1	0
		%	0,0%	5,6%	2,8%	0,0%
	Expected achievement	f	0	0	0	2
		%	0,0%	0,0%	0,0%	5,6%
	Outstanding Achievement	f	0	0	0	34
		%	0,0%	0,0%	0,0%	94,4%
Total	f	36	36	36	36	
	%	100,0%	100,0%	100,0%	100,0%	

Source: Applied instrument

Figure 1. Levels of Achievements obtained in the competition

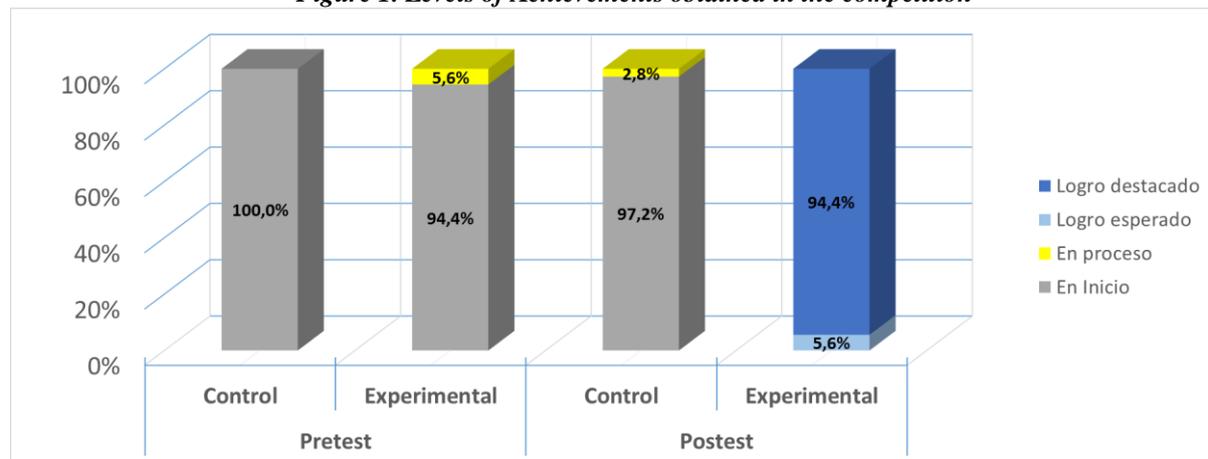


Figura 1. Niveles de Logros obtenidos en la competencia

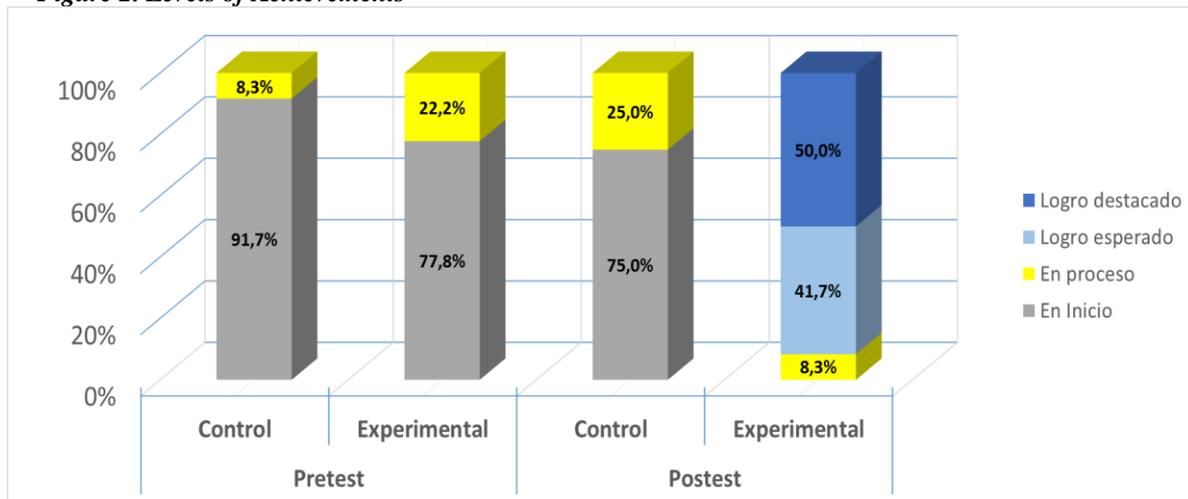
Source: Table 1

Table 2: Levels of Achievement obtained in D1: translate quantities into numerical expressions

