

# *Communication processes of students with cerebral palsy in digital learning environments*

Tatiana L. dos Santos da Cunha  
Universidade Federal do Rio  
Grande do Sul  
Porto Alegre, Brasil  
cunha.tatiana@uol.com.br

Lucila Maria Costi Santarosa  
Universidade Federal do Rio  
Grande do Sul  
Porto Alegre, Brasil  
cunha.tatiana@uol.com.br

José Valdeni de Lima  
Universidade Federal do Rio  
Grande do Sul  
Porto Alegre, Brasil  
cunha.tatiana@uol.com.br

**Abstract** – This study aimed to identify possible contributions of using Digital Learning Environments for the communication processes of students with cerebral palsy. The subjects used Digital Learning Environments, including the Eduquito and a social network. From the mediation and virtual contact with other children, the dimensions we observed were reading and writing, oral language, and social development. The results showed that children began to virtually interact with other children and understand and use new concepts and new technologies. There was an evolution in the written language as well as a decrease in the production of misspelled words during the research.

**Keywords**—*Digital Learning Environments; Cerebral Palsy; Computer and Education.*

## I. INTRODUCTION

This work arises from a concern about the benefit of new technologies for the communication abilities of people with disabilities.

We live in a time when technology contributes to facilitate the development of human beings in several areas of life, including education. Depending on motor and/or oral communication limitations, students with disabilities are often excluded from society, and sometimes they are not introduced into regular classes in school. To improve the quality of their lives, making them more active and allowing them to participate in society, there are new technological resources being used to aid in school and socio-digital inclusion.

Creating opportunities of access to the digital world for all individuals is fundamental for a society that claims to have the participation of all its citizens, to respect differences and to provide equal opportunities. Technological resources can be mediators between the child and learning. For children with Cerebral Palsy (CP), these resources also help with communication through social interactions. Also, it is important to highlight how important social interactions are in the development of individuals. Following this point of

view, the contribution of the social interactional theory by Vygotsky is fundamental. This theory studies the ways in which humans develop intentional mechanisms, consciously controlled actions that set them apart from other living beings. Vygotsky [2] points to the key role of the interaction between individuals with different levels of development.

Communication is a need that is present in human life. It is responsible for the exchange of information between people and for social interactions. Human beings perfected their communication and started to use resources to facilitate this process and their relationship skills. Nowadays, written communication is the most widely used form of communication in digital media. Reading and writing are very important for people to exercise their rights to work and participate in society as citizens, and to receive information and learn throughout life.

New technologies have been created from the needs that have emerged over the years. They have given people with disabilities access to computing devices, which results in greater autonomy and independence in their academic, professional, domestic and entertainment lives - something that seemed unlikely a few years ago. Thus, we assume that technology offers features that enable the development of children with CP. In his reports, Vygotsky [3] states that the laws underlying development are the same for normal children and children with disabilities, and that these individuals must use their "healthy" senses to understand the world, that is, they should use their skills to compensate for their impaired senses.

The growing development of information technology has contributed to the democratization of the use of virtual spaces. But are new technologies capable of improving the communication abilities of individuals with disabilities?

Students with disabilities, especially with CP, can benefit in their overall development, challenging

clinical and, especially, educational prognostics. With the evolution and the use of technology, we observe today that these students have a potential that goes beyond the limits set previously. Currently, there are specialized people involved with these students, helping them develop their potential, preventing deformities and other possible deficiencies that may arise along with the CP.

The computer and the resources available, such as Digital Learning Environments (DLEs), can be seen as a leap in the quality of life of students with CP. Through several possible adaptations, these environments may become important tools for learning and for their development, as well as essential for communication, thus assuming a very important role in promoting the social inclusion of these individuals. Based on the above, the goal of this study was to explore technological resources to observe the development of communication processes in children with CP through their interaction in digital environments.

## II. RESEARCH QUESTIONS

The aim of this study was to observe and assess the interaction and production/construction of written communication of subjects with CP, with more and less experience with computers. This assessment will be carried out by using DLEs and exploring its tools, both online and offline. Besides, we will monitor the spelling mistakes in the textual productions of students and analyze possible changes found with the development of written communication to answer the following research question: Do Digital Environments favor the process of interaction and construction of written communication in subjects with cerebral palsy?

