

Mobile Adventure: RIAMOS to Strengthen the Development of Mathematical Logic and Language in Early Education in Rural Contexts

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Abstract

In the development of the substantive function of the link with society of the National University of Education (UNAE), the Mobile Adventure: RIAMOS project arises from the career of Early Childhood Education (EI), with the aim of building experiential learning experiences, from educational contexts that promote the comprehensive training of children in early childhood in rural contexts. Therefore, this research analyses the impact of Aventura Móvil: RIAMOS on the development of the areas of logical-mathematical relations, comprehension and expression of language in early education in rural contexts. We worked with a methodology based on a mixed approach, with a prevalence of a qualitative, descriptive and interpretative approach and a quantitative approach focused on the pre- and post-tests applied to children in rural parishes in Cañar and Azuay. Mobile Adventure: RIAMOS is a space that integrates different actors: students, parents, authorities, teachers, students in training for comprehensive education. Through the pre-test, educational needs were identified, which were strengthened throughout the class sessions through the implementation of innovative planning, relevant to reality. The post-test reflected the advances and progress made by each child with the application of the didactic strategies and activities. In summary, Mobile Adventure: RIAMOS proves to be an effective initiative to enhance the reinforcement and integral learning of children in rural environments.

Keywords: *Mobile Adventure, Educational Contexts, Learning Experiences, Mathematical Logic, Language.*

Introduction

In contemporary society, education faces a variety of challenges that have a positive or negative impact on the education of individuals. Access to education in rural contexts, from an early age, presents a series of technical, administrative, access and quality difficulties in contrast to education in urban contexts (Olmedo-Neri, 2022). The elements constantly enunciated are questioned and implied in the noble task of education to build a fair, equitable, inclusive and intercultural society, with emphasis on values, principles, development of competencies and skills, as well as respect for the rights and duties of each individual. To this end, the decentralisation of education from urban to rural areas is essential to reduce these gaps (Erreyes-Toledo and Álvarez-Lozano, 2021).

In this line, the importance of promoting education from the early ages of children is fundamental, as it fosters comprehensive training and lays the foundations for the academic, personal and professional success of individuals. During the first years of life, children go through a crucial stage for their growth and learning; therefore, it is important to develop various skills and competencies that will be useful throughout their lives. According to Sánchez Morales (2020), families play an essential role in the integral formation of children from an early age, as they contribute with their affective bond and their commitment to the development of skills and competences that are indispensable for the years to come. However, the influence of technologies and scientific advances demands that teachers, students and other actors take on challenges that require their commitment, responsibility and involvement in academic progress.

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Early childhood education should focus on strengthening brain development, as this is a time of rapid neural connections. This has a significant impact on the development of emotional, social and cognitive dimensions, which in turn translates into progress in language, logical-mathematical thinking and abstraction skills.

Therefore, a holistic education during these years involves creating stimulating and nurturing environments for the successful growth and development of the child (Papalia et al., 2009).

In this sense, early education in rural contexts is complex, due to the difficulty of accessing initial training centres and the fact that its positive impact on the infant's growth is not valued, which is why it is important to promote early childhood education that caters to rural contexts, in such a way that it enhances the development of children's problem-solving skills, creativity, coexistence, numerical thinking and literacy, since these skills will contribute to academic success and will give them a head start in their academic development.

For its part, the National University of Education UNAE, as a public institution dedicated to the training of professionals in the broad field of education, among one of the basic principles of its Pedagogical Model that govern the structure and design of the curriculum, highlights: "The priority of social commitment" that integrates the most relevant professional knowledge with service to the community, i.e. the linking of academia with the situations present in different contexts and therefore highlights the active methodology of "learning and service" as a process that addresses the needs of social realities (Universidad Nacional de Educación, 2017).

Therefore, one of the essential functions of higher education, and underlined by the UNAE, is the link with society. According to its Strategic Plan for Institutional Development 2023 - 2026, this is conceived as an element that is articulated with teaching, complementing theory with practice through reflective and experiential experiences. It is also integrated with research by allowing the identification of situations that feed back into research projects, promoting both scientific knowledge and ancestral knowledge. Its main objective is to promote the transfer of knowledge through the management of quality processes, thus seeking the sustainable development of the most vulnerable groups in social contexts (National University of Education, 2023).

Mobile Adventure: RIAMOS As a Response to Rural Contexts

Thus, within the UNAE's links with society, one of the projects that are being implemented from March 2023 to March 2025 is the Mobile Adventure: RIAMOS, with transcendence in the rural parishes of the province of Cañar and Azuay, whose objective is to provide early education, face-to-face, reaching the homes of children who do not have the possibility of accessing training focused on the development of mathematical logic and language. All this through a mobile classroom equipped with resources, didactic materials and with the human resources of the students in training and the teachers of the UNAE assigned to the project, who make it possible for education to reach the territory and specifically the most vulnerable groups of society.

