

# Hope Project: Development of mobile applications with augmented reality to teach dance to children with ASD.

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**Abstract.** New ICT information and communication technologies, and specifically augmented reality (AR), are providing educators with effective strategies that allow them to be more effective in teaching-learning processes in children with ASD. This research aimed to develop an intervention plan to improve certain skills in children with ASD. Through a qualitative-quantitative, descriptive, experimental study, the Hoope software used as an innovative resource. At the end of this research, we can conclude that through augmented reality (AR) we reinforce and innovate certain teaching-learning processes, showing favorable results that show that through an intervention plan through NICT there may be positive impacts on children with ASD.

**Keywords:** *ASD, Teaching, Hoope, Augmented Reality, NTIC.*

## 1 Introduction

One of the great challenges facing developing countries is the search for equity to educate in diversity[1], currently there are a large number of children who are diagnosed with developmental disorders, these children generally need particular attention and the implementation of strategies to improve the education they receive[4]–[5], since it is directly proportional to benefit their environment and therefore the quality of life[6].

Autism spectrum disorder, henceforth ASD, can be defined as a complex neurodevelopmental disorder[8]–[10], which is detected in the early years and lasts a lifetime [12]. The NICT, considering it as a facilitator of the decoding of information,

is logical, concrete, located in a space, not the verbal language that is invisible, temporary and abstract , [17], [18]. Thus, the research first proposes an intervention plan that uses NTIC that can be used by educators, psych pedagogues, therapists, parents who work daily with ASD children.[15], [16], making use of augmented reality[17], for this purpose the software called Hope (Hoope) is used, in order that children can develop certain skills and abilities.

The study structured as follows: Section 2 explains the methodology for the investigation. Section 3 presents the results of the study, Section 4 presents a reflection of the results found in the application of the Hoope software in the experimental study, Section 5 presents the conclusions, recommendations, limitations, and future lines of research.

## **2 Material and method**

The research addresses a mixed approach supported by the qualitative and quantitative method, additionally the study is of the type: descriptive, exploratory, because it seeks to know in a detailed way the relationship between pedagogical practice through technological innovation mediated using new emerging technologies and the benefits of the application of Hoope software in the teaching-learning processes of children with ASD.

The modality used is documentary and field research[18-19]. This is because the experimentation is conducted on a specific software called Hoope created in the Laboratory for Research of New Computer Technologies LINTI, of the National University of La Plata in Argentina, and documentary because the process and the results are supported in a methodology and in the theoretical support of previously conducted research[20-21].

The field work conducted in Ecuador, specifically in the city of Quito at the Ludic Place Therapeutic Center, which welcomes ASD children offers support for the prevention and addressing of specific learning needs associated with the presence and risk of spectrum disorders. In this area, various methodologies, programs, techniques, and instruments used to be able to support the children who attend consultations. The procedure for data collection will be through scheduled sessions where a multidisciplinary team intervenes through an interview, deep observation.

### **2.1 Population**

The Director of the Ludic Place Center, destined for three professionals (teacher, psychologist, and psych pedagogue) participated in this process. These professionals were receptive to new and innovative strategies that include the use of new information and communication technologies. Additionally, parents, supported the proposal, and signed the informed consent for their children to participate in the intervention.

Children with ASD, Matias, who from now on will be identified with the letter M, is 4 years old and has high-functioning ASD; while Eidan, who from now on will be identified with the letter E, is 5 years old and has medium-functioning ASD; have been evaluated and diagnosed in the Ecuadorian Institute of Social Security of Ecuador (IESS).

### **2.3 Work plan.**

The work plan was developed for a period of six months, from February to June 2021, where several activities were planned: the conceptualization of the project, the bibliographic review, the viability of the Project, validation of the current situation of infants, contextualization, needs analysis, development of the intervention plan: diagnostic phase, intervention phase, evaluation phase. For the intervention plan, the sessions were designed to work for 20 to 25 minutes, twice a week, for a period of several months.

### **2.4 Phases of the intervention**

**Phase I:** Diagnostic or initial evaluation. Diagnostic and detailed evaluation of the student, before starting the intervention we conduct a complete and in-depth evaluation of M and E, to approach the intervention process in an individualized way. It is necessary to emphasize that the center has the diagnosis of children.

