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Cooperative learning for geometric notions in kids of 5-years-old in kindergarten

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ABSTRACT

Cooperative learning has become a fundamental teaching-learning strategy for the social construction of knowledge. This methodology is ideal for students at kindergarten in regions such as Latin America and the Caribbean, where the effects of learning poverty condition socioeconomic development. Therefore, the objective was to evaluate the incidence of cooperative learning in the teaching of geometry in 5-year-old students belonging to educational institutions of the kindergarten in the three natural regions of Peru. This was qualitative, descriptive-correlational research. Two data collection instruments were applied to 78 students who served as a sample. To analyze the relationship between the variables, Spearman's Rank-Order was used, which confirmed the positive relationship between them; therefore, the influence of incorporating this type of learning does have an impact on the logical development of children. Quality education with optimal learning strategies will lead these students in the future to a good level of performance in academic tests such as PISA.

Keywords: cooperative learning, geometric notion, education, learning strategies.

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INTRODUCTION

Education in Latin America and the Caribbean is no indifferent to the perceived poor quality of teaching (World Bank, 2021). This is reflected in aspects such as infrastructure, methodology, quality of teaching staff, and the inadequate use of learning strategies developed by institutions. The aforementioned demonstrates that teaching in the region is going through a crisis, especially in areas such as mathematics.

Given the following indicators of the spontaneous interest of children of the initial level in front of the evaluation of I1 Absence of intellectual curiosity that presents results of 33.07%, I2 Lack of astonishment before new situations with result 32.38% and I3 Absence of imagination with result of 21.54%, it is evident that it is necessary to develop programs that allow to develop in children a greater interest in discovering the usefulness of geometric notions that will be of routine application and consistent in their development and daily life (Vallejos, 2019)

The development of activities to improve the displacement capacity in children that allows them to achieve spatial relationship capacities is essential for their integral development of the child (Ayesta, 2019), this also occurs in daily life as well as a clear object in the situations of formation in different realities (García, 2018). In this sense, learning geometric notions becomes

a basic competence for students since it will allow calculations of surface and space (Cevallos, 2022).

Certainly, the teaching approach used in the first levels of education is the basis for future learning, since it should be oriented to develop students' logical skills. The development of these is important in the general education of kids since it encourages observation and interpretation, analysis, and understanding at an early age (León, Antilef & Ramírez, 2016).

Since mathematics is based on solving problems through algorithms and formulas which makes it difficult to explain in children, so the teaching of mathematics in Early Childhood Education should be limited to a minimum collection of simple tasks, under the epistemological principle focused on isolated and finished problem-solving techniques (Wilhelmi, 2008).

Currently, educational research in Latin America and the Caribbean has focused on the development of teaching-learning methodologies based on cooperative learning, since it generates in students the need to continue learning and at the same time reinforces the innate knowledge of each one of them. This idea is reinforced by comparative studies between different types of learning, where the results obtained on cooperative, competitive, and individualistic learning methods are contrasted. It strengthens the conception that cooperative learning generates better performance, positive relationships, and mental health (Johnson, J., Johnson, R. & Johnson, E., 1994).

It is important to point out that, when applying the cooperative learning method, it does not mean that there is an annulment of personal development; on the contrary, the resources, knowledge, and skills of each participant are better used, since it seeks the collective construction of knowledge. Therefore, with the incorporation of this teaching-learning technique, it is possible to achieve in kids, a positive interdependence, allowing them to socialize among group members and in general, provide them with the necessary tools to develop high academic performance (León, Casas & Ramírez, 2016). Currently, the incorporation of new methodologies in learning, lead teachers to include in their pedagogical structure, inclusive teaching, in order to generate that the student manages to develop in a personal, social, and professional field so that in the future they can confront new challenges (Herrada & Baños, 2018).

Since the birth of cooperativism, there was a close relationship between cooperative society and education, because it is considered as the basis of integral development (Mata, 2018); cooperative learning is an educational practice that has been carried out with great success in the last decades (Azorín, 2018). Therefore, it is considered to be a methodological tool capable of responding to the different needs presented by the societies of the 21st century.