The impact of Aventura Móvil: RIAMOS in rural contexts is significant and essential, as it contributes to the democratisation of initial education. In addition, it is committed to education from an early age, in which everyone has the opportunity to enhance their skills and competencies, from the contexts in which they find themselves. On the other hand, it contributes to the inclusion of key actors in the educational process, such as parents, neighbourhood leaders and authorities, who assume a social commitment and become involved in community processes and situations. According to studies by Álvarez-Álvarez et al. (2020), it is estimated that rural contexts are favourable spaces for the application of different methodologies and coexistence among students. Many curriculum contents can be adapted to the demands of the context. It has been observed that families collaborate and get involved in their children's education, and students show good behaviour.

Mobile Adventure: RIAMOS with a focus on teaching and learning processes

Aventura Móvil: RIAMOS aims to: build experiential learning experiences from educational contexts through the use of relevant and innovative didactic resources, the implementation of active methodologies, contributing to early childhood education in the areas of child development: communication and language, and mathematical logic. The direct beneficiaries of the project are infants living in rural areas of Cañar and Azuay, where education is not accessible, and the indirect beneficiaries are parents, authorities, neighbourhood leaders and communities in general.

Mobile Adventure: RIAMOS Focused on Communication and Language Development

With regard to the communication and language component, which is essential for the oral and written expression of infants, work is done with songs, rhymes, readings, drama games, imitation, narratives, stories, vocabulary games, word association, conversations, listening and following instructions. In this way, inclusion, interculturality and appreciation of the resources offered by the environment are promoted. In this sense, Villa and Blanco (2023) emphasise that communication is fundamental for establishing relationships with the environment, developing social connections, managing emotions, understanding feelings and strengthening self- concept. Therefore, the teacher must employ a variety of strategies that recognise the needs of the students, their level of learning and the context.

Mobile Adventure: RIAMOS Focused on the Development of Mathematical Logic

In the development of mathematical logic, activities are used that involve classification, categorisation, puzzles, construction games, counting, quantity association, memory, attention and comparison, as well as the exploration of shapes, figures, patterns and sequences. In this process, the student is the protagonist and the activities are adapted to his or her individual needs. According to studies by Díaz- Jiménez (2023), it is crucial for children to experience a variety of playful and natural situations in order to develop mathematical notions that are fundamental for their later education. Therefore, the teacher should encourage children's autonomy in problem solving, stimulate their interest, motivation and freedom to express ideas, which will contribute to the development of mathematical logical thinking.

Therefore, the present study aims to analyse the impact of Aventura Móvil: RIAMOS on the development of mathematical logic and language in early education in rural contexts, with the participation of children, students in training, UNAE teachers, families and authorities. In this line, Yacsahuache et al. (2021) emphasise that mothers, specialists, teachers, community members are indispensable for the academic progress of learners, the promotion of social interaction, the development of confidence, security and cognitive aspects.

Materials and Methods

This research presented a mixed approach in which the qualitative research focused on the descriptive and interpretative and the quantitative research focused on the pre- and post-test with the identification of needs and potentials in the areas of child development: communication and language, and logical-mathematical. Therefore, from the perspective of Hernández-Sampieri and Mendoza (2020), mixed methods are executed according to different circumstances and sequences, in some cases the qualitative precedes the quantitative or vice versa, or such is the case that they can be developed simultaneously with the merging of processes and stages from the beginning and throughout the research.

A mixed approach allows for a better study of the reality to be observed, i.e. they complement each other, enhancing the research. In the words of Viruez-Valverde (2020) "The mixed approach means not to remain with a unidimensional definition of the object of study and to assume an equally pluralistic approach" (p. 81), that is, to study the object from multiple perspectives. The quantitative approach provided reliability and the qualitative approach allowed for an important contextualisation and characterisation of the observed phenomenon (Olmedo-Neri, 2022), essential characteristics for this research.

Population

The research study involved 81 children from 2 to 4 years of age from rural contexts in the province of Cañar, Azuay, and 14 student trainees from the Early Childhood Education course at the National University of Education UNAE, whose data are organised in the following table:

Table 1. Students Participating in the Project

Parishes	Quantity	Percentage
Berries	10	12,5 %
Guapán	12	15 %
Luis Cordero	9	11 %
Cojitambo	18	22 %
Déleg	9	11 %
Llacao	9	11 %
Nazareth	14	17,5 %
Total	81	100 %

Source: RIAMOS Project

Prepared by: Researchers

Techniques and Instruments

Within the framework of this research, the observation technique was chosen as a fundamental tool for the study. Specifically, structured observation was used, which was supported by the use of instruments such as the observation guide. This meticulously designed guide is characterised by the use of predefined categories that allow data to be obtained in a controlled, classified and systematic manner. By implementing this mixed approach, it was possible to acquire detailed and specific information about the reality studied. Accurate diagnoses were generated on the different aspects observed, as well as the development of intervention models based on solid empirical data. According to Campos and Covarrubias (2012, p. 51), structured observation is a valuable tool for research, as it offers the possibility of obtaining concrete and reliable data that support the analyses and conclusions of the study.

