

PRO(G)NATURA: PROGRAMMING LANGUAGE AND CURRICULUM DEVELOPMENT FROM THE FREE INITIATIVE OF CHILDREN IN NATURE

Isabel Duque¹, Ricardo Almeida¹, Marlene Migueis², Emília Bigotte de Almeida^{1,3}

¹CASPAE (PORTUGAL)

²UA/DEP/CIDTFF/EDUCA_LAB (PORTUGAL)

³IPC/ISEC (PORTUGAL)

Abstract

Currently, within the Curriculum Autonomy and Flexibility Project (CAFC), schools are invited to transform teaching and change the way the curriculum has been managed, making it more appropriate to the context in which it's developed and to which it's developed for this century: a teaching process centred on the student, on his/her needs and on his/her interests. This article aims to present some results of Pro(g)Natura (PgN), an educational program that combines and articulates the teaching and learning processes of Scratch programming language, nature environment and classroom. This is a program that results from a partnership between three community projects: All in Scratch, for technological education, Invisible Limits, for education in nature and E7G Trampoline, for social inclusion. Pro(g)Natura articulates the benefits of regular contact with nature, prioritizing the free initiative of the student, and the Teaching of programming with the teaching and learning environment in the classroom, within the scope of the development of the CAFC. Starting in the 2018/2019 school year, this project involved the participation of three groups of students from the 1st year of the 1st cycle, from three schools, from a group of schools in the city of Coimbra – Portugal.

The data that we present is part of a larger study and it's referred to the middle evaluation of this project, with a total duration of four years. This study is based on the participation of 41 students and 2 teachers in the Pro(g)Natura educational program. The data presented refers to the perception of the children's guardians regarding the articulation impact from the three referred contexts for the promotion of general competences in students. For this study, questionnaires were applied to the parents of the participating students. The analysis of the responses of the 23 supervisors who responded to the survey allows us to understand that PgN will have contributed positively to the development of essential student learning, with regard to the acquisition of general skills, related to the effective use of codes that allow students to express, represent, select and disseminate knowledge.

1 INTRODUCTION

Nature exploration, through play, is understood as privileged activity to the child's development. According to several studies, playing in the nature has positive impacts to the physical and mental health and to the concepts learning process on different areas (e.g. [1], [2]).

In Portugal, freely playing in the nature was an activity in decline during the last decades. The privilege was given to activities managed by adults, in controlled areas, mostly in indoor environments. This movement was observed on educational and learning environments, and not just in activities organized by the family. Teachers and educators focus on the development of academic knowledge, developed in contexts controlled by them, given few opportunities to the children to explore freely and discover and solve problems by themselves [3].

During the last years, we saw a growing movement from indoor to outdoor activities. Inspired by the Scandinavian educational approach, the number of projects and educational offers, specially to children aged 3 to 5 years, are increasing in Portugal. This movement is justified with the evidences about the benefits of this approach to the child development.

According to Fjørtoft [4], Scandinavian children enjoy educational environments that provide regular play in nature. These environments, according to the author, have shown positive impacts on the child's physical and motor development. To Godbey [5], the regular contact with nature, through good opportunities to play, is determinant to health, namely to wellness. The physical and cognitive activity promoted by nature environments can be considered by us a strategy to combat actual problems such

as the obesity, stress, depression, and hyperactivity (e.g. [6], [7], [8]). Nature provides engaging and stimulating play, where children can develop a better understanding about themselves, their skills and their relationship with the natural world. And these benefits, promoted by regular nature play, continue throughout life (e.g. [9], [10]).

Evidences point to Scandinavian '*uteskole*' and '*friluftsliv*' approaches to learning in nature as an effective strategy for the development of socio-emotional, cognitive and motor skills, as well as for the development of environmental awareness of the child (e.g. [1], [11], [12]). According to the evidences, children who attend schools with regular exploration of nature demonstrated a greater development of mathematical and biological knowledge, compared to students who based their learning only on classroom environments (e.g. [13], [14], [15]). In addition, learning in a nature-based learning environment offers students the opportunity to solve problems, calling forth and using cooperation and creativity [14].

Inspired by Scandinavian educational programs, namely those developed in Denmark and Norway, in 2018 Pro(g)Natura (PgN) was started in Portugal. This is an educational program that combines the benefits of contacting with nature, technology and social inclusion at the service of the teaching and learning process, in an articulated and integrated way. This program understands, not just the benefits of outdoor learning, but the technological learning impact to the development of XXI century's children [11].

The use of programming software, dedicated to the development of technological skills in children is, nowadays, considered as priority in school context. Scratch software, developed by the Lifelong Kindergarten Group at the Massachusetts Institute of Technology (MIT) Media Laboratory, is one of the most programming software uses in Portuguese's schools. It is a simple and intuitive programming language that enables learning in different subjects such as math, science, arts, music or languages and to the development of problem-solving skills (e.g. [16], [17], [18]).

Seeking to break the boundaries between areas of knowledge, raised for decades by the Portuguese education system, Pro(g)Natura is developed as a way to respond to the Curriculum Autonomy and Flexibility Project (CAFC), initiated by the Ministry of Education (ME) in 2017 [11]. This measure gives schools the management of their curriculum and the organization of subject areas. The main goal is the achievement of the competencies provided for in the so-called "Student Profile on Exit from Compulsory Education" (SP) [18]. According to CAFC, in the elementary school (6-10 years), learning must be active, meaningful, diverse, integrative and socializing [19]. The school needs to challenge students to develop researches, using a school beyond the classroom. A school environment open to the outside, for the discovery of knowledge in a contextualized way (e.g. [11], [18], [20]).

