



# Cyclon Language First Grade App: Technological Platform to Support the Construction of Citizen and Democratic Culture of Science, Technology and Innovation in Children and Youth Groups

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**Abstract.** This article shows the construction of software applications Cyclon Language First Grade App, like a strategy in which communities of practice, learning, knowledge, innovation and transformation are generated, understood as a transversal process, where collaborative, problematizing learning is encouraged, by critical inquiry, permanent interaction, cultural negotiations and the dialogue of knowledge, typical of the pedagogical proposal of the Ondas program. It is summarized in the following aspects: “Building an identity that incorporates the recognition of science and technology as a constituent element of everyday culture both in individuals and in the communities and institutions of which they are part, involving various sectors of society: productive, social, political, state and in the various territorial areas: local, departmental and national. Development of forms of organization oriented to the appropriation of values that recognize a cultural identity around science and technology in the aspects mentioned in the previous point. This implies models of participation, social mobilization and public recognition of scientific and technological activity. On the other hand, the incorporation of the research activity in the elementary and middle school involves the development of national, departmental and local financing mechanisms; in such a way that children and young people can develop their abilities and talents in a favorable environment of both social recognition and economic conditions. Development of a methodological strategy supported by ICT that helps the Colombian population to recognize and apply both individually and collectively, science and technology through research activities designed according to the characteristics of the scientific method. “The appropriation of ICTs as a constitutive part of the citizen and democratic culture of the CT + I and the construction of virtual reality as central to the process of knowledge democratization.

**Keywords:** Citizen and democratic culture · Technology and innovation · Technological platform · Spanish language learning

## 1 Introduction

The appropriation of this culture implies the development of scientific, technological, innovation, social, cognitive and communicative abilities, skills and competences and the capacities to inquire and observe, which are consolidated as children, girls and young people receive adequate guidance in approaching their problems, through daily work in the different spaces of socialization; In this sense, educational institutions play the main role: preparing their teachers in methodologies that favor such appropriation, and seeking alliances with academic and non-academic entities that conduct research [1].

This project was a special interest in the construction of a citizen culture in science, technology and innovation, promoting in the students and teachers of the Department the formation of communities and the realization of research that seeks to solve the problems of their environment and build capacities. To move in a world that makes its reorganization from the new processes of knowledge and knowledge, founded on the CT + I. The constituent elements of this culture are [2, 3]:

- Demystification of science, its activities and products to be used in everyday life and in solving problems.
- Democratization of knowledge and knowledge guaranteeing its appropriation, production, use, conversion, storage and transfer systems in all sectors of society.
- The capacity of judgment and criticism about its logic, its uses and consequences.
- The skills, abilities and competences derived from these new realities (technological, scientific, cognitive, social, valued, communicative, proppositive and innovation).
- The skills, abilities and knowledge for research.
- Collaborative learning and the ability to relate to organizational systems in communities of knowledge and knowledge, networks and lines of research.
- The incorporation in the pedagogical and investigative processes of information and communication technologies.
- The ability to ask, raise problems and give them creative solutions through the development of inquiry processes.
- The development of creativity through actions that lead to innovations. The ability to change in the midst of change.

## 2 Pedagogies Focused on Research

A methodological line that tries to give way to the contemporary debate about science and its impact on education, uses research to boost school processes, and generate methodological alternatives to build a school close to the configuration of a scientific spirit. In this line, research is understood as the basic tool of knowledge production, and it is the

support to introduce children and young people in the path of critical thinking, which facilitates the learning that corresponds to their age group [4].

Various methodological proposals arise, coming from different latitudes. His concern is not only research, but also the act of teaching and learning, and therefore, the required teacher profile and its role in the face of knowledge. Likewise, the required efforts of this professional shape a different institutional framework, consistent with the methodological commitment to the development of school life. Teaching focused on research takes multiple paths and places particular emphasis, not all convergent or complementary.