The diagnostic sheet, an estimation scale selected because of the nature of the population observed, composed of children aged three to five years, was used as an instrument. This choice is justified by its ability to allow the educator to assess specific situations and topics (Landry, 2005). In order to evaluate the didactic experiences implemented in the mobile classroom, this instrument was used both before the interventions, as a pre-test, and at the end of the interventions, as a post-test. It should be noted that these didactic experiences were previously planned by the student interns and reviewed by the teachers who were members of the project, ensuring their suitability for implementation with the children in the mobile classroom space.

The instrument focused on observing the learning domains: verbal and non-verbal language, and logical-mathematical relations of the 2014 Ecuadorian Early Education Curriculum. It separates the skills to be observed into four ages: 24 months and 16 days to 36 months and 15 days, 36 months and 16 days to 48 months and 15 days, 48 months and 16 days to 60 months and 15 days, and 60 months and 16 days to 71 months and 15 days. It is rated as follows: 1 Does not achieve, 2 In progress and 3 Mastered the achievement.

Procedure

The Social Outreach Project: Mobile Adventure: RIAMOS develops intervention activities in rural contexts of Cañar and Azuay, specifically in the parishes of Bayas, Guapán, Luis Cordero, Cojitambo, Déleg, Llaqueo, Nazón, prior to the intervention in each sector an approach was made with the authorities of the parish in

which commitments are reached on the part of the university and part of the context, These commitments are reflected in the care of the mobile classroom, the invitation of the children to be beneficiaries for two days a week, one hour a day, the time of permanence of the mobile classroom is one month in the sector.

At the beginning of the sessions, a pre-test was applied to the children to identify the previous conditions of the children, which are the references for the adaptation of strategies, methodologies and activities to the reality of the infants. In the last session, a post-test was applied to the children to indicate the improvement and progress of the students in the areas of child development: communication and language, and mathematical logic. In addition, a workshop was held with parents to discuss the progress made and some strategies to continue reinforcing the aforementioned areas and skills at home.

Results and Discussion

The Mobile Adventure Linking Project: RIAMOS is positioned as a space that promotes improvements in the teaching-learning processes of children in rural contexts. To begin with, an approach is made with the competent institution in the parish where the intervention is planned to be carried out, following a previously agreed schedule.

In this context, the Mobile Adventure: RIAMOS project travelled to different rural contexts in the provinces of Azuay and Cañar, such as Cojitambo, Guapán, Luis Cordero, Nazón, Déleg, Bayas and Llaqueo. Interventions aimed at children with identified needs were carried out in coordination with the parish autonomous decentralised governments (GAD) and in collaboration with the sector's teachers who work directly with the children. These teachers belong both to the regular education system and to specific rural programmes, such as Creciendo con Nuestros Hijos (C.N.H.) and the Servicio de Atención Familiar para la Primera Infancia (S.A.F.P.I.).

It is established that the interventions are carried out in specific areas that are worked on in Early Childhood Education (ECE): logical mathematics and verbal and non-verbal language, this approach obeys certain requirements that have been established in previous discussions with the agents who are in direct contact with the children mentioned in the previous paragraph.

