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The Educaplay interactive platform for the learning of mathematics in populations with special educational needs

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Abstract. Mathematics, in populations with Special Educational Needs, must be worked from the context of the students and with problems that they can show leading them to apply the concepts and solutions to everyday life. In this context, the present study is based on the objective of implementing pedagogical strategies based on the use of the Educaplay interactive platform for the learning of mathematics in populations with special educational needs in the "Carmen Teresiano" school in the city of San José de Cúcuta, Colombia. From the theoretical point of view, it is based on humanist theory and the cognitive paradigm; on the other hand, it is based on the manual of the teacher of children with special educational needs of the "Ministerio de Educación", Chile. Methodologically, it is a quasi-experimental study of pre- and post-test with only one group. The results of the pretest reflect deficiencies in the use of basic mathematical contents in the target population, which allowed for the design and implementation of an intervention plan and then to reapply, under the same conditions, the post-test. This resulted in an increase in the execution of the questions posed, which demonstrates the effectiveness of the intervention plan.

1. Introduction

It is recognized by those involved in teaching that strategies that contribute to improving mathematical learning, particularly with special populations, to achieve meaningful learning are not regularly used in the classroom by all teachers and the time they spend on numbers in their classrooms is insufficient. In addition, there is very little use of technology to support mathematics teaching. There is a kind of disarticulation between the different factors that intervene to guarantee the success of school integration and particularly a good learning of mathematics, at least of the elementary contents for use in life.

In this context, this study is based on the objective of implementing an intervention plan using the Educaplay interactive platform for the learning of mathematics in populations with special educational needs at the "Carmen Teresiano" school in the city of San José de Cúcuta, Colombia. From a theoretical point of view, the learning of mathematics is based, on the one hand, on humanist theory [1] and on the cognitive paradigm [2]. On the other hand, it is supported in the manual of the teacher of children with special educational needs of the "Ministerio de Educación" of Chile [3,4]. For the use of the technological tool, we take the ideas of García Aretio [5]. Methodologically, it is a quasi-experimental pre-and posttest study with a single group.

2. Theoretical foundations

2.1. Special education and the learning difficulties of mathematics
When the learning difficulties of mathematics are raised, the most common ones that are diagnosed in children with special educational needs are mentioned, these can be classified in [6,7]:

- Acalculia, which is referred to as the alteration in abilities and mathematical processing due to brain injuries. In this case, it is not a learning difficulty, but a disorder due to a brain injury.
- Dyscalculia, seen as a persistent and specific learning difficulty in mathematics. It manifests with difficulties to understand and perform mathematical calculations. Dyscalculia is a disorder that seems to be due to neurobiological causes, it is not due to external injury. Children suffering from dyscalculia may present alterations in the functioning of the brain areas responsible for mathematical learning and therefore, process the mathematical information in a different way.

2.2. The learning of mathematics in populations with special educational needs
Mathematical knowledge, like any object of knowledge, constitutes an elaboration of culture [8,9]. The degree of approximation that each student has to this knowledge will depend to a large extent on the context in which they are located and on the experiences, they have had as users of this knowledge and of the teaching processes, which depend on the position of the teacher [10]

Then, the contents for the development of the learning of mathematics, following the "Ministerio de Educación" of Chile [3] are organized in five stages: I stage basic concepts, II stage numbers, III stage additive problems, IV stage multiplicative problems and V money management stage. It is important to highlight that, in making a review and consultation with experts, in Colombia a proposal on the teaching of mathematics that would adapt to the requirements of this research was not achieved.

2.2.1. First stage: basic concepts. In this stage, concepts that allow both the development of thinking skills and the subsequent construction of other more complex knowledge are addressed.

2.2.2. Second stage: the numbers. In this second stage, situations that aim to allow, on the one hand, an approach to the world of numbers by students and, on the other, the quantification of collections, are approached.

