

ICT, Inclusion and Pedagogical Diferention: Exploratory Study

Manuel Filipe
Escola Superior de Educação – Instituto
Politécnico de Castelo Branco
Castelo Branco, Portugal
manuellopesfilipe@gmail.com

Henrique Gil
Age.Comm – Instituto Politécnico de
Castelo Branco
Castelo Branco, Portugal
hteixeiragil@ipcb.pt

Noémia Marques
Escola Superior de Educação – Instituto
Politécnico de Castelo Branco
Castelo Branco, Portugal
nena.mestre@gmail.com

Sara São Pedro
Escola Superior de Educação – Instituto
Politécnico de Castelo Branco
Castelo Branco, Portugal
salejo10@gmail.com

Abstract— *The present work intends to address the importance of Information and Communication Technologies (ICT) in the teaching and learning process of a child with educational special needs in a pre-school context. The child in our study has a structural chromosomal anomaly, which makes the overall development atypical for her 6 years of age. Her difficulties lie at the level of attention, concentration, motricity and language. After an evaluation of the difficulties and possibilities of the child, the main objective of the educational intervention was to motivate the child and to optimize the learning of the basic contents essential for her entrance into the 1st CEB school, as well as to promote her active participation and involvement in a task. The family was involved to achieve continuous and systematic intervention through playfulness. The results of the intervention were obtained through direct and participatory observation with the child, and it is possible to observe some progress in its overall development.*

Keywords—*Chromosome anomaly, Digital Resources, ICT, Inclusion, Pedagogical differentiation.*

I. INTRODUCTION

The child we selected for our exploratory study has a rare problem. It has a chromosomopathy characterized by partial trisomy of chromosome 1 and partial monosomy of chromosome, and has great difficulty in maintaining attention / concentration, dispersing very easily, thus obtaining a global developmental delay with a profile to reveal greater concern in the areas of motor skills and language.

This paper will be structured in two parts: one of more theoretical reflection, focusing essentially on a review of the specific literature on the benefits of digital resources and neurosciences in children with similar characteristics; and another of a more practical nature on the application of digital educational resources for preschool children that focus on the development of language, concentration and fine motor skills, applied in direct work with the child, considering their specific difficulties: Games For Children and Words to Mouthfuls. Thus, in the first part of the paper, we present the theoretical framework that approaches Chromosomopathy and the specific difficulties of the child involved in this study, as well as the benefit of ICT in educational intervention. The second part of

the work presents the objectives of each of the 2 digital applications chosen, and the third part of the work will focus on their implementation in direct work with the child, in an educational context. It will also be presented the research methodology that supported this study. In the last part of this paper, the conclusions about the benefits observed in the child development will be presented, after the implementation of digital educational resources in the direct work with the child. The main objective of our research was to confirm the advantages of using ICT through digital educational games, adapting individualized strategies to promote the social inclusion, development and learning of a child with educational needs in a school context.

II. ICT WITHIN THE EDUCATIONAL CONTEXT

A. Theoretical framework

The use of Information and Communication Technologies (ICT) by schools in the 21st century is an important resource in the teaching and learning process of all pupils, and it is generally agreed that it has positive effects on students' learning. themselves, as it enables the development of new cognitive skills. This assumption is in accordance with Decree-Law no. 54/2018, which regulates the Portuguese Educational System and establishes the principles for an Inclusive Education, where the focus is placed on a continuum of educational responses in view of the diversity of students attending regular schools. education. In this legal document, reference is made to the specific resources to be mobilized to respond to the educational needs of each of the children throughout their school career.

Among the guidelines for teaching practice are a set of strategies and learning facilitating resources to be implemented in the classroom context, and teachers should use audiovisual aids (images, internet, educational software,...). The teaching action must, therefore, consider the individuality of each student, the way he learns and processes the information (auditory, visual, kinesthetic), proceeding to a pedagogical differentiation, through the availability of different supports

related to the presentation of information. resources available at school. According to [5], some authors highlight the new roles that teachers must assume in the context of the knowledge and learning society in which we live today: an information manager (Berliner, 1990), a learning mediator (Nisbet, 1992; Fosnot, 1996), a guide of cognitions (Fino, 2001), a facilitator and builder of knowledge (Hartnellyoung, 2003).