The definitions of cooperative learning vary according to the approach with which it is observed, for example, if we talk about a conditional approach, it refers to the way of working together, with the condition that to achieve the objectives both members have to achieve their goals. As well as this type of approach there are four more types, which are focused on group work, relational, motivational, and inclusive (Azorín, 2018).

The incorporation of this learning in the classroom allows organizing activities in a way that generates academic and social experiences. According to Buriticá (as cited in Adams, 2013), basically, this occurs because this learning is centered on collective or group work, it is believed that by applying this method, students will be able to acquire and develop their skills. At the same time, this technique allows making better use of the tools to achieve academic objectives. Cooperative learning in kindergarten kids is the basis for them to learn to coexist and respect their peers as they acquire knowledge. The teachers' strategy to achieve this objective is to form small, diverse, and mixed groups in order to cause a harmonious coexistence among them.

The benefit of applying this methodology in 5-year-old kids is to generate a level of individual and collective responsibility since teamwork awakens in their empathy and commitment with their peers to achieve the solution to the problems. The improvement in the social skills of kids, makes them learn to generate an opinion, express it, and in turn manage to respect the point of view of each member of their team (Uranga-Alvídrez, Rentería-Soto & González-Ramos, 2016).

In addition, the implementation of cooperative learning in early childhood education allows children to think positively and to accept diversity more easily, because children from an early

age begin to develop different types of thinking. One of them is logical-mathematical, which develops from 7 or 8 months of age, with the recognition of the object, when the child is between 4 and 5 years old already recognizes a geometric figure despite the modifications that occur in the visual space (Rivera, 2018). According to the Ministry of Education in Peru (MINEDU) (as cited in Van, 1986), children in the first stage only recognized geometric figures by their shape or appearance generally. Perceiving figures by their sides, vertices, angles are not yet present in them. However, children can make graphic representations of what they perceive or observe.

That said, it is essential to reinforce the logical thinking that the kid has already acquired in the first years of life, the mathematical skills that they have will help them to manage situations logically, according to this, in a study performed in a kindergarten in Osorno - Chile, with 20 kids aged between 4 and 5 years, to observe the process of solving mathematical problems, during a program of mathematical logical relationship and quantification, with didactic techniques for problem-solving through play, it was observed that kids respond significantly to the questions when didactic strategies were applied to attract their attention, which allowed them to have a greater ability to concentrate during the solution of the problem.

The study also showed that the kids had certain skills to solve problems expressed orally, they understood the procedure of the activity, even though in some cases the results were not optimal, they analyzed other options through reasoning. The kids during the development of this program were able to relate number with quantity, when asked them "how many tires two cars have?", continuous games were applied to reach the solution to that question, acquiring skills and cognitive abilities during the solution (León. et al., 2016). In the Peruvian context, it has been observed that the educational system is aimed at developing an individualistic education. Teachers are generally focused on providing concrete answers to questions, but do not encourage scenarios where students can develop their potential.

To correct this situation, some educational institutions and teachers opted to include educational technologies as a strategy in the teaching-learning process, considering the benefits it would bring in terms of student motivation. However, it has been evidenced that it has been developed under a bad practice leading to a scenario further away from the expected because far from enriching the learning sessions, they have become a distractor between the teacher and the student, since it is still implemented under educational models that focus only on the teacher (Rojas Huerta, 2016).

This situation has brought consequences at the national level, which are reported in the evaluations of educational performance, for example, for the year 2018 the international student assessment program (PISA) showed that Peru ranked 64th in the ranking of knowledge concerning the area of reading, mathematics, and natural sciences. The score achieved although it is true it was better compared to the result obtained in 2015, there are still elements that need to be addressed to improve. The performance in the area of mathematics as reflected by said test, increased by 13 points with respect to the previous year, the areas of language and science also had an improvement, of between 3 and 7 points respectively (Peruvian Ministry of Education, 2018).