2.2.3. Third stage: additive problems. At this stage, students are expected to face problems where the counting of all objects is no longer sufficient to determine the number of objects a collection has.

2.2.4. Quarter stage: *multiplicative problems*. In this phase, for children with special educational needs, the multiplicative problems refer to the problems that are solved with a multiplication or a division. The multiplication problems that are proposed correspond to problems of iteration of a quantity of measurement.

2.2.5. Fifth stage: money management. This fifth stage, which may constitute an independent stage or be the culmination of the previous ones, offers the possibility of applying acquired mathematical knowledge to real situations close to the reality of the students, through the management of money.

2.3. Using the Educaplay interactive platform for the learning of mathematics
The Educaplay interactive platform for the learning of mathematics is the central axis of the execution of the intervention plan to be developed in this research. In order to conceptualize the Educaplay platform, we take the postulates [5] where it is stated that the world of education cannot ignore the technological reality of today, neither as an object of study nor, much less, as an instrument to use to train citizens who They are already organized in this society through virtual environments. In this regard, Educaplay interactive platform for the learning of mathematics was created as a platform for information

by a Spanish company with experience in working with e-learning platforms. Through the Educaplay interactive platform, you can prepare activities for classes such as crossword puzzles, video, word searches, presentations, associations, interactive maps, multiple-choice assessments, riddles and word ordering.

3. Method

The present study sought to contribute to the learning of mathematics in children with special educational needs, based on pedagogical strategies supported by the use of the Educaplay interactive platform for the learning of mathematics in the "Carmen Teresiano" school in the city of San José de Cúcuta, Colombia. In this sense, it was based on a quantitative research, with a design of pretest and posttest with a single group, since the study allows a first approach to the problem under analysis.

The population, was constituted by 28 students with special educational needs, the sample, selected of intentional way by the investigator, was confirmed by ten students. They were selected among those who present the following characteristics that serve as inclusion elements: (i) are regular students of the institution, (ii) regularly attend school, (iii) parents and / or guardians signed an informed consent allowing them to children participate in the study and (iv) the children, by themselves, expressed the desire to participate in the research.

For the elaboration of the instrument that allowed to apply the pretest and the posttest, the postulates of the "Ministerio de Educación" of Chile [3] were taken into consideration, who raises the basic foundations for functional mathematics in children with special educational needs. In this sense, an instrument containing ten questions was prepared so that the student could give an oral or written response to the statement. These ten questions constitute two of each of the five proposed stages: I stage basic concepts, II stage numbers, III stage additive problems, IV stage multiplicative problems and V stage money management.

4. Results

The results are presented as follows: first the results of the pretest are organized, then a synthesis of the development of the intervention plan and finally the results of the posttest. In the pretest and posttest results, the question proposal is presented, followed by a synthesis of the students' answers in a table, then these results are taken to a graph that gives way to the analysis where only what happens with the children when they gave the answers to each question. In the intervention plan, a synthesis of the activities developed with some evidence is organized. At the end of this segment there is a discussion of the results where the relationship between pretest and posttest is explained, establishing a relationship with the authors that address the subject under study and the incidence of the intervention plan. Next, the results obtained are exemplified with a question mark.

4.1. Pretest results

When analyzing the pretest data, it can be inferred that in the basic concepts or pre-numerical skills, a high percentage of research participants find it difficult to solve exercises where skills are put into play for which it is not necessary to use numbers and refer to correspondence 1 to 1, classify objects according to an attribute and series. In the same way, it happened with the questions associated with the stage of numbers, in which a significant high tendency of students did not give a correct answer to the proposed propositions. The students respond when the collections are with one or two objects, but if this amount is raised they remain silent or not correct.

In addition, in questions related to additive problems, the subjects who participated in the research face problems where the addition of objects with much difficulty. Well, recurrently, students found it difficult to compose numbers in an additive way and mental calculation for additions and subtractions. Regarding the questions on multiplicative problems, children with special educational needs presented a high negative tendency to solve exercises and problems that imply multiplication and division.

