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Didactic strategies and solving quantity problems in primary school students in Peru

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***Abstract*---**The research aimed to determine if didactic strategies improve the resolution of quantity problems in primary school students of an Educational Institution of the suyo pampa annex, Taya Bamba district, Peru in 2021. The type of research was applied with pre-experimental design, the sample is all students of the primary level of the aforementioned educational institution. The strategies were applied in learning sessions and the technique used was the test and the instrument the pretes and poles. It was determined that there is evidence to suggest that the application of didactic strategies in the learning sessions present weaknesses that need to be corrected, as evidenced by the results of the ECE applied to students, of the III and IV Cycle of primary education, determining among other factors that significant learning is not promoted without an adequate planning and application of the strategies and didactic processes in the learning sessions in an educational institution of the district of Taya Bamba in Peru.

***Keywords*---**didactic strategies, quantity problem solving, primary school.

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Introduction

In ancient times the conduct of the teaching of mathematics was traditional focused on the repetition of algorithms and primarily memorism prevailed, so today it is observed that in these contemporary times the way of conducting teaching is changing, we are aware that it is moving from a routine teaching to another cognitive, according to the Ministry of Education (MINEDU Ecuador, 2018) mentions that the generation of the third millennium is in permanent changes in accordance with the advancement of science and technology; in this regard; mathematics has constantly evolved from a traditional teaching to an active one that allows the student to learn to solve everyday problems using strategies, procedures and at the same time strengthening their critical thinking. At the international level, the United Nations Educational, Scientific and Cultural Organization. The effect of these results is deduced that there is a poor management of didactic strategies and methodological procedures in the teaching of mathematics so that students can develop the problems and manage to systematize the evaluation contents (Yanile-Valenzuela, Nancy-Montes & Olga-Perez, 2019). Likewise, the Program for International Student Assessment (PISA 2018) evaluates the ability to enunciate, use and understand mathematics in different contexts, taking into account mathematical reasoning and the use of concepts, procedures, data and mathematical tools to describe, explain and predict phenomena. According to this model, Pisa includes the following competences: solves problems of quantity, solves problems of regularity equivalence and change, solves problems of form movement and location and management of data and uncertainty, the evaluation was carried out to 79 participating countries, in four areas, mathematics, reading, science and financial education, being the countries of the Asian continent that occupy the first places and the highest scores in said the countries are the following China obtained 591 points, Singapore 569 points and Macau (China) 558, demonstrating better academic preparation and therefore better educational quality.

Our country ranked 64th out of 79 participating countries. However, with the new results found, it is notorious that there are many deficiencies in the use of strategies and didactic processes to interpret and understand and solve the problems, which is why the score required by the Oecd Organization, Cooperation and Economic Development (2018) was not reached, observing that from 400 students aged 2-6 years it was 39.6% and 1c to 1 to the percentage of 60.4%. On the other hand, the Legislative (2003) indicates that the school has the mission of training people who respond to the demands posed by society, developing their skills linking with the world of work, facing the incessant changes in society and knowledge. Likewise (Montero & Mahecha, 2020) in a study on the understanding and resolution of mathematical problems from the macro structure of the text mentions a great concern of primary school teachers about the low performance of students in the area of mathematics and in state tests despite the fact that there is aptitude in the solution of algorithms, there are difficulties in understanding mathematical problems. These difficulties are consequences of teachers who inadequately use didactic strategies in the development of learning sessions, not achieving progress to a higher level of students in the development of the activities developed.

In the same way, the Unit for the Measurement of Educational Quality (UMC) carries out an evaluation every year called Census Evaluation in the area of mathematics; with all third and fourth grade students ECE(2018) is a standardized evaluation that the Ministry of Education has been carrying out, with the sole purpose of knowing how much they have learned from the competences and abilities that have been developed in the learning sessions by the teachers, in which the following results corresponding to the year 2018 were obtained, satisfactory we have the following 30.7% means that students are located in the expected achievement in process 40.7% means that students need greater accompaniment to achieve the expected achievement, in the beginning 19.3% higher priority must be given so that the student can advance to a process and with it reach an expected achievement and prior to the start we have the following evidence of 9.3%.