Also the Profile of Students Leaving Compulsory Education [9] published by the Ministry of Education, is based on principles, values and areas of competence, which implies on the part of educational agents to rethink the pedagogical and didactic practices aimed at achieving learning. by mobilizing the most effective resources in order to adapt their educational action to the globality of the students and the purposes of the competency profile provided for them. In this context, [9] is of the opinion that "The areas of competence (...) presuppose the development of multiple literacies such as reading and writing, numeracy and the use of information and communication technologies, which are foundations for learning, and continue learning throughout life "(p.20). According to [4] the purpose of 21st century education systems will be to try to guarantee the primacy of knowledge construction in a society where the flow of information is vast and abundant, and where the role of the teacher should not be It is more of a mere transmitter of knowledge, but of a mediator of learning. All these assumptions deserve our commitment as educators / mediators of the learning to be done by our students, and should whenever possible harness the potential of ICT as a facilitating means of strategies that can adapt to their educational needs, and consequently, the active participation of students in the construction of knowledge of different curriculum contents, replacing a traditional teaching practice with a constructivist practice.

In this sense, and according to [2]: "Understanding, rethinking and addressing the differences of each child has been facilitated with the advent of technologies aimed at assisting teachers in this purpose. (...) The use of ICT is present in the school through software and digital resources, promoting social and digital inclusion, and constitutes an increase in education, from its functionalities and its wide possibility of use, articulating access, the integration and interaction of these students in the classroom".

Thus, we understand that the use and mastery of ICT should be a basic literacy competence to be developed as early as possible and should be included in the curriculum of pre-school education. As an educational resource, they play an even more important role for children with educational needs, since it is in early childhood that the brain is most willing to learn and much more likely to be influenced by external factors and experience, and the quality of stimuli. fundamental, so that learning can be consolidated in memory.

The role of the educator will be to create learning situations, guide and motivate their students through various stimuli (visual, auditory, tactile) allowing learning to be captured by the various senses, making their brain more

functional and as recommended [12] the use of ICT: "In education it can be an important tool, if used effectively in order to promote knowledge, because education is to search for possibilities and reduce the limits. (...) It is important to reflect on the fact that education is a shared process of reciprocity, and to seek the student in all possible ways: by experience, by image, by sound, by representation, by technology".

ICT and Educational Apps emerge as a response to technological development in the so-called knowledge society and make an excellent contribution with immense functionalities and capabilities to suit individual educational needs, which is why the school cannot exclude them. Educational mobile applications, as a pedagogical resource, arouse the curiosity of children, creating conditions for them to "learn to learn". They refer to all multimedia programs or material resources that can be installed on electronic devices, providing tools to support learning in a school context, as they enable new ways of learning and foster the development of skills essential to global development. of each student considered individually.

Mobile devices as an educational resource allow the creation of a stimulating environment that promotes meaningful and diversified learning, constituting an alternative means of information and communication in the school context. Its use enables most students with educational needs to overcome physical and socio-emotional barriers, facilitating them to perform many tasks, helping to mitigate the consequences of their problems. This last aspect is of the utmost importance if we consider children who have psychomotor functional deficits, such as the child in our study, and access to these devices is a privileged way for students to be able to perform certain activities in a timely manner. otherwise that would not be possible. As stated by [6] "accessibility to information and communication technologies (ICT) must be considered as a quality of life factor to which everyone is entitled. For most people technology makes life easier. For a person with NE, technology makes things possible.