In relation to the exercises on money management, it can be said that the trend with respect to students who did not guess the answer is not significant. It was in this type of content that the students performed better in the pretest.

4.2. Plan of intervention

The intervention plan, both in its didactic and technological aspects, related to the use of the Educaplay tool in the learning process to contribute to the learning of mathematics in populations with special educational needs was structured as follows: theoretical approach, justification, contextual framework, objectives and design of the proposal which consists of four general workshops with thematic axes: prenumeric concepts, numbers, addition and subtraction, multiplication and division and management of money.

4.3. Posttest results

The posttest data leaves highly satisfactory results. After applying the treatment to the students, a significant tendency was observed in the number of subjects who raised the positive responses in all the questions raised. As for the exercises on the basic concepts or prenumeric skills, a high percentage of participants raised the percentages of correct answers. In the same way, it happened in unknowns referred to additive problems. However, regarding the questions on multiplicative problems, a low negative trend is maintained, however, the scores improved in relation to the pretest. And with respect to the exercises on the management of money students raised the scores in relation to those obtained in the pretest, this content being the most accepted by the special children participating in the research.

5. Discussion

Regarding the item that exemplifies these results, on basic concepts, it can be seen, in terms of the one-to-one relationship, that there was a significant increase in the posttest with respect to the pretest, since 30% of respondents correctly in the pretest, 80% of correct answers were passed after the treatment plan was applied. In this regard, some researchers [11] report that the number is associated with the establishment of the pre-numeric aspects or basic concepts, such as correspondence, position value, seriation, forms of representation in space, which contributes to the thought reversible, useful for learning the number.

Here arises a question for reflection; what are the basic concepts that allow special education pedagogues, who develop content associated with mathematics, to identify that students have already established the notion of number? In the search for an answer to this question, it was achieved that one of the authors who have investigated the basic concepts for the acquisition of the number, is the Swiss psychologist Jean Piaget.

On the other hand, it is mentioned that the number can be related to a set of units' equal to each other, for which it is necessary, in the child, the logical reasoning [12]. It alludes that to help you understand the number you can place in small groups to organize different objects, which implies the notion of classification. Likewise, another of the ideas about how the child constructs the number is related to the way of ordering things, classifying and establishing the notion one by one, as happened with the activities developed in the intervention plan where children, starting of concrete material and the Educaplay interactive platform for the learning of mathematics, they did exercises of several basic aspects such as the one-to-one notion, classification and seriation.

6. Conclusion

The Educaplay interactive platform for the learning of mathematics represents a pedagogical solution based on Internet technology, which can allow the learning of mathematics in special populations. This tool allows a space of interactivity where students put their creativity into play. This interactivity, in addition to the ease of its creation and administration, is what has allowed a participatory work among students when developing mathematical exercises, which were supported by concrete material.

During the development of the proposal, the organization of the pedagogical space as an important action to make the school an environment that falls in love with special children, was a significant contribution. Thus, during the execution of the workshops, the classroom was reorganized, from a place where children were always seated one behind the other, to a space where work in groups, in pairs or in plenary became aspects of daily organization. This gave way to greater participation which allowed us to see that quiet students almost always became more participative and spontaneous in the classroom.

In relation to the post-test evaluation, children with special educational needs demonstrated the effectiveness of the intervention plan mediated by the Educaplay interactive tool, since there was a significant increase in the execution of the items. It can be said that the workshops mediated by the interactive Educaplay interactive platform for the learning of mathematics were highly significant; at the beginning the students had a hard time, but little by little they were participating with greater emphasis. It could be mentioned that one of the capabilities of technological tools is related to social inclusion, enabling students with different needs to have access to a large amount of information and, as happened in this research, it has been especially valued for the construction of more interactive teaching environments and more dynamic learning experiences.

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