**Phase II:** During the Intervention. For the intervention phase, strategies were proposed to conduct a playful activity mediated through technology using the Hoope system. This system allowed the child to interact alone or with the help of the professional who guides the session. The activities that were conducted have a defined order, each session seeks a purpose and previously some aspects considered essential have been considered, such as the organization of spaces, the time of the sessions, the necessary materials, and the collaboration of the center team is counted on therapeutic and with parents.

**Phase III - Final Evaluation - psych pedagogical.** The purpose is to contrast the results obtained in the diagnostic evaluation with those that will be obtained after the process. Using the interviews, it is possible to obtain the necessary information to capture the results of the intervention of children with ASD with the Hoope Software.

### **2.5 Resources used in the intervention plan**

To conduct this research, some resources were used, which are indicated below.

**Human Resources:** Multidisciplinary group made up of teachers, psychologists, educational psychologists, doctoral students, systems engineers, parents, and children with ASD.

**ICT Resource:** In relation to technological resources, the Hoope System created in the Research Laboratory of New Computer Technologies LINTI of the National

University of La Plata - Argentina was used, a Kinect device, and a laptop. The Hoop System is a system that is based on augmented reality, it is focused on children with ASD from 3 to 14 years old. This software allows the participant to choose options that allow reinforcing teaching-learning areas. Next, Figure 1 shows the resources used for the process.



**Fig. 1.** Main menu of the software Hoop main menu. Capture made of the software used for pedagogical intervention.



**Fig.2.** Resources used in pedagogical intervention

### **2.5 Activities designed to reinforce teaching-learning processes.**

Next, the activities planned for the teaching-learning processes presented, for the intervention plan, we choose to reinforce several processes perception, imitation, fine motor skills, gross motor skills, visual motor skills, the same ones that are presented below in Table 4 planning temporary activities.

**Table 1. Curricular content planning intervention project**

<b>Area: Education</b>	Directed to: Children with autistic disorder    Time: 25 minutes per session ASD
<b>Theme:</b>	Learn by dancing-Playful Activity. Use of Hoope system
<b>Objectives of the intervention plan</b>	
<b>Perception:</b>	Recognition, awareness and playful experimentation of the body. Visual perception (fundamental to the basis of cognitive processing and reasoning), is the ability to recognize and interpret different visual material correctly and transform this information into an adapted motor response. Therefore, it is an important skill, indispensable for school success.
<b>Imitation.</b>	Recognition, awareness and playful experimentation of the body as an expressive medium with the elements that make up the language of dance, space, time and energy.
<b>Fine motor</b>	Recognition, awareness, and playful experimentation of the body.
<b>Gross Motricity</b>	Recognition, awareness, and playful experimentation of the body.
<b>Visio coordination Driving</b>	Recognition, awareness and playful experimentation of the body.
<b>Name of the activity</b>	
<b>Contact points/ touch point</b>	They are interactive zones that appear randomly around the upper part of the user and are activated by being touched with the hands.
<b>Kick points / kick points</b>	They are interactive zones that appear randomly around the bottom of the user and are activated when touched with the feet.
<b>Route tracking / tracking match:</b>	They are a set of strokes that appear randomly around the top of the user, they are activated by touching the starting point and dragging the hand along the entire path to the end point.
<b>Avatar pose / match poses:</b>	They are a set of poses that appear randomly at each end of the user and are activated when he manages to imitate the pose by more than 80%.
<b>Mix of poses and exercises</b>	They are a set of poses that appear randomly
<b>Skills with performance criteria</b>	Learning Activities: perception, imitation, fine motor skills, gross motor skills

Shown in Figure 4 the activities proposed in the Software called Hoope to work the space of perception, imitation, fine and gross motor skills and visual motor coordination in children with ASD.



**Fig. 3.** Activity proposed to work imitation, perception, fine and gross motor skills and visual motor coordination. Software Hoopé - playful game for children with ASD.

### 3 Results

Once the application of the Intervention Project is concluded, the purpose is to contrast the results obtained in the diagnostic evaluation with the results after the intervention process using the Hoopé application. We focus on determining if the intervention plan generated favorable results and if there is evidence of any progress in the teaching-learning processes of children M and E.