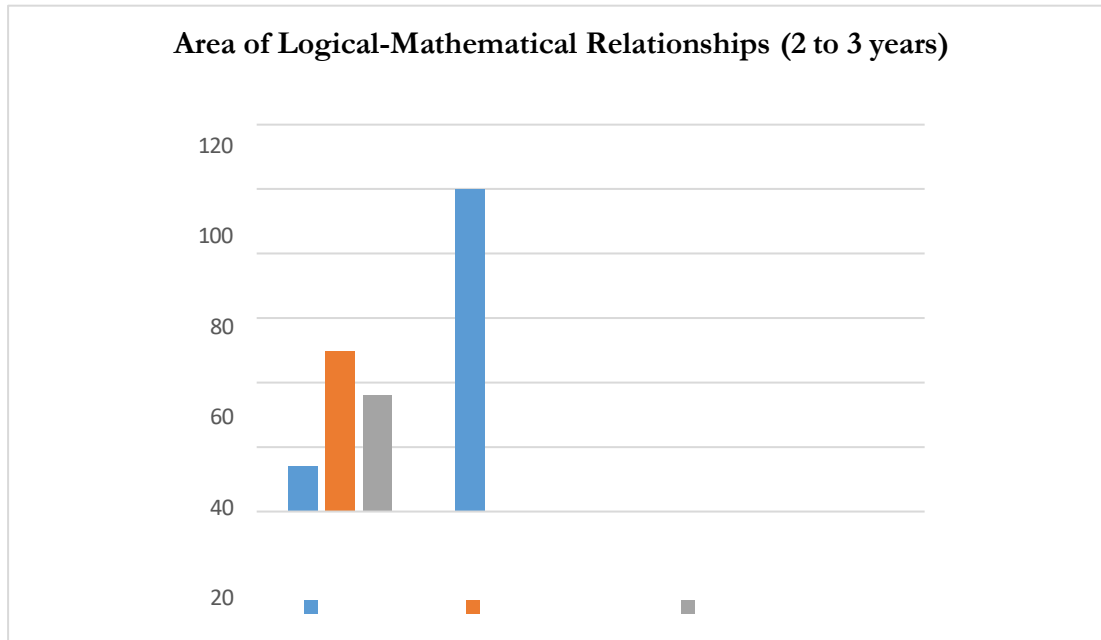
In this sense, based on the skills taken from the EI curriculum in relation to the construction of number and space, form and measure. For the authors Cardoso and Cerecedo (2008), the development of numerical competence in early childhood involves the ability to create relationships of numbers, space, shapes, logically and with the ability to express them with language, always bearing in mind the cultural relevance of infants for this process. In this sense, the process carried out within the didactic experiences of the RIAMOS project are fulfilled, the skills of grouping and recognition of objects, constructions from models, spatial notions, association of shapes and logic were diagnosed; with sessions and didactic material planned specifically for the group of infants observed, bearing in mind their context.

In the development of verbal and non-verbal language, the focus was on oral expression, lexical development through the ability to acquire new words, semantic development through the discovery of the meaning of new words and pragmatics through the appropriate use of words in context, given that "there is consensus that the fundamental interest of the educational process in early childhood should be centred on preparing children from and for life" (Ramírez-Téllez et al., 2023, p. 72).

With regard to the interventions, work was carried out with children with educational needs in the areas of mathematical logic and verbal and non-verbal language. In addition, interventions were carried out by age,

taking into account their cognitive and pedagogical development with the aim of distributing skills and abilities appropriately by age group.

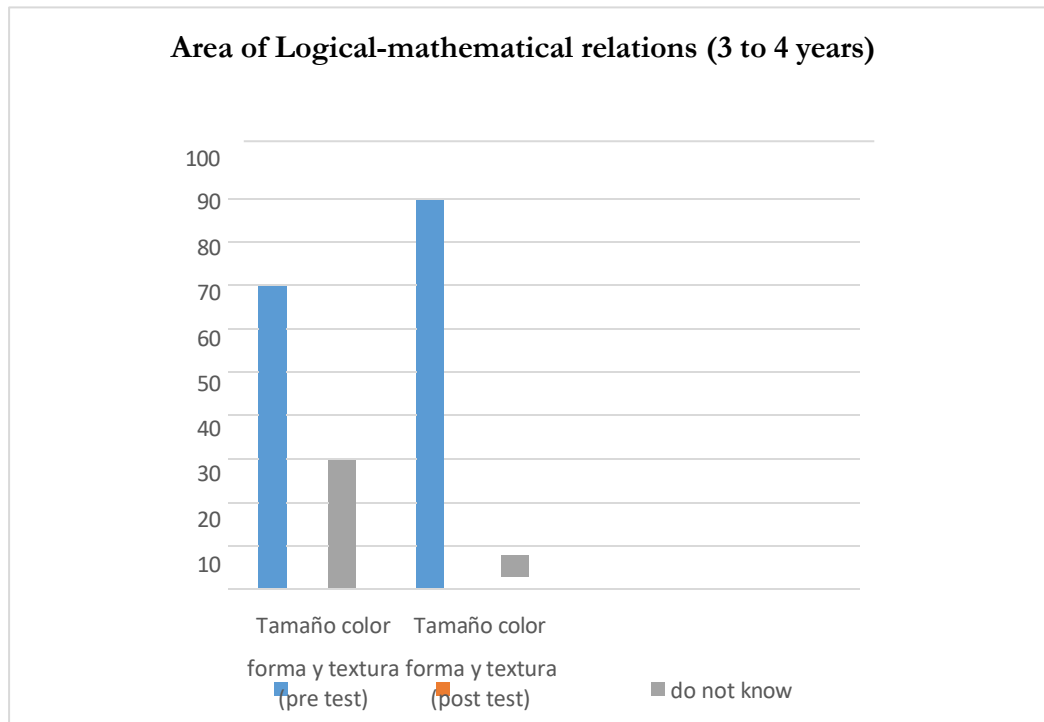
Figure 1. Area of Logical-Mathematical Relations: Size, Colour and Shape