The pedagogical strategy focused on research is, according to the policy of training human resources and social appropriation of scientific and technological knowledge of Colciencias, the fundamental axis to foster a citizen culture of CT + I in children, girls and boys, young Colombians, because they recognize in them their ability to explore, observe, ask about their environments, their needs and their problems; through project design [5, 6].

Therefore, it is necessary to recognize the role that research activity can play in the modern world, which means a displacement of an activity that was always in the adult world and today clearly appears in that of Colombian children and young people, as a practice transferred to multiple spheres of society, and very particularly, within children's and youth cultures, marking their personal developments, their socialization and their learning [23, 24].

In this sense, today a network is built between research and the world of children and youth that makes it impossible for these practices not to be exogenous to these cultures, but that "it is recognized as an activity of the human being, possible to develop in all areas of knowledge and with very young children. It is also understood as a process of deciphering the human condition from the life experience of this population in school, family and community contexts" [7].

Given that these processes are necessary in the practices, not only academic and scientific, but also of everyday life, it is necessary to "develop a stage of sensitization and induction to infants and young people about the importance of research as the fundamental axis of their training process". In this context, and from the perspective of the Waves program, developing research in school implies [25, 26]:

1. Understand that research questions become permanent and arise from the interest, initiatives and concerns of educational actors.
2. Assume that research must produce various benefits for children and young people: some, in relation to the construction of scientific knowledge and therefore, with the advances of CT + I; others, with the development of research skills and abilities of the subjects.
3. To promote, from a very early age, the cognitive, communicative and social capacities in children, with which they could explore the academic world that is presented to them, towards the search for a meaning for their life.
4. Build meaningful experiences for boys, girls and young people, through pedagogical strategies that link them as central actors in the process.

In this context, the Project, conceives research as a process of deciphering reality based on questions and problems identified by children and young people, is the specific mechanism on which the program methodology is built.

Through it it is feasible to meet expectations of social and personal order for those who undertake this task, because through it it is possible “on the one hand, find real solutions to social problems and on the other [can be assumed by] restless individuals, with initiative as a life perspective. In this sense, it does not only imply the construction of knowledge, but also the transformation of social realities [8, 9].

### 3 Brief Review of Literature

Performing a review of the literature we can highlight the following works that have been developed in order to enhance brain activities, which are detailed below:

Brain Training (that is, improving, rehabilitating, or simply maintaining cognitive function through deliberation cognitive exercise) is rapidly growing in popularity, but remains highly controversial. Among the biggest problems in current research is the lack of a measure of participants’ expectations, which can influence the degree to which they improve with training. This research is based on a questionnaire to measure the perceived effectiveness of brain training software. Initially in this investigation the expectations of the participants were measured at the beginning of the study, and then at the end of the investigation, the effectiveness of the process is measured, whether high or low. Based on the knowledge they have collected from advertising and other real-world sources, people are relatively optimistic about brain training. However, short messages can influence expectations about reported brain training results: reading a brief positive message can increase reported optimism, while reading a short negative message can decrease it. Older adults seem more optimistic about brain formation than young adults, especially when they report being well informed about the formation of the brain and computers. These data indicate that perceptions of brain formation are malleable to at least some extent, and may vary depending on age and other factors. The questionnaire can serve as a simple tool, which is easily incorporated to assess the apparent validity of brain training interventions and create a covariate to account for expectations in statistical analyzes [10].

These types of solutions have also been implemented to other sectors such as medicine, [11] working a memory loss is common in patients with heart failure (HF), but there are few interventions that have been proven to counteract it. The objective of this study was to evaluate the effectiveness of a cognitive training intervention, Brain Fitness, to improve memory, brain-derived neurotrophic factor (BDNF) levels, working from memory, processing speed, executive function, activities instrumental of daily life, mobility, depressive symptoms and quality related to the health of life.