## III. MATERIALS AND METHODS

This was a qualitative research, with the study of multi-cases.

Data collection was performed with direct observation based on the DLE *Eduquito* and a social network, and on the written communication development processes. Descriptive records of the interactions of the subjects were carried out, regarding the DLEs. After the students used the environments, we described the speech aspects and those related to the process of interaction in oral and written communication. We also analyzed the spelling mistakes found in the productions. The spelling mistakes we analyzed were reported by Zorzi (1998) and described in 11 categories.

For this study, nine students were selected. They got specialized care at the Educandário São João Batista Rehabilitation Center. The students were aged nine to 18 years; five students were male and four were female.

All the students went to regular schools and knew how to read and write. Their progress in school

ranged from the 2nd year of elementary school to the 1st year of high school. The students included in this study had a clinical diagnosis of CP without associated diseases. The etiology of the disease was not taken into account in this study. Data collection took 13 months.

This research followed these steps: Initially, the subjects were divided into two groups, where we considered their previous experience with computers, or lack thereof. Group 1 was composed of the five students who had more experience with digital environments. Group 2 was composed of four students without previous experience or who did not use the computer much. After that, we presented the DLEs that would be used by the students. Those who did not already have e-mails created their own accounts. Then, they all registered to the DLE *Eduquito* and to the Social Network. After this, we monitored and recorded all the interaction processes and written communication in both groups and in both the environments. All students were asked to write texts on a suggested topic, which resulted in two textual productions, written on different days. Students built a collective text, from various textual productions of their own.

## IV. DIGITAL LEARNING ENVIRONMENTS

### A. *Eduquito*

*Eduquito* was the DLE chosen for this study. *Eduquito* was based on the social interactionist approach proposed by Vygotsky, which investigates how social interaction helps with the development of Higher Psychological Functions [4]. The DLE *Eduquito* has activities that motivate individual and collective growth. For this reason, we chose to use this inclusive DLE, which was designed so users could use tools that allow exchange of knowledge through mediation and social interaction.

### B. *Social Network*

We chose this social network because of its wide acceptance among the target audience of the research. Furthermore, we considered these issues: (1) familiarity of the subject with the logic of the tool, as well as their facility to learn; (2) the possibility of unrestricted access to its content and (3) it provides interpersonal interactions that value the autonomy of the subject.

With Web 2.0, concepts such as participation, interaction, communication and sharing have been reinterpreted to mean possibilities for the use of technological resources. The web as a platform started to boost the construction of different collaborative tools, seeing the user no longer as a mere receiver of information, but rather as someone who participates, operates, and contributes to the production of content.

Social networking sites have become increasingly popular with the rise of Web 2.0, the so-called second generation of web-based communities, with increased collaboration and sharing between users through applications such as wikis, blogs and podcasts, RSS feeds etc. [5]. Sites like MySpace.com, Friendster and more recently Facebook.com, have become increasingly popular, especially among young people who use these new technologies to create communities.

The participation of the subjects in the study was in accordance with the resolution 196/96 of the National Health Council (ethical aspects of research on human subjects). The parents or guardians of the students all signed a Free and Clarified Consent Form.

## V. RESULTS AND DISCUSSION

Data analysis was performed based on the use of the tools available in the DLE *Eduquito*, the social network, in the narratives of the Whiteboard (QB) and on the students' oral and written communication. For this research, each student created a nickname so that they would have their identity preserved. This nickname was used when they made the Virtual Book (LV) using the QB accessible tool. The study of the gathered information was divided into two phases: individual analysis and group analysis. We used tables for viewing the indicators we raised more easily, without any classificatory or quantitative character. The findings in the students' text production were also put in tables. Thus, it was possible to calculate the percentage of misspellings, considering the type of mistake committed by time, and also by which environment the event was found.

On the first activity involving textual productions, we got 24 texts back from the students. On the second one, 20. In the last phase of data collection, a new group was created in the social network, named BOOK CLUB. The students suggested the development of a Virtual Book, using the QB accessible tool, available on *Eduquito*. Inspired by other narratives, the children wrote a story with superheroes invented by them. The VB was entirely created by the group, and the narratives were maintained word for word, without changes or adaptations. The images placed in the environment by the mediator were designed by the writers themselves, using Paint.