For the evaluation of the proposed curricular activities, a scale of three possible options is used. The multidisciplinary team that accompanied the development of the pedagogical intervention plan was asked, if the child with ASD is this M or E carried out the proposed activity, it is classified as passed and it is scored as 3, if the child tries to carry out the activity it is determined that the activity is emergent and is scored with

2, if on the contrary the child fails in the process, the activity is scored with 1. The table of results of the proposed curricular activities is shown below.

**Table 2. Results of the proposed curricular activities processes before and after AR**

Results of the proposed curricular activities post-AR use				
Actions	Before RA		After RA	
	M	AND	M	AND
Child with ASD				
Activity to work imitation	1	1	3	3
Activity to work perception	2	2	3	2
Activity to work fine motor skills	1	2	2	3
Activity to work fine motor skills	1	2	2	3
Activity to work visual motor coordination	2	1	2	2

In the following image we can observe E using the Hoop Software during a scheduled session. In the Fig. 4 describes the activity proposed to work imitation: Software Hoop - playful game for children with ASD.



**Fig. 4.** Activity proposed to work imitation, Software Hoop - playful game for children with ASD

Next, the results presented to show the progress of each participant after complying with the proposed work schedule, through the designed phases and after the proposed sessions. Table 5 shows the comparison of M results, an analysis of the activities is conducted at the beginning or diagnostic phase and after the use of the Hoop System that includes several activities. The interview conducted in the third phase of this intervention plan, it conducted in the educational center, they were informed in advance of the day and time where the meeting was to take place.

**Table 3.** Representative graphs of data analysis.



**Results of M after the intervention with AR**



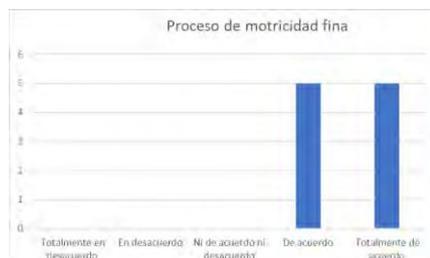
**Results of M after the intervention with AR**



**Proposed activity Interview results after the intervention process Imitation process**



**Perception process interview results**



**Results of the fine motor process interview**



**Gross motor process results.**

Imitation activities. Question: Do you consider that the child's ability to imitate has improved after the use of augmented reality applications, specifically through the Hoop software. Analysis: When asking the multidisciplinary team (psychologist, teacher, and psych pedagogue), they totally agreed that the children reinforced the imitation process, developing the proposed exercises in an easier and more intuitive way with the application of augmented reality, using the option 1 of the proposed Hoop game.

Perception activities: Question: Do you consider that children's perception has improved after using the Hoop software application that includes a natural interface

with augmented reality? Analysis: The child's perception has improved, after the use of the Hoope software, people from the multidisciplinary team indicated that they fully agree, and others agree.

Fine motor activities: Question: Do you think the child's fine motor skills have improved after using the Hoope software? Analysis: The fine motor skills of the child has improved after the use of applications with augmented reality, some people from the multidisciplinary team indicated that they were in complete agreement and others indicated that they agreed, as shown in the figure.

Gross motor activities: Question: Do you consider that gross motor skills on the part of the child have improved after the use of applications with augmented reality? Analysis: The gross motor skills of the child has improved after the use of applications with augmented reality, imitations of movements of the robot from the Hoope game, were carried out by the children during the sessions.

Visual motor coordination activities: Question: Do you think that the child's ability to associate animals with colors has improved after the use of augmented reality applications? Analysis: The visual motor coordination capacity of the children has improved after the use of applications with augmented reality, all the people on the team indicated that they were in complete agreement.

## **4 Discussion**

It is necessary to review the fulfillment of the proposed objectives of the intervention project and determine to what extent these developed and fulfilled.

In relation to: Review and analyze updated bibliography in relation to the teaching-learning process of children with ASD that favor the approach, concretion and deepening of the proposal, it conducted considering different theories and research that exist in this regard and the subsequent selection of academic research to prepare the literature review.