Also in depression analysis Cognitive training (CCT) through computerized paradigms offers the potential to improve cognition, mood and daily functioning, but its effectiveness is not well established. [12] The objective of this research was to conduct a systematic review and meta-analysis to determine the efficacy of CCT in depressive disorders.

Other applications like a cognitive studies is to give that working memory is an important cognitive skill that is linked to academic success, there is increasing attention

to exploring forms to support working memory problems in students [13]. A promising approach is computerized training, and the objective of the present study focused on a computerized training of working memory that could lead to effects in the training process. Students were assigned to one of three groups: Trained a once a week (WMT-low frequency); Study Group, where they trained four times a week (high-WMT frequency). All three groups were tested on memory measures, verbal and nonverbal ability, and academic achievement of work before training; and re-tested in the same measures after training, as well as 8 months later. The data indicate increases in both verbal and visuo-spatial working memory tasks for the high frequency training group. The improvements were also evidenced in tests of verbal and nonverbal ability tests, as well as spelling, in the high frequency training group. There were some maintenance effects when the students were rehearsed 8 months later. Possible reasons as to why computerized work memory training resulted in some far transfer effects in the high frequency training group are included in the debate.

The computerized auditory cognitive training to improve cognition and functional outcomes in patients with heart failure was a pilot study, focused on the feasibility and effectiveness of auditory computerized cognitive training (ACT) was examined in patients with heart failure (HF) [14]. Individuals with HF have four times the risk of cognitive impairment, but cognitive intervention studies are scarce, making use of computerized intervention to work attention and memory issues.

For the specific case of this study, the cyclon application is analyzed in the light of a parallel experiment with the same population of influence with another application called GlyphReader, which aims at training in phonemes for children with cognitive and intellectual disabilities.

## 4 Methodology

The experience of implementing the Ondas program shows a diversity of approaches and methodological processes impossible to synthesize in a single methodological commitment, since each group mixed tools and components of different approaches, depending on the problems worked, the advisors, the possibilities of resources and access to certain types of instruments, according to the context in which it will be developed [15].

The foregoing allowed us to know that the research response is experienced within a perspective of “epistemological and methodological freedom of investigation. The teams define their epistemological perspective - empirical-analytical, hermeneutic, social critic, constructivist, among others - as well as its methodological approach - quantitative, qualitative, participatory, etc. - based on its relevance to answer the question and the objectives of the research. It also recognizes the differences in the research styles of the subjects and in their structures of thought and training [16, 17].

The specialized accompaniment, developed by the external advisors of the projects and by the teachers, has made possible the process of systematic inquiry oriented from different approaches and has translated these elaborate and complex systems into the logic of children’s and youth cultures, without losing the conceptual and procedural rigor; element that has allowed the emergence of this new field of knowledge: to build research processes in initial education for the younger age groups of the population [18, 19].

It has also been concluded that one of the aspects that permanently makes a presence in the different methodological approaches used, is the question as a starting point and feedback of the research process. This question also has some special characteristics, and it can be affirmed that in the 6 years of development its implementation there are some accumulated on it: its use, its methodological place and its conception, which today allow it to be recognized as central or base of the methodological strategy.

Consequently, the methodological process and the place of the question “are understood not as instrumental processes that operate mechanically, but with culturally situated subjects, who put into play their sensitivity, their knowledge, their prejudices, their ability to observe, of creating and innovating in the research process, specifically of these age groups” [20].

Therefore, it is intended that the virtual community knows different research methods and their way of applying them, that integrates methods and techniques to collect information so as to overcome old contradictions and fragmentations of reality between the natural and the social, between the narrative and the quantitative, and that, in collective work, agreements are generated that allow defining their research paths, consistent with their projects and in relation to the specific needs of the regions, helping to build the specificity of Waves [21, 22].

#### 4.1 Population and Sampling

For the development of this research, 350 first-grade students were taken from the public schools of the Magdalena department in Colombia, who were intervened in the reading-writing processes through the development of this project.