According to the previous statements, the question arises "Is there a relationship between cooperative learning and geometric notions in 5-year-old kids?" Therefore, the objective is to evaluate the incidence of cooperative learning in the teaching of geometry in 5-year-old students belonging to educational institutions of the initial level of the three natural regions of Peru (Coast, Highlands, and Amazon). To this end, it should be considered that the different educational indicators are usually influenced by the socioeconomic characteristics according to each region (MINEDU, 2016).

METHOD

To address this research, the quantitative paradigm was adopted, of descriptive - longitudinal scope, of pre-experimental design, to compare cooperative learning and geometric notions, employing a pre- and post-test.

Population and sample

The target population consisted of 5-year-old boys and girls from three kindergarten educational institutions geographically located in three natural regions of Peru. The institutions selected for the study were the "Institución Educativa Inicial 022 Unanue" in San Vicente of Cañete - Lima, "Divino Niño de Jesús" in Chupaca – Junín, and "Institución Educativa Inicial No. 243 Virgen de las Mercedes de Tushmo" in Pucallpa - Ucayali, belonging to the Coast, Highlands and Amazon, respectively. The sample was taken by the census in each institution, where 28 children were selected on the Coast, 26 in the Highlands, and 24 kids in Amazon.

Instruments

For the application of the research instrument, informed consent was obtained from the principals of the three educational institutions. The instruments used consisted of observation cards and a checklist, which is a descriptive instrument that evaluates the kids' abilities and knowledge, given that the observable behavior of the kids in an activity can be determined.

The indicators were the following: identify basic geometric shapes (triangle, circle and square), differentiate geometric figures (circle - square - square - triangle - triangle - circle - triangle), recognize geometric figures in objects in their environment (windows, sun, etc.), explore and reproduce presentations that can be produced by combining figures such as the Tangram and use figures such as the square, circle or triangle to create objects that arise from their imagination.

These indicators were assessed using three criteria, the first is expected achievement, which refers to when the student as evidence of the achievement of the expected learning in the determined time, the second is, in-process referring to when the student will be on the way to achieve the expected learning, for which they require accompaniment during a reasonable time to achieve it, and finally, start that is when the student is beginning to develop the expected learning or evidence difficulties for the development of these, needing more time of accompaniment and intervention of the teacher, according to their pace and learning style; these evaluation criteria are governed by the provisions of the Ministry of Education of Peru for kindergarten students in Peruvian territory (MINEDU, 2006).

The observation sheet is the instrument in which the kids' behaviors are systematically recorded in order to proceed to the evaluation of the information recorded. This sheet will allow us to evaluate the different learning styles of the kids of the institutions belonging to the study, the qualification of these will also be measured according to what is mentioned in the checklist.

Some of the indicators to evaluate are assume team responsibilities, show tolerance of the idea of other team members, share their knowledge with the other members of the team/classroom, they use the work material adequately and express their ideas clearly.

Both instruments should be reliable by means of Cronbach's Alpha Coefficient, to then be applied to the students belonging to the three initial education institutions that make up the study. Both instruments were applied in two stages (post - pretest). The first evaluation was in the first Bimester of 2019 and the last evaluation, according to the instruments, in the last Bimester of the same year.

Data treatment

The first step in the statistical analysis of the data will be the application of the Kolmogorov Smirnov test to determine the normality of the variables, cooperative learning, and geometric notions. Secondly, the relationship between the aforementioned variables will be tested by applying the Spearman's Rank-Order Coefficient, which should be calculated to determine the possible correlation between the variables and thus determine if there is a relationship with the incorporation of cooperative learning in the kindergarten institutions and the geometric notions of the kinds in the study.