Source: Mobile Adventure Project: RIAMOS

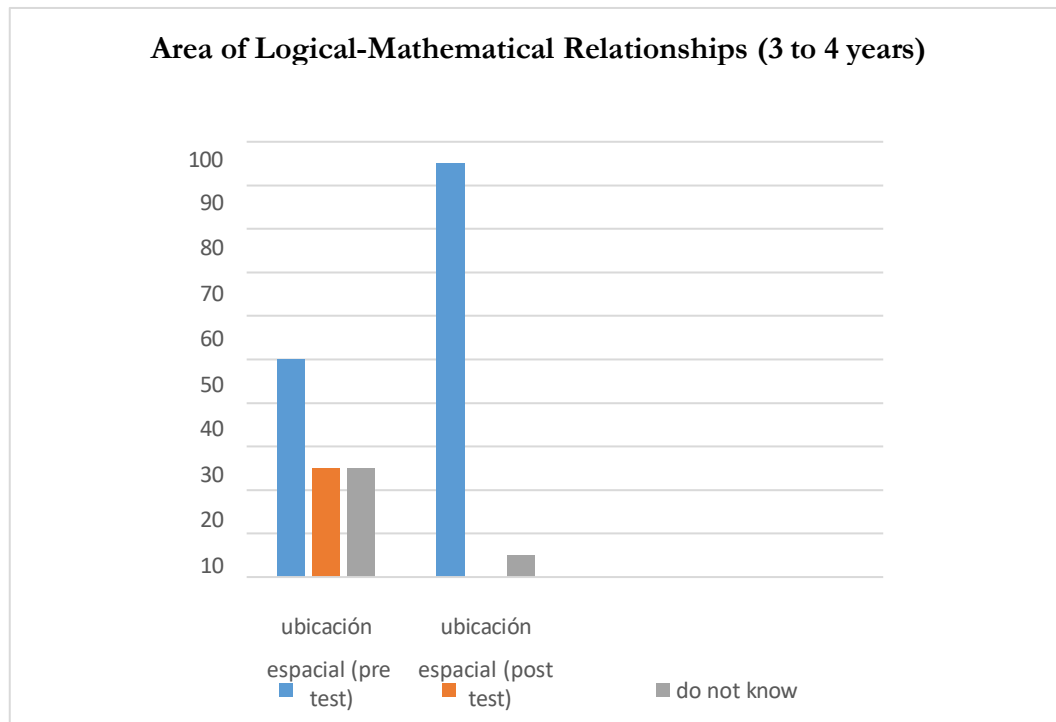
In fact, in relation to the pre-test in the 2 to 3 year-old age group, 14% of the population under intervention showed that in relation to the area of logical- mathematical relations, 50% had little knowledge of the skills, as they did not recognise objects by their size, colour and shape in 36% and 14% had knowledge. Similarly, the construction of the models was not done and they were engaged in another activity. In relation to the location of the objects, the children only pointed to the place where the object was located. Finally, we can see that the infants did not have a developed language and, therefore, it was difficult for them to communicate.

With regard to the post-test, it was found that the children were able to identify the colours yellow, blue and red adequately. Also, in relation to the location of an object, they were able to identify up and down and finally, with regard to the construction of a model, the children did not manage to complete the tower of glasses, although they tried to do so in comparison with the first one, which they did not even touch the materials.

*Logical-Mathematical Relations: Size, Colour, Shape and Texture***Figure 2.** Logical-Mathematical Relations: Size, Colour, Shape and Texture.

Source: Mobile Adventure Project: RIAMOS

In the 3 to 4 year-old group, which represents 58% of the population in rural contexts, different results were observed. In the pre-test, it was found that 70% of the children were able to recognise objects by their colour, shape, size and texture, while the remaining 30% had difficulties in identifying them, or did not know them at all. Subsequently, they were asked to make constructions following a model, but none of them succeeded. In the post-test it was observed that most of the children were able to identify colours, shape, size and texture.