B. The contribution of neurosciences

The contributions of neurosciences allow us to better understand the functioning of the brain today and to realize that its development depends on the quality of the stimuli it receives. The human brain receives information through the senses, and it is through the neurons that this information is passed that travels throughout the brain through the axons. This passage occurs through electrical and chemical signals between neurons and small spaces called synapses, allowing information to be processed and transformed into action. The more stimuli it receives, the more the brain develops and the greater the certainty that information will reach long-term memory. In an appropriate learning environment, children should be given the opportunity to exercise their brains so that synapses intensify and cognitive development takes place. Knowing that it is in early childhood that there is an increase in brain cell connections, the earlier the educational and rehabilitative

intervention of the child with a rare syndrome begins, the more likely it is that their overall development may progress.

Thus, neuroscientific knowledge about brain functioning, regarding learning and memory, contributed to the planning of well-founded educational strategies, so that the apprehension of contents with the help of tactile objects and digital educational resources, was performed by the child's direct action on objects, since learning is constructed through sensory perception. On the other hand, it was also possible to promote more interactive, dynamic and fun classes because the use of the Tablet always has fun, the playful.

These practices are critical for schools to become increasingly inclusive through quality education, as the use of multisensory resources enables broader neural networks to be triggered, synapses to be strengthened and incoming information to be fixed in memory more efficiently.

C. Characterization of the child

This investigation involved a 6-year-old child who will hereinafter be referred to as C as a way of protecting his or her identity. She is 6 years old, female and attending the last year of kindergarten. He lives in the Castelo Branco region with his father, mother and a 10-year-old brother. She is a very sociable girl, curious and who likes to learn although her low level of attention / concentration compromises some acquisitions. She is usually friendly and well-disposed and very affectionate with reference adults and peers.

It has a structural chromosomopathy characterized by partial trisomy of chromosome 1 and partial monosomy of chromosome 4. The report [7] of the karyotype (set of chromosomes and their characteristics) of the child attested by a clinical report of genetics, identified the presence of a chromosome 4 of anomalous conformation in the distal region of the long arm, interpreted as a derived chromosome, resulting from an unbalanced segregation of maternal translocation. Consequently, the patient has a partial trisomy of the 1q45.1 → 1qter region and a partial monosomy of the 4q35.1 → 4qter region.

Due to its chromosomopathy, it presents great difficulty in maintaining attention / concentration, dispersing very easily, thus obtaining a global developmental delay with a profile revealing greater concern in the areas of motor skills and language. The stages of physical growth have been done more widely and of intellectual development as well, due to the reduced concentration. At the level of fine motor skills, movement is slow and inaccurate. Needs continuous follow-up by therapeutic professionals such as Speech Therapy, Occupational Therapy and regular medical follow-up such as Physiotherapy, Psychology, Neuropediatrics, Ophthalmology and Pulmonology.

D. Digital applications

Through WEB 2.0 technologies, it was possible to select some digital educational games that can facilitate access to

curriculum content to develop, in a playful and enjoyable way for the child, which are generally very attractive and intuitive, and therefore facilitators of new learnings. As a pedagogical tool, digital play plays an important educational role for children's cognitive development, stimulating their attention span, concentration and memory, as well as helping them to develop psychomotor skills, as it implies that they strive to achieve their intended goals. The student of our study has achieved, through continuous and systematic use, a marked improvement in all these aspects as well as greater precision in fine motor skills. As advocates [13] "The use of technologies adapted to the needs of children (...) can be considered as a facilitator of motivation for educational activities (activities and / or strategies), interaction with their environment, creativity, self-confidence, understanding concepts and theoretical-practical knowledge, autonomy in problem solving, and the development of logical reasoning."

Digital educational games were selected according to the student's abilities, considering the educational objectives appropriate to their age and above all because they can be used by the child in an autonomous and constructive way. In this sense and according to [11]: "(...) the digital technological fluency of educators is directly related to technology, pedagogy, curriculum content, the context involved that implies knowing how to use, understand, create and share new things with digital technologies."