FINDING AND DISCUSSION

The acquisition of knowledge occurs best in a cooperative learning environment, because all the actors in the class contribute directly or indirectly to increase the previously learned knowledge (de la Barra Var Treek, 2016)

This type of structure learning is focused on the pattern teacher-student and student-student as they work together to achieve the objectives established in the organization, stressing that this model of work environment in classrooms supports the development of an inclusive education, which allows all participants to receive a quality education.

Of the above, we can say that the key to the intellectual progress of the child is to have a model of learning appropriate to thread their knowledge and skills inherent logic; so, in advance will guarantee the results of the research carried out with children 5 years of age, that aims to know if there is really a relationship between the learning they receive, and the development of notions geometric.

The result of the validation of the instrument using Cronbach's Alpha gave us a 95.7% approval and validity of 98.6%, by means of the confirmatory construct method, given these favorable results we will begin to measure the influence of the study variables already aforementioned.

The evaluation of the first Bimester of 2019 shows that 9 kids are still in the kindergarten phase of geometric knowledge, at the same time, 17 of the kids are still incorporating to the cooperative working methodology (Table 1). It should be noted that 56.4 % of the kids in the studies have already developed some geometric notions, in terms of identification and figure differentiation (Table 2).

Table 1. Cooperative learning in kids of 5-years-old from kindergarten educational institutions – pretest.

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	Expected accomplishment	15	19.2	19.2	19.2
	In process	46	59	59	78.2
	Starting	17	21.8	21.8	100
Total		78	100	100	100

Source: Author's elaboration.

Table 2. Geometric notions in kids of 5-years-old from kindergarten educational institutions – pretest.

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	Expected accomplishment	25	32.1	32.1	32.1
	In process	44	56.4	56.4	88.5
	Starting	9	11.5	11.5	100
Total		78	100	100	100

Source: Author's elaboration.

In the correlation pretest of the study's variables were find a linear relation statistically significant, moderate, and directly proportional, between cooperative learning and geometric notion in kids of 5-years-old from kindergarten educational institutions ($rS = 0.395$, $p < 0.05$) (Table 3).

Table 3. Correlation test for the cooperative learning variable and geometric notion – pretest.

			Cooperative learning	Geometric notion
Spearman's Rank-Order	Cooperative learning -pretest	Correlation coefficient	1.000	.395**
		Sig (bilateral)		.000
		N	78	78
	Geometric notion - pretest	Correlation coefficient	.395**	1.000
		Sig (bilateral)	.000	
		N	78	78

Note: ** The correlation is relevant in the 0.01 level (bilateral).
Source: Author's elaboration.

On the other hand, when evaluating the last Bimester of 2019, to observe the changes made by the learning methodology development in the study population, the results were as follows according to the measurement instruments used.

Table 4 shows the consolidation of the variable "Cooperative learning" getting of the research made to the kids of 5-years-old from three educational institutions of kindergarten. The information analyzed of the observation sheet shows that the majority of the kids are still in process of incorporation of cooperative learning, 4 of them are recently participating in a classroom with this type of teaching and 35.9 % of the total are already learning of this model.

Table 4. Cooperative learning in kids of 5-years-old from kindergarten educational institutions – posttest.

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	Expected accomplishment	28	35.9	35.9	35.9
	In process	46	59.0	59.0	94.9
	Starting	4	5.1	5.1	100
Total		78	100	100	100

Source: Author's elaboration.

As a result of the net evolutionary process of children in different areas of knowledge, their reasoning ability of each individual is significant since they can relate geometric figures and compare numbers.

Based on the premise expressed above, we will analyze the geometric notions held by the kids in this study. According to the information from the checklist (Table 5), 43.6% of the kids who participated in the study have notions related to geometry, 5.1% of the total number of surveyed aforementioned are in their kindergarten corresponding to the variable geometric notions.

Table 5. Geometric notions in kids of 5-years-old from kindergarten educational institutions – posttest.

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	Expected accomplishment	34	43.6	43.6	43.6
	In process	40	51.3	51.3	94.9
	Starting	4	5.1	5.1	100
Total		78	100	100	100

Source: Author's elaboration.