## 5 Applications Features

Cyclon first grade is a software tool that supports the identification and learning of the vowels and consonants of the first grade children of the educational institutions of the Magdalena department in Colombia. Through this implementation it is sought to make a learning of the Spanish mother tongue as a fundamental basis for the use of the reading-writing process in students, see Fig. 1.



**Fig. 1.** Learning the vowels



Fig. 2. Listening vowels

Additionally, they are included through interactive activities to identify each of the letters of the alphabet to identify the correct sounds according to the different activities proposed, see Fig. 2.

Additionally, each of the users can select both vowels and consonants to form different words at the beginning of the reading process (Fig. 3).



Fig. 3. Finding new words

## 6 Results and Conclusions

As a result of the software implementation, it was found that the use of information technologies and communications contribute to the learning process, especially in children who begin the schooling process. The results before the intervention of the software and after the use of the application can be seen in the following table and are compared with the use of the GlyphReader tool (Tables 1 and 2).

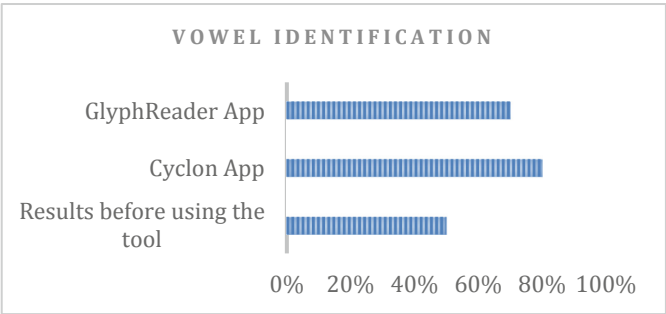
Table 1. Variable analysis with cyclon language app

Variable	Results before using the tool	Results after using the tool
Vowel identification	50%	80%
Reading sounds	40%	85%
Find new words	55%	95%

**Table 2.** Variable analysis with GlyphReader

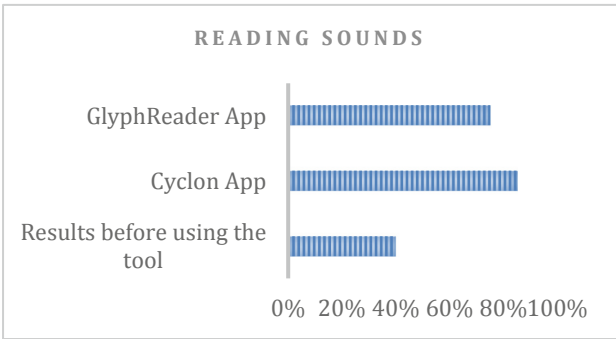
Variable	Results before using the tool	Results after using the tool
Vowel Identification	50%	70%
Reading sounds	40%	75%
Find new words	55%	85%

Performing the analysis of the sensitive variables of the study, it can be noted that in identification of vowels taking into account the methodology and definition of activities, Cyclon App obtains an improvement of 30% versus GlyphReader with 20%, which can be observed in the Fig. 4.



**Fig. 4.** Variable comparison vowel identification

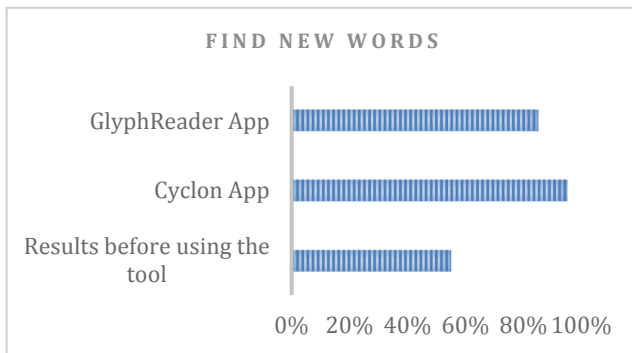
As far as reading of sounds could be identified, Cyclon App obtains an improvement of 45% versus GlyphReader with 35%, which can be seen in Fig. 5.