With respect to the year 2016 we perceive that there is a slight decrease in the levels of initiation, process evidencing an increase in the satisfactory level of the average measure in the results of the year 2018, this low performance has a weakness in the teachers they develop their activities with the traditional approach and do not handle didactic strategies in the development of the teaching of mathematics in students.
According to Silva (2018) in the training of primary education teachers there are many difficulties in their teaching, the disciplinary knowledge of the area of mathematics is not taken into account, nor is the use of didactic strategies as a result not used in the development of learning activities having as results students with difficulties in understanding the problems and therefore deficient achievement of learning. In our Region La Libertad teacher training is not launched is why the low results in the academic performance of students caused by the ignorance of didactic strategies by teachers Ticlia (2021 p.4) in the province of Sánchez Carrión, in the development of the activities carried out in the classrooms it has been observed that students have different problems, among them the displeasure towards the area of mathematics and specifically in using didactic processes for the development of problems, which has its origin in the inadequate teaching of teachers, deficient didactic strategies, little educational material for the area and lack of technology that motivates students to learn in a meaningful way. Also, Ticlia (2021) the use of didactic strategies in the development of mathematics learning sessions is very important for students to realize easily and meaningfully and therefore perfect student learning.

Similarly the Educational Institution 80468 is no stranger to the negative results related to the learning of the resolution of mathematical problems, since in the educational institution, the teaching and learning in the resolution of mathematical problems is deficient are not developed in students the competences, Solves problems of quantity, The competence of Solves problems of Regularity equivalence and change, the competence of Form movement and location and Management of data and uncertainty of the National Curriculum of Education (CNEB) and that these competences, respond to their interests and needs of the students; that is, to teach and learn to solve problems, it must be based on proposing to our students in each class session situations or problems that require them at all times to act autonomously and competently, as well as to act and think mathematically. For this reason, it has been believed that it is convenient to carry out the study of didactic strategies to improve the resolution of quantity problems in the area of mathematics. In this sense, the objective of the research was to determine to what extent the didactic strategies improve in the resolution of quantity problems in the primary students of an Educational Institution of Suyopampa, district of Tayabamba, Peru in the year 2021.

Methodology

The research was applied, with quasi-experimental design, quantitative approach. It was considered as a dependent variable: problem solving, which operationally led to the administration of a questionnaire of problem solving in mathematics, where the domain of translating quantities into numerical expressions was valued, communicates its understanding of numbers and operations, uses strategies and procedures of estimation and calculation, argues statements of numbers and operations, measured on a nominal scale. Variable Independiente: Didactic strategies, which operationally refers to the elaboration of a plan of strategies, development and evaluation, whose dimensions and indicators are: Design of the plan of heuristic strategies, planification of the learning sessions, and strategies with the use of information and communication technologies resources to raise and solve problems, strategies for problem solving and valoration of the strategies used in the learning process, measured on a nominal scale. A study population-sample was considered, made up of all EI primary students from N°.80468-Suyopampa and 30 students from EI 80425 from Quros-Tayabamba (Table 1).

Table 1
Study population-sample*, according to sex, 2021*

Gender	Fi	hi %
Women	36	48.0
Men	39	52.0
Total	75	100.0

In the present study the test was used as a technique, which according to Minedu, CEB-Peru, the evaluation is a systematic process in which relevant information is collected about the level of development of the competences in each student, in order to contribute opportunely to improve their learning, the technique described previously in the present research work was used to assess the problem-solving capacity in the students of the level primary of the educational institution N°. 80468 of the annex of Suyopampa, district of Tayabamba, province of Pataz. In terms of the instrument used in this research was, Pretest and Postest, the pretest.

Statistical analysis

For data analysis, non-parametric tests were used for longitudinal data (repeated measurements over time, case control group and experimental group) as described below (for details see Brunner et al. 2001):

Design F1-LD-F1

Suppose different groups of subjects are observed repeatedly at different times over time, and each group is randomly assigned a treatment (treatment 1, treatment 2, ..., treatment ata). In that case, the k-th subject in treatment i is observed on t occasions and the underlying statistical model of this design can be described by random vectors, with marginal distributions, for which independence is assumed. In that sense, the structure of this F1-LD-F1 design is shown in Table $\boldsymbol{X}_{ik} = (X_{ik1}, \dots, X_{ikt})', k = 1, \dots, n_i, i = 1, \dots, aX_{iks} \sim F_{is}, i = 1, \dots a; s = 1, \dots, t2$.

Table 2
F1-LD-F1 design and corresponding marginal distributions

			Data			Marginal distributions		
			Time			Time		
Factor A Treatment	Subject	Vector	$s = 1$	$\cdots$	$s = t$	$s = 1$	$\cdots$	$s = t$
i = 1	$k = 1$	X_{11}	X_{111}	$\cdots$	X_{11t}	F_{11}	$\cdots$	F_{1t}
	$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$
	$k = n_1$	X_{1n_1}	X_{1n_11}	$\cdots$	X_{1n_1t}	F_{11}	$\cdots$	F_{1t}
$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$
i = a	$k = 1$	X_{a1}	X_{a11}	$\cdots$	X_{a1t}	F_{a1}	$\cdots$	F_{at}
	$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$
	$k = n_a$	X_{an_a}	X_{an_a1}	$\cdots$	X_{an_at}	F_{a1}	$\cdots$	F_{at}

Source: Brunner et al. (2001)

In this experimental arrangement with longitudinal data, the treatment effects are described by the relative marginal effects, where is the weighted average of all the marginal distribution functions of the experiment and is the total number of observations (dependent and independent).$p_{is} = \int H dF_{is}\, H = N^{-1} \sum_{i=1}^{a} \sum_{s=1}^{t} n_i F_{is}\, N = t \sum_{i=1}^{a} n_i = t.n$).