As was said above, the subjects were divided into two groups, considering their previous experience with computers, or lack thereof. The members of Group 1 were GP, FP, BL, SM and SC, with better performance than the other participants, possibly because they had had more experience with digital environments. Group 2, consisting of MV, SG, AQ and EK, showed more difficulty, perhaps for lack

of prior experiences. Each member created and developed their own part in the story, writing from two to six narrative fragments, until the book was complete.

In the process, the participants made it clear that their contributions did not need to be definitive in the production of other students, and could be changed if the original authors did not feel comfortable with the content. Such behavior indicates that, despite this being a collective production, new authors did not feel completely free to influence the course of the material. The concept of authorship [6] [7] still appeared to be associated with the creator of the text, the representative role of owner of the material; we did not identify a change of focus from authorship to content. Figure 1 presents data on the number of narrative fragments produced by the students of the two groups within the DEs.

|         | NARRATIVES | SOCIAL NETWORK | WHITEBOARD | TOTAL      |
|---------|------------|----------------|------------|------------|
| GROUP 1 | GP         | 2              | 6          | 8          |
|         | FP         | 14             | 6          | 20         |
|         | SM         | 5              | 3          | 8          |
|         | SC         | 8              | 2          | 10         |
|         | BL         | 4              | 2          | 6          |
|         | TOTAL G1   | 33 (76,7%)     | 19 (65,5%) | 52 (72,2%) |
| GROUP 2 | MV         | 2              | 3          | 5          |
|         | SG         | 4              | 2          | 6          |
|         | AQ         | 2              | 3          | 5          |
|         | EK         | 2              | 2          | 4          |
|         | TOTAL G2   | 10 (23,2%)     | 10 (34,4%) | 20 (27,7%) |
| TOTAL   | 43 (59,7%) | 29 (40,3%)     | 72 (100%)  |            |

Figure 1 – Number of narratives by the students divided into groups, within the digital learning environments

It appears that the group of students with more experience always had more than twice the number of written productions compared to the less experienced. However, in the QB, students in Group 2 showed proportionally less difference compared to the other group. This decrease in difference may be related to the fact that the QB was used at the end of the study, enabling the students who belonged to Group 2 to understand the new tools introduced in the research and thereby be able to evolve, which might have affected their writing skills.

We identified and analyzed individually the mistakes produced by the research subjects in the collected written material produced in the digital environments. The data show, for the large group, 348 spelling mistakes in 4,371 words examined. This amount, added to the diversity of types of mistakes found instantly caused difficulties as to how to classify them. Questions of how to interpret or consider these mistakes were very frequent, and eventually it motivated us to search for classifications that had already been used and that could help in this study. Thus, we ended up using an existing classification [8]; this classification is based on other studies, and it has 10 categories or types of spelling mistakes that were most commonly found in the writing of children in

general. The author of this classification created one more category to account for certain idiosyncrasies or certain particular and uncommon ways of writing that were found in one or other child, and could not be considered as the most common difficulties. From these results, the data were grouped according to the evolutionary stages of the research: early (between one and six months) and late (between seven and 12 months).

Figure 2 shows the percentage of spelling mistakes per student, compared to the number of words individually analyzed during the two phases of the research.

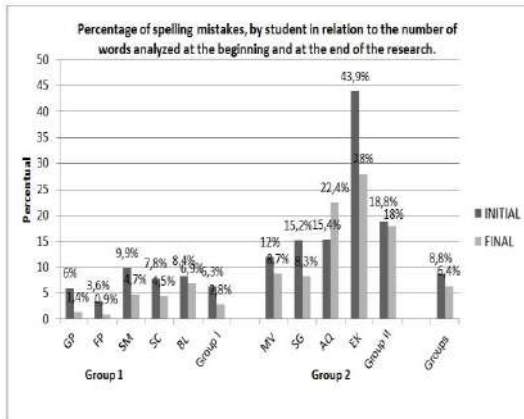


Figure 2 - Percentage of spelling mistakes, by student in relation to the number of words analyzed at the beginning and at the end of the research.