Figure 3. Area Of Mathematical Logical Relationships: Spatial Location

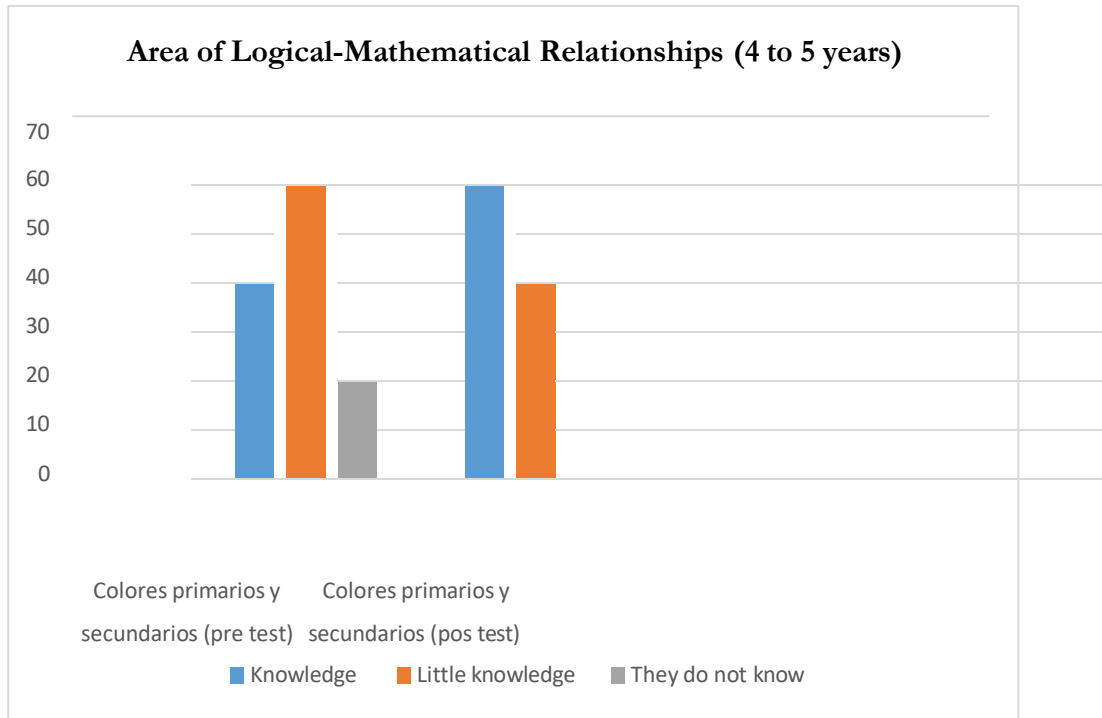
Source: Mobile Adventure Project: RIAMOS

In terms of spatial notions, 50% were able to recognise the location of objects, 25% could only identify two notions (up/down) and the other 25% could not identify any. In the post-test, significant progress was observed in the ability to replicate the constructions given as models, although not all were able to do so in their entirety.

During the activities, objects of different colours, shapes and sizes were presented, followed by questions such as: "What colour is it?", "What shape is it?", and "Is it big or small?". The objects were also sorted by colour, using balloons, and by size, with the help of didactic material. For the model constructions, Lego puzzle pieces were used, and for the recognition of spatial notions, didactic material with images of a tree and a house was used.

The children showed great interest in the mobile classroom activities, which allowed us to establish closer communication with them and to get to know their context better.

This facilitated educational actions such as storytelling, group and individual games and activities, enriching their knowledge with stimulating materials such as balloons, blackboards, puzzles and stories. After becoming familiar with the environment, the children participated enthusiastically in the activities, which reflects a positive evolution in their attitudes and behaviour, generating enriching norms of coexistence.

Figure 4. Area of Logical-Mathematical Relationships: Primary and Secondary Colours

Source: Mobile Adventure Project: RIAMOS

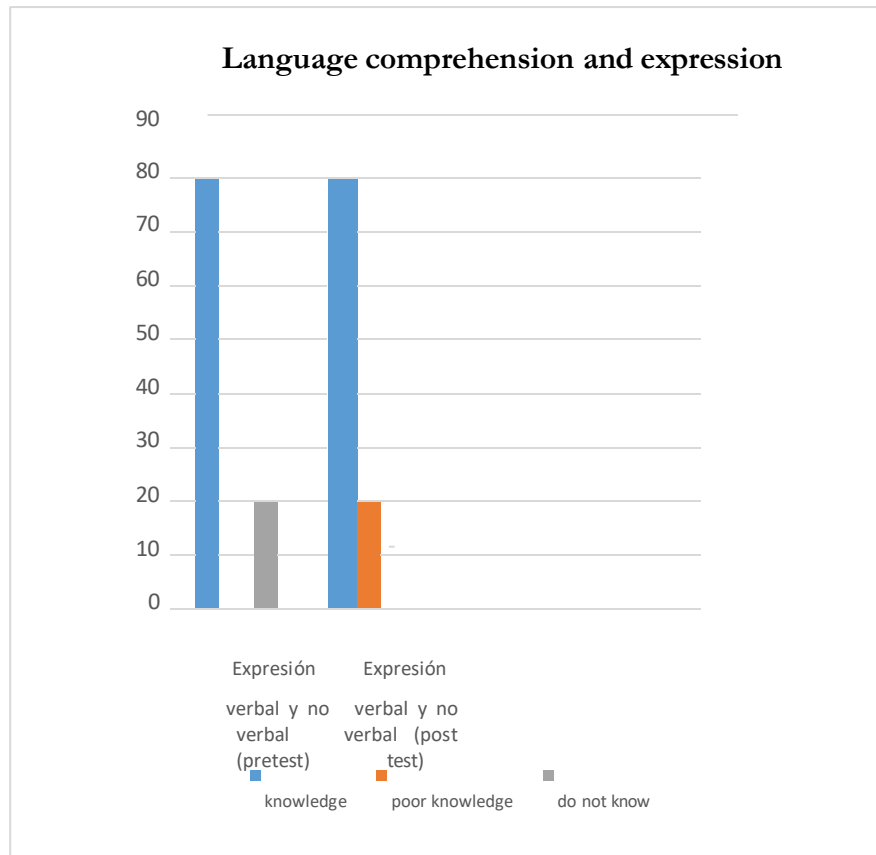
In the 4-5 year old population, an average of 11 children participated in the interventions, representing 14% of the total population in rural settings. In the pre-test, it was found that 40% of the children recognised primary and secondary colours, while 60% were in the process and 20% were unable to do so. As for the notions of order and location of objects, 60% of the children were in the process and 40% were not able to do so. During the post-test, it was determined that 20% were able to acquire the skill, while 80% were still in the process.