A particular case of the F1-LD-F1 design (2x2 cross-over design)

Consider a study where the effect of two treatments (control and experimental group) is evaluated on the response of subjects in two time periods (Pre-test and Post-test), for which some routines were used in the nparLD package of R by non-parametric statistical analysis of longitudinal data (*WTS* and *ATS* statistics).

Results and Discussion

Table 3 shows the results of the non-parametric analysis (ANOVA-type statistic) for the study on didactic strategies and solving quantity problems in primary school students in Peru. The main question of this experiment is whether the time profiles of the two groups (control and experimental) are parallel, that is, if there is a statistically significant interaction between the group (treatment) and time (pre-test and post-test). The results suggest that there is a statistically significant interaction ($p < 0.05$) between the group and time in relation to the four characteristic dimensions of the didactic strategies: Design of the plan of heuristic strategies, planification of the learning sessions, and strategies with the use of information and communication technologies resources to raise and solve problems, strategies for problem solving and valoration of the strategies used in the learning process. The absence of such interaction would be indicated by parallel time profiles. In this sense, Figures 1-4 show that the profiles of the relative marginal effects related to thep_{is} four characteristic dimensions of the didactic strategies are not parallel, which coincides with the results of the ANOVA-type statistic. These results suggest that there are significant differences ($p < 0.05$) between the results obtained by both groups (control group and experimental group) in relation to the four characteristic dimensions of the didactic strategies (design of the plan of heuristic strategies, planification of the learning sessions, and strategies with the use of information and communication technologies resources to pose and solve problems, strategies for problem solving and valoration of strategies used in the learning process) in the study on didactic strategies and problem solving of quantity in primary school students in Peru.

Table 3
Non-parametric test statistics for a study on didactic strategies and quantity problem solving in primary school students in Peru

Factor (Didactic strategies)	*P* value associated with the ANOVA-type test statistic			
	Dimensions			
	Design of the heuristic strategy plan (D1)	Planification of learning sessions(D2)	Strategies with the use of information and communication technology resources to raise and solve problems(D3)	Strategies for problem solving and assessment of the strategies used in the learning process (D4)
Factor (Control-experimental group)	1.875905×10^{-05}	1.109991×10^{-09}	7.529502×10^{-07}	3.859203×10^{-14}
Time (Pre-test and Post-test)	3.18165×10^{-73}	2.411809×10^{-41}	5.810772×10^{-43}	1.785986×10^{-25}
Factor x time	3.475394×10^{-74}	1.539540×10^{-26}	3.412413×10^{-29}	4.236904×10^{-07}

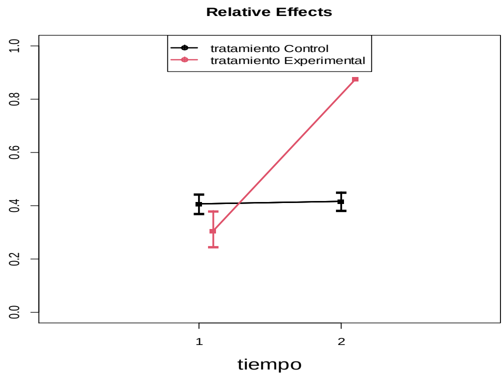

Figure 1. Graphs of 95% confidence intervals for effects p_{is} related to the design dimension of the heuristic strategy plan in a study on didactic strategies and quantity problem solving in primary school students in Peru.

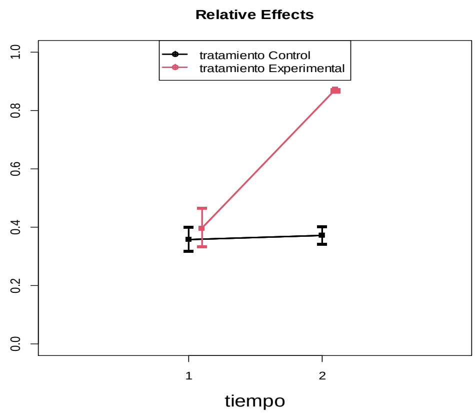

Figure 2. Graphs of 95% confidence intervals for effects p_{is} related to the planification dimension of learning sessions in a study on didactic strategies and quantity problem solving in primary education students in Peru