			Pre test		Post test	
			GC	GE	GC	GE
D1	Start	f	33	28	27	0
		%	91,7%	77,8%	75,0%	0,0%
	In process	f	3	8	9	3
		%	8,3%	22,2%	25,0%	8,3%
	Expected achievement	f	0	0	0	15
		%	0,0%	0,0%	0,0%	41,7%
	Outstanding Achievement	f	0	0	0	18
		%	0,0%	0,0%	0,0%	50,0%
Total	f	36	36	36	36	
	%	100,0%	100,0%	100,0%	100,0%	

Source: Applied instrument

Figure 2. Levels of Achievements



Source: Table 2.

Table 3: Levels of Achievement obtained in D2: Communicates your understanding of numbers and operations

			Pre test		Post test	
			GC	GE	GC	GE
D2	Start	f	33	32	34	0
		%	91,7%	88,9%	94,4%	0,0%
	In process	f	3	4	2	1
		%	8,3%	11,1%	5,6%	2,8%
	Expected achievement	f	0	0	0	13
		%	0,0%	0,0%	0,0%	36,1%
Outstanding Achievement	f	0	0	0	22	
	%	0,0%	0,0%	0,0%	61,1%	
Total	f	36	36	36	36	
	%	100,0%	100,0%	100,0%	100,0%	

Source: Applied instrument

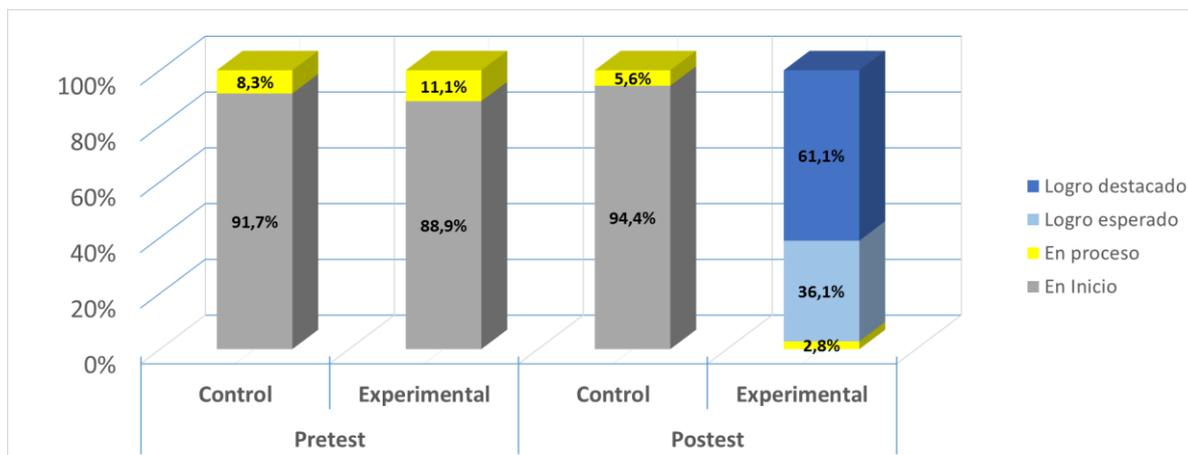


Figure 3. Levels of Achievements obtained
Source: Table 3.

Table 4: Levels of Achievement obtained in D3; Uses estimation and calculation strategies and procedures

		Pre test		Post test	
		GC	GE	GC	GE
D3 Start	f	28	28	11	0
	%	77,8%	77,8%	30,6%	0,0%
In process	f	0	0	0	0
	%	0,0%	0,0%	0,0%	0,0%
Expected achievement	f	8	8	21	5
	%	22,2%	22,2%	58,3%	13,9%
Outstanding Achievement	f	0	0	4	31
	%	0,0%	0,0%	11,1%	86,1%
Total	f	36	36	36	36
	%	100,0%	100,0%	100,0%	100,0%