Eight students presented a lower percentage of mistakes at the final stage of the research compared to the beginning, except AQ, who lowered his performance during the development of the study. Group 1, when compared to the other group, had a lower percentage of mistakes. In Group 1, GP reached six percent at the beginning and that total decreased to 1.4 percent of mistakes at the end of the analysis. This happened to all the students of this group: FP began with 3.6 percent and finished with 0.9; SM went from 9.9 percent to 4.7 percent; SC, 7.8 percent initially, and 4.5 percent at the end; and finally BL, who went from 8.8 percent to 6.9 percent, the subject with the lowest decrease of mistakes in this group. Group 2 had the following developmental profile regarding the percentage of mistakes: MV started with 12 percent and this ratio decreased to 8.7 percent; SG went from 15.2 percent to 8.3 percent; EK, a student who had the highest percentage during the study, 43 percent in the first phase, ended with 28 percent; finally, AQ, the only student with an increase in the number of mistakes during the research, went from 15.4 percent to 22.4 percent. Given this last situation, regarding the negative slope of AQ's performance, we sought to understand what happened in the process that could contribute to this isolated result. We checked his history to see if there was any evidence or information to somehow explain such a significant behavior concerning the number of

spelling mistakes. AQ did not have Internet access at home and only used the environments during the time of the research, or when some computer activity was offered by the school. Despite him showing interest in these activities, the child's family was not interested in assisting him or encouraging the use of computers as a support of his disability. After the research, AQ was suspended from his appointments at the institution for non-adherence to therapy and missing too many appointments. We believe that this might be one of the factors that caused this performance.

The family should understand the child as a being in training who seeks to build their learning through interpersonal experiences [9]. The family can influence the child's school learning, since it is the family that gives the first instructions on moral and social rules. In this study, AQ's family may not only have interfered in his performance, with respect to language, but also ended up hurting the progress of his therapy when they decided to abandon the activities carried out in the institution. The difference of the total percentage of spelling mistakes found during the research, regarding the complete research and all its participants, is on Figure 3.

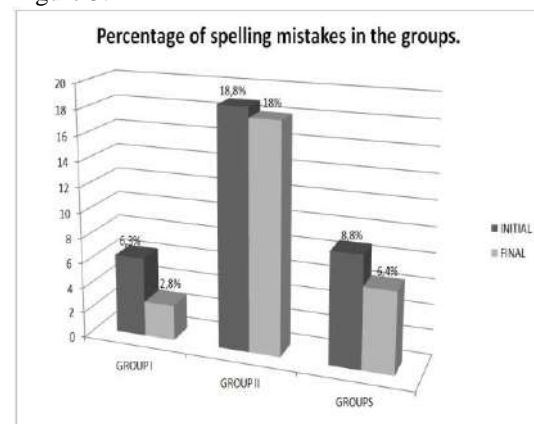


Figure 3 - Percentage of spelling mistakes in the groups.

Group 1 had 6.3 percent in the first phase and, at the end, 2.8 percent. On the other hand, Group 2, with a much higher initial percentage, 18.8 percent, completed the study with 18 percent, which is still a considerable amount. However, despite this result, it is necessary to point out that Group 1 always presented a better evolution in writing when compared to Group 2, whose improvement is not significant in terms of changes in writing behaviors. As to the results of all subjects, the process started with 8.8 percent of spelling mistakes, and ended with 6.4 percent.

The act of getting to know digital technologies because of socio-digital inclusion, as well as favoring communication for individuals with disabilities, brings out studies that show the benefits of using Assistive Technologies as a resource in the construction of knowledge. In short, at the beginning, at the moment when the new tools

were being presented, the group required a significant amount of support. Gradually, this amount of aid decreased, which shows the progressive autonomy acquired by subjects in the course of the interactive process. In a study carried out in Cape Town[5], where the objective was to verify the usability of Facebook for teaching and learning, the authors argue that students used the environment to replicate in the social network what was happening in the classroom, thus becoming "on-line" friends of their university colleagues. This same process of interaction with the general group was observed in this study. Students, at the beginning of the research, knew each other superficially within the institution. After the start of the study, students had more frequent interaction in a collaborative educational space, and established bonds of friendship outside the virtual context as well.