In order to train C skills and optimize them, especially the manipulative skills essential to training in writing, reasoning and motivation, we selected three digital educational games that, based on the research done, will be the most appropriate to the syllabus of pre-school education. -school. The first two, described below, were used in the intervention and the last one, in the evaluation of results:

- Jogos Para Crianças – application that allows through 10 different games count / compare / sort, find differences, match / series, make sets, memorize, develop language, hand-eye coordination, visual perception, know professions;
- Palavras Aos Bocadinhos – Speech Therapy support application, consisting of 9 games / exercises, focused on the area of syllable division, allowing to work segmentation, identification of syllable sounds, help the evocation, emission, replacement, addition, inversion and perform auditory memory games;
- Jogo Educativo Para Crianças 6 – With 12 different games, it allows you to identify animal names and sounds, improve memory, logic and concentration, distinguish shapes, identify numbers and colors; develop creativity, make photos and paint, play the piano, solve puzzles and mazes.

III. METODOLOGIA

A. Methodological framework

The planning of our educational intervention was reflected, considering all the foundations prescribed in this paper, the difficulties of the child due to the problem presented and also the Curriculum Guidelines for Preschool Education [8] that refer to an integrated approach and globalization of the different Content Areas to be developed, facilitating the transition of the student to the elementary school.

The use of these applications facilitates the achievement of various pedagogical objectives, while allowing the adoption of more dynamic and attractive teaching methodologies, as well as learning environments oriented to the realization of problems and educational success. We opted for the use of mobile (tactile) devices and digital educational games.

The methodology adopted by us fell into a qualitative investigation, an approach that favored a single case study. The action research was exploratory, descriptive and interpretative.

The Early Intervention team of researchers proposed alongside the child's family to integrate research as an active part of this process.

From the point of view of [10] all action research is participatory: "the participation of the people involved in the problems investigated is absolutely necessary", since researchers play an active role in monitoring a concrete action, in solving problems encountered, in the evaluation of results and simultaneously in the construction of knowledge. According to this perspective, our strategy has been to choose the specific case of a child, focusing mainly on his / her problem, the ecological contexts in which he / she interacts and the possible benefits of ICT in the school context, in order to make the case understandable. , through their particularization and in direct contact with the child.

Ten practical sessions and intervention were held with the participating child, using the digital educational games selected according to the "Curriculum Guidelines for Early Childhood Education", where we collected some field notes, which allowed us to adjust our educational options in face of difficulties and needs of the child, and at the same time carry out continuous assessments as expected in an action-research.

B. Main aims of the research

- Investigate whether the introduction of ICT in the teaching and learning process facilitates student involvement and participation in school activities.
- Verify that the use of digital educational games, helps to understand and assimilate the curricular contents for preschool education;
- Evaluate the benefits of ICT in the development of the child's motor skills, language and concentration;
- Demonstrate the benefit of ICT as a pedagogical strategy that favors the social inclusion of children in the school context.

The digital app alone motivates children to learn by providing a range of positive emotions through rewards in the form of smiling smiles, balloons, little stars and other verbal gratifications (laughter, pleasant words) that bring a sense of satisfaction to each other. since they can meet the objectives of a stage. These aspects were also observed in our student, since: "The player feels valued for each mission accomplished, through rewards, points or power [1] (...), thus becoming attractive by the need of the This ability helps the child to focus fully on what he is doing, even if he has to repeat some of the most difficult steps or levels, investing more in his abilities and skills to make progress in learning. "Digital games require attention, memory, decision making, cognitive and motor skills, persistence, ability to deal with failure and success".

IV. EMPIRIC ACTIVITIES

This project was applied for 2 months, with weekly sessions of 1 hour, totaling 10, in kindergarten context (Table 1). At the same time, the family applied to C-Tablet, almost daily at home, for systematic and continuous continuity. In both contexts, the same applications were used under the same conditions: finger use and tactile pen use, alternately, to get used to pencil and pen control in school.