**Fig. 5.** Variable comparison reading sounds



In the competition to find new words, Cyclon App obtains an improvement of 45% versus GlyphReader with 35%, which can be seen in Fig. 6.



**Fig. 6.** Variable comparison finding new words

## References

1. Laukkanen, A., Pesola, A.J., Heikkinen, R., Sääkslahti, A.K., Finni, T.: Family-based cluster randomized controlled trial enhancing physical activity and motor competence in 4–7-year-old children. *PLoS ONE* **10**(10), e0141124 (2015)
2. Domitrovich, C.E., Durlak, J.A., Staley, K.C., Weissberg, R.P.: Social-emotional competence: an essential factor for promoting positive adjustment and reducing risk in school children. *Child Dev.* **88**(2), 408–416 (2017)
3. Hartmann, K., et al.: Cutaneous manifestations in patients with mastocytosis: consensus report of the European competence network on mastocytosis; the American academy of allergy, asthma & immunology; and the European academy of allergology and clinical immunology. *J. Allergy Clin. Immunol.* **137**(1), 35–45 (2016)
4. Nufiar, N., Idris, S.: Teacher competence test of Islamic primary teachers education in state Islamic primary schools (MIN) of Pidie regency. *Jurnal Ilmiah Peuradeun* **4**(3), 309–320 (2016)
5. Hanko, G.: Increasing competence through collaborative problem-solving: using insight into social and emotional factors in children's learning. David Fulton Publishers, London (2016)
6. Laukkanen, A.: Physical Activity and Motor Competence in 4–8-Year Old Children: Results of a Family-Based Cluster-Randomized Controlled Physical Activity Trial. *Studies in Sport, Physical Education and Health* 238. University of Jyväskylä, Jyväskylä (2016)
7. de Araújo Vilhena, D., Sucena, A., Castro, S.L., Pinheiro, Â.M.V.: Reading test—sentence comprehension: an adapted version of Lobrot's lecture 3 test for Brazilian Portuguese. *Dyslexia* **22**(1), 47–63 (2016)
8. Peters, R., Broekens, J., Neerincx, M.A.: Robots educate in style: the effect of context and non-verbal behaviour on children's perceptions of warmth and competence. In: 2017 26th IEEE International Symposium on Robot and Human Interactive Communication (RO-MAN), pp. 449–455). IEEE, August 2017