## VI. CONCLUSIONS

The results showed a successful process for the production of narratives. Students began to produce more stories after the use of the DLEs. In addition, we noted that the texts had fewer spelling mistakes - a significant improvement in writing and in the intelligibility in the communication process. Initially, the aim was to encourage the production of texts through *Eduquito*; however, in the course of data collection, we felt the need to include a new feature in this process. The proposal to use the social network as a DLE resulted in numerous developments, and we believe this is an important tool for future research. Social networking is, indeed, a powerful communication environment that emulates, notably, many forms of interaction between subjects. It was concluded that the more innovative the environment, the more interest is aroused in students. In this study, we saw that students, besides creating a greater number of narratives, interacted more within this virtual environment than in other environments. The social network proved to be a resource that included the students and was part of their usual routine.

The absence of a tradition of studies that present possible changes in communication for students with CP through the use of information and communication technologies is evident. Overall, despite the difficulty in comparing the results of this work with that of other studies on the subject, due to differences in methodologies used and the pathology associated with the student, we could verify that the spelling mistakes made by individuals with no CP did not differ in nature from those observed in individuals who do not present this disability. It is noteworthy that the studies we found did not analyze typed writing, but handwriting.

The study also revealed improvements within the groups. In all aspects analyzed, it was observed

that, in a constant way, the groups showed the same trend of improvement. The first group improved in every way, just as the Group 2. Although Group 1 demonstrated an ever higher percentage of improvement, the trend in Group 2 was the same. Also, we found aspects related to a pattern in writing. Some students employed abbreviated words in this study, and this practice occurred in all the studied environments. The way that the student used language was reflected in their writing.

In conclusion, we hope this research will spark interest for new and future research in the area. The results contain information that shows the importance of researching this theme. Regarding future studies, it would be interesting to research the other tools that offered by *Eduquito* and their relationship with communication. The positive results observed in the written language showed that it is always possible to discover new dimensions when we use information technologies as a resource or the communication of subjects with disabilities. The new technologies that are available today do not offer subjects a new world without problems, but they can serve to assist and facilitate everyday life. In this study, we observed that the environments used with the students helped them participate more, express themselves, interact more and especially improved the written communication of children with disabilities, pointing positively to digital technologies as resources to support the development of children with CP. Thus, every second dedicated to this project was worth it.

## VII. REFERENCES

- [1] Decreto Legislativo nº 186, de 2008. Disponível em: <http://www2.senado.gov.br/bdsf/item/id/99423>
- [2] Vygotsky, L. S. A Formação Social da Mente: o desenvolvimento dos processos psicológicos superiores. 7ª edição. São Paulo: Martins Fontes, 2007.
- [3] Vygotsky, L. S.; A defectologia e o estudo do desenvolvimento e da educação da criança anormal. Educação e Pesquisa, São Paulo, v.37, n.4, p. 861-870, dez. 2011.
- [4] Santarosa, L. M. C.; Conforto, D.; Basso, L. "O. Eduquito: ferramentas de autoria e de colaboração acessíveis na perspectiva da web 2.0", Revista Brasileira de Educação Especial. [online]. 2012, vol.18, n.3, pp. 449-468.
- [5] Tanja E Bosch. "Using online social networking for teaching and learning: Facebook use at the University of Cape Town", Communication: South African. Journal for Communication Theory and Research, 35:2, 185-200, 2009.
- [6] Primo, A. F. T.; Recuero, R. C. "Hipertexto Cooperativo: Uma Análise da Escrita Coletiva a partir dos Blogs e da Wikipédia", Revista da FAMECOS, n. 23, p. 54-63, Dez. 2003.
- [7] Haetinger, M. G. **O Universo Criativo da Criança na educação**: coleção Criar. Vol. 03. Rio Grande do Sul, 2005.
- [8] Zorzi, J. L. Aprender a escrever: a apropriação do sistema ortográfico. Porto Alegre: ArtMed; 1998.
- [9] VYGOTSKY, L. S. Pensamento e Linguagem. São Paulo: Martins Fontes, 4ª edição. 2011.