Source: Applied instrument

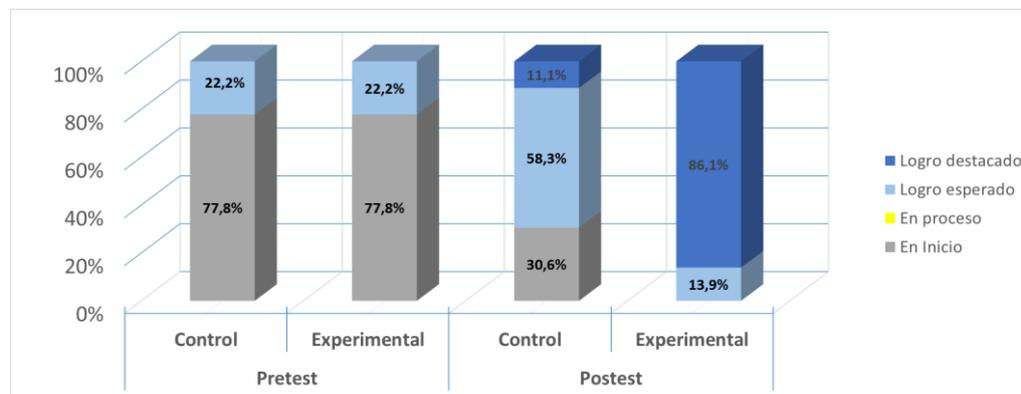


Figure 4. Levels of Achievements obtained

Source: Table 4.

Table 5: Levels of Achievement obtained in D4: Argues statements about number relationships and operations

			Pre test		Post test	
			GC	GE	GC	GE
D4 Start	f		30	30	22	1
	%		83,3%	83,3%	61,1%	2,8%
In process	f		5	5	10	6
	%		13,9%	13,9%	27,8%	16,7%
Expected achievement	f		1	1	0	0
	%		2,8%	2,8%	0,0%	0,0%
Outstanding Achievement	f		0	0	4	29
	%		0,0%	0,0%	11,1%	80,6%
Total	f		36	36	36	36
	%		100,0%	100,0%	100,0%	100,0%

Source: Applied instrument

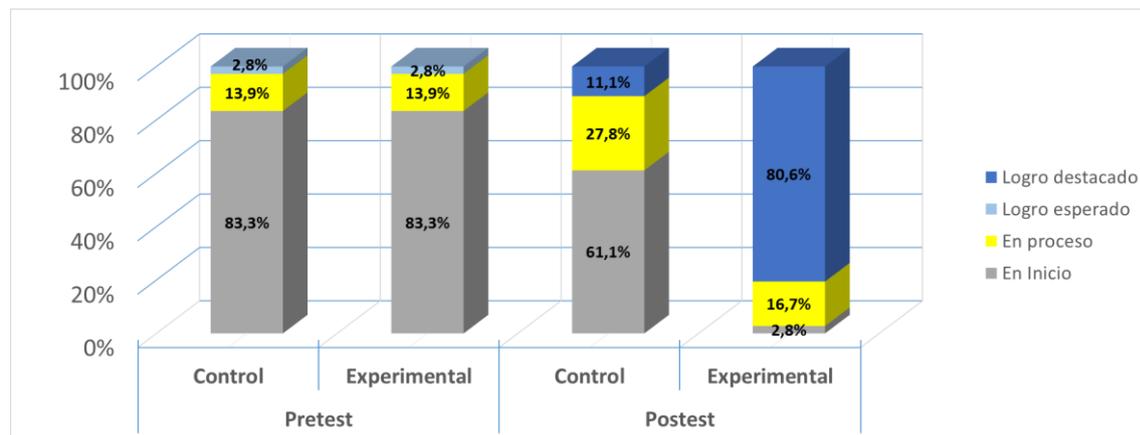


Figure 5. Levels of Achievements obtained

Source: Table 5.

Data normality test

Table 6.: Results of the normality test

Study group	Estadístico	Shapiro-Wilk	
		gl	Sig.(p)
Pre test			
D1	,312	36	,000
D2	,312	36	,000
D3	,514	36	,000
D4	,470	36	,000
Variable	,158	36	,000
Post test			
D1	,540	36	,000
D2	,246	36	,000
D3	,734	36	,000
D4	,645	36	,000
Pre test			
Variable	,246	36	,000
D1	,514	36	,000
D2	,366	36	,000
D3	,514	36	,000
D4	,470	36	,000
Post test			
Variable	,246	36	,000
D1	,748	36	,000
D2	,675	36	,000
D3	,412	36	,000
D4	,512	36	,000

Fuente: SPSS vr. 25

General hypothesis testing

Ho (Me1 = Me2). The application of the “forms of representation” program does not significantly influence the development of the quantity problem solving competence in fourth grade primary school students.