When making a general comparison of both variables (Figure 1), the most outstanding percentages in terms of the geometric notions that the kids in the study have, 19.23% of the 78 kids in the kindergarten institutions are already developing this knowledge; in second place, the Highland region comes out with 19.23% of the process of acquiring the basic notions of geometry.

As for the cooperative learning methodology, 12.82% are already implemented in the Coast and Highland regions, respectively. In the Amazon region of our country, this methodology has not yet been incorporated as in the other regions, 19.23% are still implementing this methodology in their classrooms.

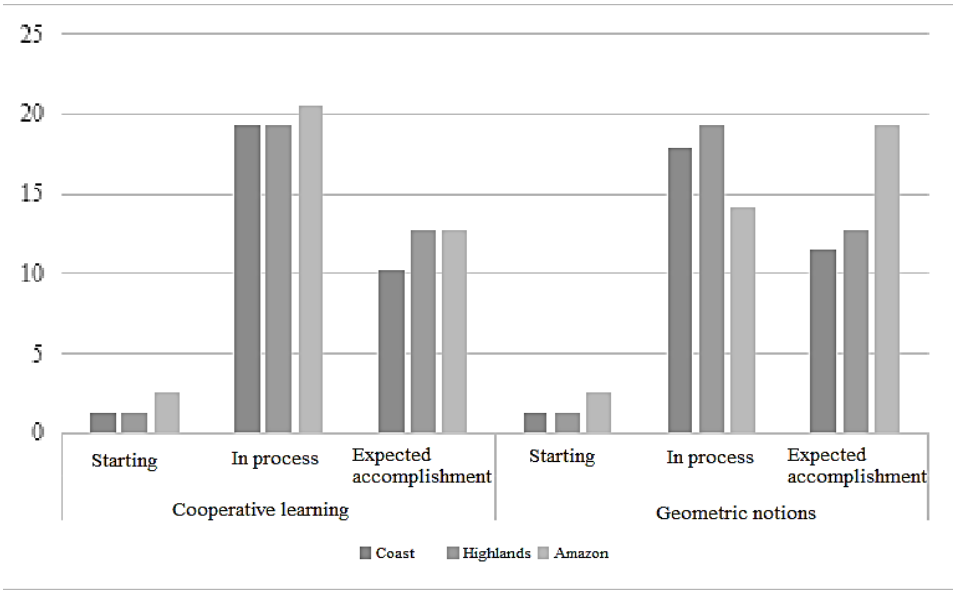

Figure 1. Comparison Variables (Source: Author's elaboration)

Finally, when analyzing Table 6, we observe that an optimal level of correlation is established between the variables (0.830), this being a value close to 1. On the other hand, we can affirm that there is a very strong positive correlation between them, i.e., the two study variables increase at the same time, as long as cooperative learning teaching is implemented in more kindergartens, children will be able to better develop the geometric notions they bring from home.

Table 6. Correlation test for the cooperative learning variable and geometric notion – posttest.

			Cooperative learning	**Geometric notions**
Spearman's Rank-Order	Cooperative learning - Pretest	Correlation coefficient	1.000	.830**
		Sig (bilateral)		.000
		N	78	78
	Geometric notions - pretest	Correlation coefficient	.830**	1.000
		Sig (bilateral)	.000	
		N	78	78

Note: ** The correlation is relevant in the 0.01 level (bilateral).
Source: Author's elaboration.

As for the significance level of the test, we observed that it yielded a p-value of 0.000, which indicates that there is a real relationship between the variables (p-value < 0.01 or p-value < 0.05). From a general point of view, there is no doubt that there is no direct relationship between cooperative learning and the knowledge acquired by students, as far as logical development is concerned, the support is being given to make up for the deficiency originated by the poor structuring of education. While it is true that kids already have certain notions about geometry, it is in the form of education to reinforce the knowledge to allow students to develop their capabilities to the maximum.