With regard to each of the indicators, the children showed a better understanding and development of the skills to be covered; however, it should be noted that a few children still had difficulty because they did not know a single colour or the location of the object. In this horizon, there were few classes and not much time was spent on the subject to be dealt with, so different activities had to be carried out in relation to the skills that were finally going to be evaluated.

At the beginning of the evaluation, most of the children lacked confidence, as it was the first time the class was shared with them, and this had a significant impact on the results. Thus, the pair of practitioners opted to carry out interactive activities with the children, so that they would feel comfortable and their learning would progress.

Thus, when applying the final evaluation, the children demonstrated a greater mastery of the activities, but it should be emphasised that some skills still need to be reinforced, as they were not fully accomplished.

After identifying the children's learning difficulties, planning was designed based on play and teamwork, as this would benefit both their educational and social development. In addition, activities were implemented that captured the interest of each of the children. After the application of the last diagnostic sheet, a noticeable improvement was observed in the children's performance, who were able to acquire and strengthen their knowledge.

Figure 5. Language Comprehension and Expression: Verbal and Non-Verbal Expression

Source: Mobile Adventure Project: RIAMOS

In terms of verbal and non-verbal language, 80% of the children listened to the story and imitated some scenes, while the remaining 20% only recognised the story and the characters. During activities related to daily routine, some children expressed confusion about the activities performed during the day and at night.

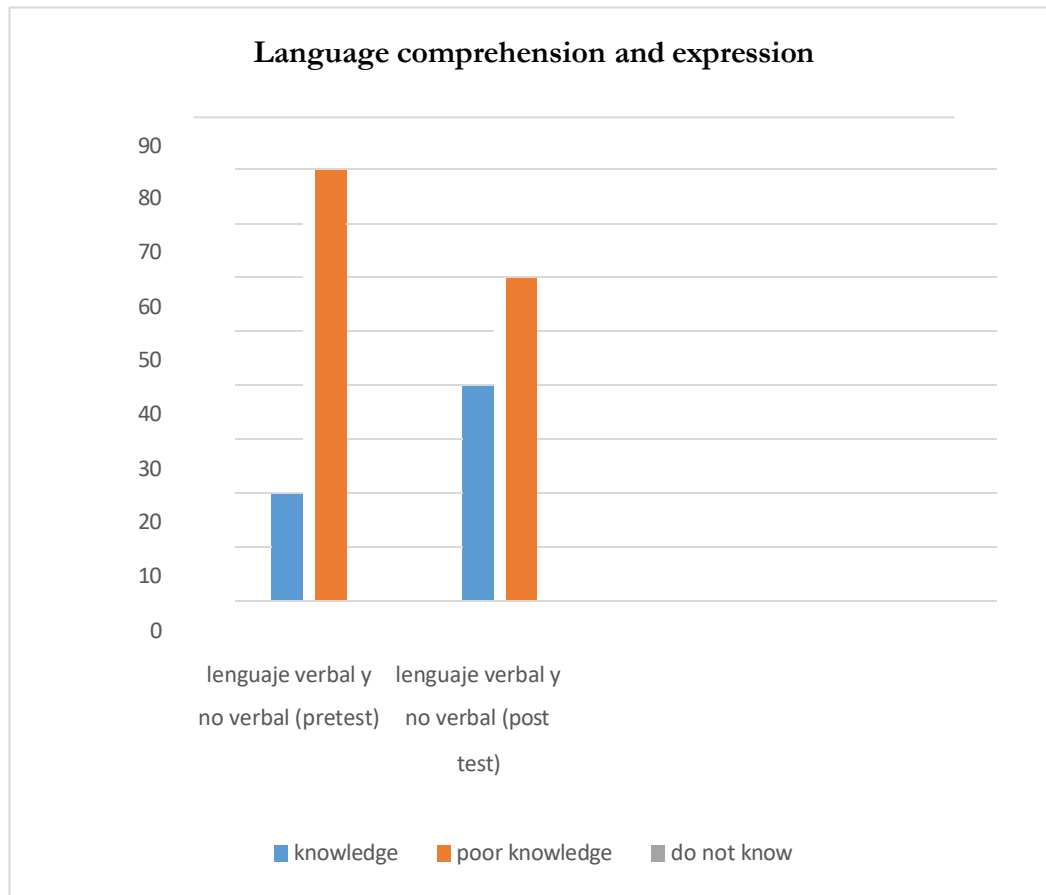
A variety of planned activities were carried out, focusing on play and direct experience, so that the children were active participants in their learning. A variety of materials were provided for them to manipulate and experiment with, encouraging their active participation. However, some children were unable to master certain skills due to absences due to health problems, which highlighted the need to implement additional activities and adapt them to each child's individual learning pace.