Ha. (Me1 ≠ Me2). The application of the “forms of representation” program significantly influences the development of quantity problem solving competence in fourth grade primary school students.

Table 7: Value of the Contrast Statistic.

Pre test					
Grupo	In start	In process	Expected Achievement	Outstanding Achievement	Test
Control	100%	0%	0%	0%	U= 612,000
Experimental	94,4%	5,6%	0%	0%	Z = -1,424 p = 0,154

Post test Grupo	In start	In process	Expected Achievement	Outstanding Achievement	Test
Control	97,2%	2,8%	0%	0%	U=0,000
Experimental	0%	0%	5,6%	94,4%	Z = -8,264 P =0,000

Source: SPSS v25

The level of achievement in the quantity problem solving competence, both of the CG and GE presented similar initial conditions in the pre-test with U-Mann-Whitney with $p = 0.154 > 0.05$. In the post-test they show us that the groups present significant differences in their levels of achievement with U-Mann-Whitney: $p = 0.000 < 0.05$, being those of the experimental group those with the highest levels of achievement.

Specific hypothesis test 1:

Ho (Me1 = Me2). The application of the

program "forms of representation" does not significantly influence the development of capacity: it translates quantities into numerical expressions, in students of the fourth grade of primary school.

Ha. (Me1 ≠ Me2). The application of the program "forms of representation" significantly influences the development of capacity: it translates quantities into numerical expressions, in students of the fourth grade of primary school.

Table 8.: Value of the Contrast Statistic.

Pre test D1					
Grupo	In start	In process	Expected Achievement	Outstanding Achievement	Test
Control	91,7%	8,3%	0%	0%	U = 558,000 Z = -1,626
Experimental	77,8%	22,2%	0%	0%	p = 0,104
Post test D1					
Grupo	In start	In process	Expected Achievement	Outstanding Achievement	Test
Control	75%	25%	0%	0%	U=13,500 Z = -7,458
Experimental	0%	8,3%	41,7%	50%	P =0,000

Source: SPSS v25

The level of achievement of the ability: translates quantities into numerical expressions, both CG and GE present similar initial conditions in the pre-test with U-Mann-Whitney with $p = 0.104 > 0.05$. In the post-test they show us that both groups present significant differences in their levels of achievement with U-Mann-Whitney: $p = 0.000 < 0.05$, being those of the EG those with the highest levels of achievement.

Specific hypothesis test 2:

Ho (Me1 = Me2). The application of the program "forms of representation" does not significantly influence the development of capacity: It communicates their understanding of numbers and operations, in students of the fourth grade of primary school.

Ha. (Me1 ≠ Me2). The application of the program "forms of representation" significantly influences the development of capacity: It communicates their understanding of numbers and operations, in students of the fourth grade of primary school.

Table 9.: Value of the Contrast Statistic.

Pre test D2					
Grupo	In start	In process	Expected Achievement	Outstanding Achievement	Test
Control	91,7%	8,3%	0%	0%	U = 630,000 Z = -0,395
Experimental	88,9%	11,1%	41,7%	50%	p = 0,693
Post test D2					
Grupo	In start	In process	Expected Achievement	Outstanding Achievement	Test
Control	94,4%	5,6%	0%	0%	U=1,000 Z = -7,856
Experimental	0%	2,8%	36,1%	61,1%	P =0,000

Source: SPSS v25

The level of ability achievement: It communicates their understanding of numbers and operations, both in the control and experimental group, they present similar initial conditions in the pre-test with U-Mann-Whitney with $p = 0.693 > 0.05$. In the post-test they show us that both groups present significant differences in their levels of achievement with U-Mann-Whitney: $p = 0.000 < 0.05$, being those of the experimental group those with higher levels of achievement.

Specific hypothesis test 3:

Ho ($Me_1 = Me_2$). The application of the program "forms of representation" does not significantly influence the development of capacity: It uses estimation and calculation strategies and procedures in fourth grade students.