9. Ke, Z., Borakova, N.U., Valiullina, G.V.: Peculiarities of psychological competence formation of university teachers in inclusive educational environment. *Eurasia J. Math. Sci. Technol. Educ.* **13**(8), 4701–4713 (2017)
10. Rabipour, S., Davidson, P.S.: Do you believe in brain training? A questionnaire about expectations of computerised cognitive training. *Behav. Brain Res.* **295**, 64–70 (2015)
11. Pressler, S.J., et al.: Nurse-enhanced computerized cognitive training increases serum brain-derived neurotrophic factor levels and improves working memory in heart failure. *J. Cardiac Fail.* **21**(8), 630–641 (2015)
12. Motter, J.N., Pimontel, M.A., Rindskopf, D., Devanand, D.P., Doraiswamy, P.M., Sneed, J.R.: Computerized cognitive training and functional recovery in major depressive disorder: a meta-analysis. *J. Affect. Disord.* **189**, 184–191 (2016)
13. Alloway, T.P., Bibile, V., Lau, G.: Computerized working memory training: can it lead to gains in cognitive skills in students? *Comput. Hum. Behav.* **29**(3), 632–638 (2013)
14. Athilingam, P., Edwards, J.D., Valdes, E.G., Ji, M., Guglin, M.: Computerized auditory cognitive training to improve cognition and functional outcomes in patients with heart failure: results of a pilot study. *Heart Lung* **44**(2), 120–128 (2015)
15. Wickman, K., Nordlund, M., Holm, C.: The relationship between physical activity and self-efficacy in children with disabilities. *Sport Soc.* **21**(1), 50–63 (2018)
16. Snow, P.C.: Elizabeth Usher Memorial Lecture: language is literacy is language-positioning speech-language pathology in education policy, practice, paradigms and polemics. *Int. J. Speech Lang. Pathol.* **18**(3), 216–228 (2016)
17. Shek, D.T., Yu, L., Siu, A.M.: Interpersonal competence and service leadership. *Int. J. Disabil. Hum. Dev.* **14**(3), 265–274 (2015)
18. Arbour, M., Kaspar, R.W., Teall, A.M.: Strategies to promote cultural competence in distance education. *J. Transcult. Nurs.* **26**(4), 436–440 (2015)
19. Sandler, J.: *Dimensions of Psychoanalysis: A Selection of Papers Presented at the Freud Memorial Lectures*. Routledge, Abingdon (2018)
20. De-La-Hoz-Franco, E., Ariza-Colpas, P., Quero, J.M., Espinilla, M.: Sensor-based datasets for human activity recognition—a systematic review of literature. *IEEE Access* **6**, 59192–59210 (2018)
21. Ariza, P., Pineres, M., Santiago, L., Mercado, N., De la Hoz, A.: Implementation of moprosoft level I and II in software development companies in the colombian caribbean, a commitment to the software product quality region. In: 2014 IEEE Central America and Panama Convention (CONCAPAN XXXIV), pp. 1–5. IEEE, November 2014
22. Ariza-Colpas, P., Oviedo-Carrascal, A.I., De-la-hoz-Franco, E.: Using k-means algorithm for description analysis of text in RSS news format. In: Tan, Y., Shi, Y. (eds.) *DMBD 2019*. CCIS, vol. 1071, pp. 162–169. Springer, Singapore (2019). [https://doi.org/10.1007/978-981-32-9563-6\\_17](https://doi.org/10.1007/978-981-32-9563-6_17)
23. Piñeres-Melo, M.A., Ariza-Colpas, P.P., Nieto-Bernal, W., Morales-Ortega, R.: SSwWS: structural model of information architecture. In: Tan, Y., Shi, Y., Niu, B. (eds.) *ICSI 2019*. LNCS, vol. 11656, pp. 400–410. Springer, Cham (2019). [https://doi.org/10.1007/978-3-030-26354-6\\_40](https://doi.org/10.1007/978-3-030-26354-6_40)
24. Ariza-Colpas, P.P., Piñeres-Melo, M.A., Nieto-Bernal, W., Morales-Ortega, R.: WSIA: web ontological search engine based on smart agents applied to scientific articles. In: Tan, Y., Shi, Y., Niu, B. (eds.) *ICSI 2019*. LNCS, vol. 11656, pp. 338–347. Springer, Cham (2019). [https://doi.org/10.1007/978-3-030-26354-6\\_34](https://doi.org/10.1007/978-3-030-26354-6_34)
25. Ariza-Colpas, P., et al.: Enkephalon - technological platform to support the diagnosis of alzheimer's disease through the analysis of resonance images using data mining techniques. In: Tan, Y., Shi, Y., Niu, B. (eds.) *ICSI 2019*. LNCS, vol. 11656, pp. 211–220. Springer, Cham (2019). [https://doi.org/10.1007/978-3-030-26354-6\\_21](https://doi.org/10.1007/978-3-030-26354-6_21)

26. Ariza-Colpas, P., Morales-Ortega, R., Piñeres-Melo, M., De la Hoz-Franco, E., Echeverri-Ocampo, I., Salas-Navarro, K.: Parkinson disease analysis using supervised and unsupervised techniques. In: Tan, Y., Shi, Y., Niu, B. (eds.) ICSI 2019. LNCS, vol. 11656, pp. 191–199. Springer, Cham (2019). [https://doi.org/10.1007/978-3-030-26354-6\\_19](https://doi.org/10.1007/978-3-030-26354-6_19)