In the first phase, between 1st, 2nd and final, it was intended to stimulate fine motor skills, develop visual perception skills and eye-hand coordination, improve cognitive ability, language and improve memory, logic and concentration. The results obtained were as follows: difficulty in hand-eye coordination, some difficulty at the logical level, namely in the associations of concepts, poor concentration and attention initially in performing the exercises and later improvement in concentration (ending an exercise without getting up). Thus we were led to reinforce positive stimuli and appreciation of achievements.

In the second phase, we worked more on language and phonological awareness never neglecting graphomotricity. He was able to identify some sounds and knew how to segment some words, demonstrated improvements in language, particularly in the articulation of words. We were always getting feedback from the family, saying that also at home C was more initially distracted and had a preference for memory games. In the last phase, the final, it was intended to ascertain if there had actually been improvements, but already with a different digital educational game that explored the same content and skills.

The time constraints for applying more sessions were a barrier to us in the potential development of C.:

- Evolution in fine motor skills;
- Evolution in coordination and visual acuity;
- Improvement in the logical process (some

reflection before the action);

- General language difficulties, although denoting being more familiar with the words and exercises to do.

There was some distraction, but in this area, too, there were developments, such as taking the exercises to the end, or decreasing the times they got up. The use of the touch pen has been increased, revealing improvements in grip and use. With the finger there were also improvements in the more careful way of performing the activities. At the same time, activities with crayons, charcoal or felt-tip pen had the same benefits.

V. FINAL CONSIDERATIONS

We can conclude that currently ICTs are naturally present in everyday life and educational spaces, offering great potential in the implementation of more dynamic teaching and learning strategies and methods, contributing to change the way of teaching and especially the way of learning. The knowledge of neurosciences about brain functioning allowed us to adapt the pedagogical strategies to the cognitive profile of the child in our study, helping them in the construction of their learning.

In an inclusive school, which integrates students with different problems and difficulties in accessing the curriculum, the use of ICT is fundamental as a resource that allows differentiated and individualized strategies that enhance the activity and participation of these students. Through digital educational games, it is possible to reconcile the achievement of educational content and objectives, with the motivation to learn to do, due to its playful and attractive characteristics.

We argue that the knowledge society must be anchored in the four pillars of education, which according [4] are: learning to know, learning to do, learning to live in common and learning to be.

Regarding the child in our study, it was possible to verify a qualitative leap in its overall development, but above all the improvement of fine motor skills through the performance of various tasks and the continued use of the Tablet. As an educational tool, ICT facilitated the student's involvement and participation in the proposed activities, helping to develop their attention and concentration skills, greater confidence and mastery of contents, indispensable aspects for the assimilation and construction of knowledge. an excellent means of streamlining the teaching and learning process.

The access to these resources reinforced the pedagogical work of the researchers, promoting the student's motivation in the teaching-learning process, as well as a greater involvement of the student in the proposed tasks, constituting as facilitating elements of an efficiency that we wanted. We therefore agree

with [4] when he says that "we are in the age where teachers should position themselves as teachers and learners, in the expectation that, through the interaction established in 'didactic communication' with students, learning will take place. for both."

We can say that ICTs allow us to modify the way we teach and the way we learn, enabling the child to be the protagonist of his own learning, becoming aware of what he has already accomplished, the difficulties that are emerging and the efforts he will have to make. perform to overcome them. Thus, we consider that the successful technology is one that is adapted to the characteristics of the child and should always be tested by the child, so that the educator can safely choose to use it.

In the opinion of [3]: "In today's globalized society, the reconfigurations produced by the use of ICT in education become unquestionable. This new model implies new attitudes and practices in the educational context, which are very relevant in the conception of inclusive school, as it presupposes ensuring a school for all, which requires a personalized response to the specific needs of each one."

Finally, quoting Marion Welchmann: "If a child cannot learn the way he is taught, it is better to teach him the way he can learn".

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