DISCUSSION

The implementation of cooperative learning consists of a training situation in which two or more people try to learn something together, contributing directly or indirectly to the increase of knowledge; For the case studied, this model allows to achieve expected parameters, even when this type of training structure focuses on the achievement of objectives, developing an inclusive education that allows sharing experiences, making collaborative learning more interesting, allowing a retention of information at high levels.

It can be affirmed that the results are satisfactorily superior to those found in the analysis of the reference, with respect to I1 Absence of intellectual curiosity that presents results of 33.07%, I2 Lack of astonishment before new situations with result 32.38% and I3 Absence of imagination with result of 21.54%, (Vallejos, 2019), so it is affirmed that the collaborative learning model for geometry in children of 5 years is favorable.

On the other hand, the commonly taught learning model follows the same formula, based on teachers having control and students are receptive, preventing the development of creativity, directly impacting the student's abilities and skills, needing a transformation to provide opportunities to grow by themselves, however this could be reversed through the use of teamwork techniques and integration practices. .

Table 1 and 2 show an education that follows the usual pattern of teaching, which is reflected in the evaluation of the first two months, which shows that 9 children of the total sample are in the initial phase in geometric notions, and in the same phase, 17 children perform collaborative learning. But what would happen if a methodical change was made in pedagogical activity? As a response and contrast with the above, we have the evaluation of the last two months of 2019, where the changes made in the development of the training methodology were observed, having the consolidation of collaborative learning.

Table 4 details the change, showing a strengthening of cooperative learning since it went from having 15 students in learning achievement to 28, in addition to the evolutionary process in geometric notions, in addition to the fact that now only 4 students need teacher accompaniment, and in Table 5, we must 43. 6% of the total sample has a consolidated geometric knowledge; the changes detailed above are supported by the study of Muñoz and Cordero (2017) who point out that with the application of this methodology several positive results are obtained, among which an inclusive participation in all activities and the promotion of positive multicultural relationships stand out.

CONCLUSION

The traditional learning that was implemented years ago in schools, only generated a delay in the progress of the children's skills and abilities, by receiving a teaching centered on the teachers, annulling the intention of the full advancement of the child, so, some of them showed insecurity, due to the individualistic way of working bringing shyness and low self-esteem.

The cases selected as evidence of the existing problem due to the lack of better standards in the interest of children towards the conforming elements of the teaching process, which show higher levels in the application of the collaborative learning model for geometry in children of 5 years is favorable and therefore of necessary application to achieve better standards.

The incorporation of a good learning methodology in kindergartens would open the possibility of a quality education, which would strengthen the innate knowledge of children. Cooperative learning is one of the techniques that would undoubtedly contribute to the educational, social, personal and performance of children, since its way of working covers many areas that currently have difficulties.

In relation to the general objective, by means of Spearman's rank order coefficient it has been determined that cooperative learning correlates in linear dependence with the geometric notions that 5-year-old children have, belonging to kindergarten educational institutions in the three natural regions of the country, in which it was possible to optimize and decrease the difficulties they had when passing from one level to another; therefore, it is a strategy that allowed children to develop without major difficulty, fostering in them the idea of continuous learning. A similar case occurred in a study conducted in Chile, where it was confirmed that the importance

of motivating attention is the main source for the development of activities, this whole process led to children being able to solve problems more fluently (León, A., Casas, J., & Restrepo, G., 2016).

The incorporation of this learning methodology in the classroom contributes to the development of teachers' competence, since they have more tools to impart knowledge, in addition Muñoz and Cordero (2017) point out that it allows proper communication in the way of working, tending an applied structure of teacher-student and student-student type developing reasoning and critical thinking, when children work in groups, exploring new knowledge.

In that sense with the present research, it was possible to determine that, thanks to the cooperative learning put into practice, the level of geometric notions improved, so that, more than half of the students in the second evaluation are in an intermediate learning process, turning the students into the protagonists of their own training process, developing analysis skills, assuming an active role allowing their involvement in how they do it and in the results they achieve.

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