As for carrying out an analysis of educational needs that allows knowing the incidence of the difficulty of certain teaching-learning processes of children with ASD who attend the Ludic Place Therapeutic Center, it was achieved by conducting interviews with the treating psychologist, Who can I obtain relevant information, taking into account that they are the ones who share directly with children with ASD and know what the needs of each one of them are.

About: Designing a plan for intervention mediated by information and communication technology, in particular augmented reality, was carried out taking into account the needs analysis, since the idea is precisely to cover the deficiencies that exist, once this aspect has been analyzed It helped a lot to take into account the general issues that were wanted to be addressed, and then to determine which were the areas that

would need to be worked to obtain the desired results and the time in which those changes are expected to be seen.

To select those activities that are the most appropriate for learning such as the processes of imitation, perception, fine and gross motor skills, and visual motor coordination, taking into consideration the context first, after that, the bibliographic review taken into consideration, to finally plan those activities that could be more suitable according to the augmented reality software application called Hoope.

## **5 Conclusions**

The intervention plan developed a method that allowed to include emerging technologies in our case the use of Software Hoope, in it, intelligent objectives proposed in a time defined, helping the children who participated in reinforcing teaching-learning processes as perception, imitation, fine, and gross motor skills and visual motor coordination that are essential to reduce the existing gap and inequality to which they exposed daily. Regarding the work in the field, direct contact with the community established through the Ludic Place therapeutic center, where they worked with children with ASD, parents, and support professionals (psychologist, educational psychologists, teachers, information, and communication technology professionals).

These studies, which include experimentation as a fundamental basis, are important since they not only come to verify theories, concepts, and information from similar works, but also serve to develop new teaching processes, and hence the importance of being able to identify to personalize teaching. The incorporation of models, methodologies, and strategies especially with children with autism is a fundamental requirement, understanding that everyone has their own learning process. For the development of the intervention program, as well as for its monitoring, evaluation, and joint decision-making, it is necessary to work in a comprehensive and multidisciplinary way to obtain better results, given the multitude of professionals involved, the intervention approached from an interdisciplinary approach unifying goals, objectives and methodology used with the child.

Using innovative resources in the classroom, it seeks to stimulate the teaching-learning processes, it is essential to offer children with ASD during their school stage an adequate teaching-learning process that allows them to strengthen their skills, this intervention as an alternative in the educational process, to work in coordination towards joint goals and priorities (parents, professionals who accompany the child with ASD, psych pedagogues among others). New ICT information and communication technologies, and specifically augmented reality, are providing teachers with new and effective strategies that allow them to be more effective in education, generating significant interest in learning in children. The intervention proposal included two children with ASD diagnosed with moderate ASD (requires notable help) and severe ASD (they require a lot of help), however, it would be opportune to carry out the intervention in children with mild ASD, it is possible that this plan and its results are

better received, and that this intervention based on information and communication technology is of relevant help in these cases.

It is important to note that this intervention plan can be applied and reinforced if applicable, these adaptations related to content have been proposed as an orientation and exemplification, however, it will be the teacher in collaboration with his team of treating professionals, who will specify the elaboration of the individualized plan based on this intervention program, as well as on the orientations offered by the pedagogical counselor. Autism is a complex disorder that has characteristics of one child with another, therefore, the interventions must be different. Individuality is precisely the factor that should never be lost sight of when planning an intervention, and what works for one case may not receive in the same way with another child; however, with the help and patience of the professionals in charge, adaptations of the plans can be made to individualize them and achieve better results.

In the case of children with ASD their development is not stable or predictable, therefore this plan must be evaluated regularly, it should be modified and perfected as many times as necessary. Computer applications in the field of education provide important advantages since they are means that tend to generate intrinsic motivation, being attractive and stimulating. We look at M and E, who like games as well as the music and sound effects provided by the Hoope Software, as well as animated characters. Regarding future lines of research, the application of this Hoope program would be of great interest not only in the therapeutic center but also in the home of children with ASD, or during schooling to reinforce the processes. We are grateful to the LINTI New Computer Technologies Research Laboratory of the National University of La Plata -Argentina, the National Secretary of Higher Education, Science and Technology SENESCYT- Ecuador, as well as the Ludic Place therapeutic center where this project was conducted.

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