In storytelling, progress was observed in the ability to order scenes sequentially.

Children also showed improvement in identifying and differentiating shapes and in recognising the location of objects in relation to themselves and to different points of reference. Despite some initial difficulties, children were able to reproduce complete sentences and describe pictures containing actions. In this line, Remache (2021) emphasises that stories allow children to discover new emotions, situations in a dynamic way, while developing language processes; however, nowadays it is possible to work with pictographic stories that relate facts with images, thereby capturing children's interest and developing language skills. For this reason, various materials were used in the mobile classroom, such as models, sensory books, slips of paper and pictures, as well as tongue twisters, riddles, songs and short poems, to improve the children's pronunciation and vocabulary.

During the post-test, it was observed that 80% of the children were more attentive and were able to correctly answer questions related to the story and their daily actions. Despite initial language difficulties, the children showed gradual progress and maintained positive affective relationships with their peers.

Figure 6. Language Comprehension and Expression: Verbal and Non-Verbal Language



Source: Mobile Adventure Project: RIAMOS

The pre-test helped to identify the children's diverse learning needs and to guide subsequent planning. It was observed that 80% of the children had language problems, so additional activities were implemented to address this difficulty. A variety of resources such as concrete materials, shadow theatre and digital platforms were used to capture the children's attention and interest. In addition, the improvement in the processes developed through the interventions supported by the reinforcement developed in the mobile classroom is mentioned with respect to the children's language.

In relation to verbal and non-verbal language: reading the stories, the infants showed greater interest in seeing the pictograms, however, they were limited in listening very attentively to the story. And, in relation to maintaining a dialogue with the children, it was difficult since, as explained above, the infants could not speak and only said two or three words. In this sense, Toctaguano and Reinoso (2022) consider that language is an essential aspect in the communicative process since it allows a better interaction with the environment; however, it implies a complex process that depends on the language spoken in a given context.

In the post-test, the children showed greater interest when listening to the story, and when asked about their daily life actions, the children responded with yes, no and other words that were in their vocabulary.

With this we can affirm that, in order for them to develop their understanding and expression of language, activities were carried out to stimulate them and these were successful, given that in the final evaluation the same skills were evaluated and it was seen that the children maintained more communication with the teachers and with their classmates and at the same time they recounted the actions they had carried out the previous days.

Conclusions

Didactic experiences show optimal results when they are designed individually for each session, based on an initial diagnosis and the skills to be addressed. Through play and teamwork, interaction is encouraged for the construction of new knowledge and the development of skills. It is essential that the children actively participate in the learning process together with the student interns, parents and teachers of the UNAE.

The initial diagnosis of children's skills enables planning to be adapted to the reality and context of each child, after having established a link with the community and the social environment. This planning leads to the creation of meaningful learning experiences. Therefore, it is crucial to consider these elements when organising the sessions and selecting the appropriate didactic material, ensuring its relevance to the reality of the children and the community where the interventions take place.

The mobile and itinerant classroom methodology favours the development of the skills of children of early education age (three to five years old) in rural contexts. In some cases, it complements formal education and, in others, it represents the only opportunity to access educational experiences planned by Early Education teachers and practitioners. This type of project provides a significant number of children with access to an educational and playful environment that contributes to the improvement of their specific skills, closely related to their environment and family. At the end of the interventions, a workshop is held involving parents, thus strengthening the link between school and family.

The contextualisation of activities designed for verbal and non-verbal language development yields positive results in children aged three to five years. This is reflected in increased attention to stories, character recognition, retelling of everyday experiences, improved sentence construction and phoneme production. These improvements enhance their lexical, semantic and pragmatic skills in their environment.

Strengthening logical-mathematical relationships from early childhood contributes to the development of knowledge and practical skills in children's lives, which are useful for problem solving, reasoning and the development of logical thinking. Through planned play situations, concepts such as grouping, association, discretion, construction, spatial notions and sequence are introduced.

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