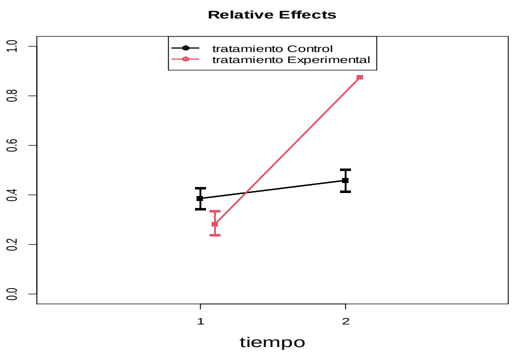

Figure 3. Graphs of 95% confidence intervals for effects p_{is} related to the strategy dimension with the use of information and communication technology resources to pose and solve problems in a study on didactic strategies and solving quantity problems in primary education students in Peru

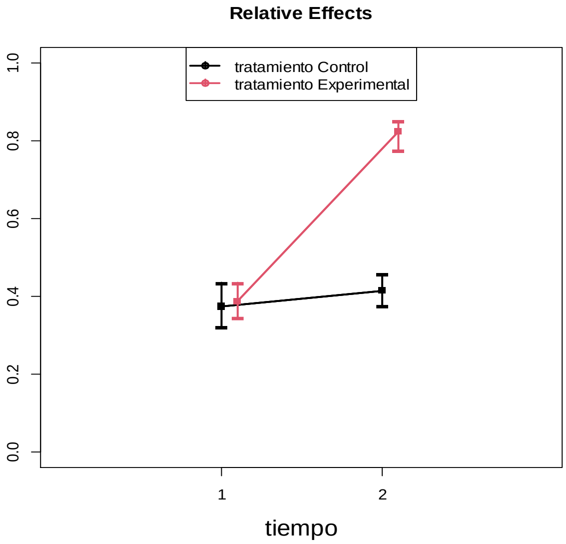

Figure 4. Graphs of 95% confidence intervals for the effects p_{is} related to the strategies dimension for problem solving and assessment of the strategies used in the learning process in a study on didactic strategies and quantity problem solving in primary education students in Peru

Conclusions

It was evidenced that there are significant differences between the results obtained by both groups (control group and experimental group) in relation to the four characteristic dimensions of the didactic strategies (design of the plan of heuristic strategies, planification of the learning sessions, and strategies with the use of information and communication technologies resources to raise and solve problems, strategies for problem solving and valoration of the strategies used in the learning process). In this way, the relationship between didactic strategies and solving quantity problems in primary school students in Peru is demonstrated.

Apéndice

Code R for the non-parametric analysis of a study on didactic strategies and solving quantity problems in primary school students in Peru.

```
library(RODBC)
canalexcel<-odbcConnectExcel2007("C:/Users/Documents/Data.xlsx")
sqlTables(canalexcel)
datos<-data.frame(sqlFetch(canalexcel,"Hoja1"))
datos
d1_pre_t_control<-datos$d4_Pre_Test[1:30]
d1_pre_t_control
d1_pos_t_control<-datos$d4_Post_Test[1:30]
d1_pos_t_control
d1_pre_t_experimental<-datos$d4_Pre_Test[31:60]
d1_pre_t_experimental
```

```
d1_pos_t_experimental<-datos$d4_Post_Test[31:60]
d1_pos_t_experimental
datos.f<-
data.frame(d1_pre_t_control,d1_pos_t_control,d1_pre_t_experimental,d1_pos_t_ex
perimental)
datos.f
library("nparLD")
D4<-
c(d1_pre_t_control,d1_pos_t_control,d1_pre_t_experimental,d1_pos_t_experimenta
l)
D4
ue<-c(rep(1:length(d1_pre_t_control),4))
tiempo<-c(rep(1,length(d1_pre_t_control)),rep(2,length(d1_pre_t_control)))
tratamiento<-
c(rep("Control",2*length(d1_pre_t_control)),rep("Experimental",2*length(d1_pre_t_c
ontrol)))
data.ci<-data.frame(D4,tratamiento,tiempo,ue)
data.ci
boxplot(D4 ~ tratamiento * tiempo, data = data.ci, names = FALSE,col = c("grey",
2), lwd = 2)
axis(1, at = 1.5, labels = "Pre-test", font = 2, cex = 2)
axis(1, at = 3.5, labels = "Post-test", font = 2,cex = 2)
legend(1, 5, c("Control", "Experimental"), lwd = c(3, 3),col = c("grey", 2), cex = 1)
ex.f1f1np <- nparLD(D4~ tiempo*tratamiento, data = data.ci,subject = "ue",
description = FALSE)
summary(ex.f1f1np)
plot(ex.f1f1np)
```

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