Ha. ($Me_1 \neq Me_2$). The application of the program "forms of representation" significantly influences the development of capacity: It uses estimation and calculation strategies and procedures, in students of fourth grade of primary school.

Table 10.: Value of the Contrast Statistic.

Pre test D3					
Grupo	In start	In process	Expected Achievement	Outstanding Achievement	Test
Control	77,8%	0%	22,2%	0%	U= 648,000
Experimental	77,8%	0%	22,2%	0%	Z = -0,000 p = 1,000
Post test D3					
Grupo	In start	In process	Expected Achievement	Outstanding Achievement	Test
Control	30,6%	0%	58,3%	11,1%	U=134,500
Experimental	0%	0%	13,9%	86,1%	Z = -6,330 P =0,000

Source: SPSS v25

The level of ability achievement: Uses estimation and calculation strategies and procedures, both CG and EG present similar initial conditions in the pre-test with U-Mann-Whitney with $p = 1,000 > 0.05$. In the post-test they show us that both groups present significant differences in their levels of achievement with U-Mann-Whitney: $p = 0.000 < 0.05$, being those of the EG those with the highest levels of achievement.

Specific hypothesis test 4:

Ho ($Me_1 = Me_2$). The application of the

program "forms of representation" does not significantly influence the development of capacity: It argues statements about number relationships and operations, in students of the fourth grade of primary school.

Ha. ($Me_1 \neq Me_2$). The application of the program "forms of representation" significantly influences the development of capacity: Argues statements about number relationships and operations, in students of the fourth grade of primary school.

Table 11. Value of the Contrast Statistic.

Pre test D4					
Grupo	In start	In process	Expected Achievement	Outstanding Achievement	Test
Control	83,3%	13,9%	2,8%	0%	U= 648,000
Experimental	83,3%	13,9%	2,8%	0%	Z = -0,000 p = 1,000
Post test D4					
Grupo	In start	In process	Expected Achievement	Outstanding Achievement	Test
Control	61,1%	27,8%	0%	11,1%	U=137,000
Experimental	2,8%	16,7%	0%	80,6%	Z = -6,205 P =0,000

Source: SPSS v25

The level of achievement of the ability: Argues statements about numerical relationships and operations, both CG and EG, present similar initial

conditions in the pre-test with U-Mann-Whitney with $p = 1,000 > 0.05$. In the post-test they show us that both groups present significant differences in

their levels of achievement with U-Mann-Whitney: $p = 0.000 < 0.05$, being those of the EG those with the highest levels of achievement.

CONCLUSIONS

First: It was determined that the application of the "forms of representation" program significantly influences the development of the quantity problem solving competence in the students of the experimental group with an outstanding achievement of 94.4% in the post-test while the group Control was located at Start with 97.2% and according to the Mann-Whitney U Test with a p value of $0.000 < 0.05$; proving the scientific contribution of the cognitive learning theories of Piaget, Vygostky and Bruner.

Second: It was determined that the application of the program "forms of representation" significantly influences the development of capacity: it translates quantities into numerical expressions in the students of the experimental group, in the post test, where 50% were located in outstanding achievement at Difference from the control group that was located in the beginning with 75% and according to the Mann-Whitney U test with a p value of $0.000 < 0.05$.

Third: It was determined that the application of the program "forms of representation" significantly influences the development of capacity: It communicates their understanding of numbers and operations in the students of the experimental group, in the post test, where 61.1% It was located in outstanding achievement, unlike the control group, which was located in the beginning with 94.4% and according to the Mann-Whitney U test with a p value of $0.000 < 0.05$.

Fourth: It was determined that the application of the program "forms of representation" significantly influences the development of capacity: It uses estimation and calculation strategies and procedures in the students of the experimental group, in the post test, where 86.1% were It was ranked in outstanding achievement, unlike the control group, which was in Expected Achievement with 58.3% and according to the Mann-Whitney U Test with a p value of $0.000 < 0.05$.

Fifth: It was determined that the application of the program "forms of representation" significantly influences the development of the capacity: It argues statements about numerical relationships and operations in the students of the experimental group, in the post test, where 80.6% were It was ranked in outstanding achievement, unlike the control group, which was in the beginning with 61.1% and according to the Mann-Whitney U Test with a p value of $0.000 < 0.05$.

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