PgN is, in fact, an educational program, focused on children 6-10 years, that intend that the students develop the syllabus in a playful and motivating way, giving meaning to the learning in order to achieve better results [16]. It is the result of a partnership between three community projects, each developed by several entities (e.g. [11], [18]): (i) *Trampolim E7G* Project: which is managed by CASPAE, a private non-profit institution, is promoted by the Coimbra Municipality. (ii) *Limites Invisíveis* Project: develops educational programs and belongs to a consortium formed by the Coimbra Education Higher School (ESEC), Department of Basic Education/ Aveiro University and CASPAE. (iii) *All in Scratch* Project: promoted by CASPAE with the support of the Coimbra Engineering Higher Institute (ISEC).

PgN assumes a regular participation in the nature and technological environment with Scratch, allied to the benefits of both environments and to the one that is usually developed in a classroom at this stage (e.g. [11], [18]). Once a week, from 9h00 to 15h00, students engage in nature exploration activities. Also weekly, students have technological classes (60 minutes), using Scratch software. During those classes, children have the opportunity to create technological products that allow the transposition of experiences developed in the nature [18]. Considering the objectives outlined by the ME for the elementary school (SP), PgN defined the following objectives to be achieved:

- 1 General Skills (GS), related to the effective use of codes that allow the expression, representation, selection and dissemination of knowledge: (a) Languages and texts; (b) Information and communication.
- 2 Specific Skills (SS), associated with the adoption of specific behaviours adopted in the two environments, where the program is developed - nature behaviours (promotion of health and well-being, environmental awareness, motor experiences and confrontation with risk) and technological behaviours (use of the software): (a) Critical and creative thinking; (b) Scientific, technical and technological knowledge considered for both environments with definition of

particular operative descriptors in each approach; (c) Aesthetic and artistic sensitivity, more related to the technological environment related to the use of the programming language in Scratch; (d) Well-being, health and environmental awareness; (e) Consciousness and mastery of the body, identified, above all, in the natural environment.

- 3 Transversal Skills (TS), which refers to decision making, interaction with others and their integration into society: (a) Reasoning and problem solving; (b) Interpersonal relationship; (c) Development and autonomy.

According to the data, the articulation between nature play, Scratch and classroom curricular activities, in the perspective of teachers, had a positive impact on the development of general, specific and transversal skills, based on the Profile's Students, of the participants in PgN (2018/19 until 2019/2020) [11]. Besides, according to the evidences presented about the impact of PgN's pilot project on a class of 24 children, this approach can be considered as a positive way to promote environmental awareness [18].

The present study is based on the participation of 41 students and 2 teachers in the PgN educational program. The data presented refers to the perception of the children's guardians regarding the articulation impact from the three referred contexts for the promotion of GS in students. For this study, questionnaires were applied to the parents of the participating students. The analysis of the responses of the 23 supervisors who responded to the survey allows us to understand that PgN has contributed positively to the development of essential student learning, with regard to the acquisition of general skills, related to the effective use of codes that allow students to express, represent, select and disseminate knowledge.

2 METHODOLOGY

PgN started in the school year of 2018/2019. Two groups participated on this educational program, in a continuous way until present, A and B, considered in this study: 24 students from group A in 2018/2019 and 23 in the school year 2019/2020; 17 students from group B in 2018/2019 and 17 in 2019/2020. Other two groups had a partial participation in one school year: C and D, not considerate in this study. The present study is based on the participation of the 41 students and 2 teachers in the PgN educational program.

Each weekly nature class had a daily duration of about 5 hours and the weekly session in Scratch environment lasted approximately 60 minutes. The development of the outdoor class resulted in the exploration of different themes, in articulation with the goals set by the teachers' according to the Student Profile. During the Scratch programming sessions, children explored the tool and developed their technologic knowledge and skills using their experiences in nature.

The group A developed 51 outdoor sessions, in nature: 24 in the 2018/2019 school year and 27 in the 2019/2020 school year. In the Scratch programming language environment, group A held 53 sessions: 26 in 2018/2019 and 27 in 2019/2020. Group B developed a total of 43 outdoor sessions: 21 in 2018/2019 and 22 in 2019/2020. The later had 43 sessions in a Scratch programming language environment: 26 in 2018/2019 and 17 in 2029/2020. It should be noted that, in the academic year 2019/2020, due to the period of confinement imposed due to the pandemic – Covid-19, 31 of the total sessions (nature and Scratch) developed by the two classes were held virtually. Synchronous and asynchronous sessions were developed with the involvement of the students' families.

During the outdoor sessions, the focus was the free play. The teacher's educational planification emerged from the child's initiative. The themes, problems and/or projects that emerge from the child's free play continued their exploration in the classroom. Those children's experiences were transferred to the Scratch programming language. Curricular knowledge was also developed in conjunction with those themes, in the three educational environments - nature, Scratch and classroom.

The present study, framed in a more comprehensive research work of mixed nature (qualitative and quantitative evaluation study), is based on an inquiry investigation-based method. With the technique of inquiry by applying a questionnaire [21], based on the work developed by groups A and B and aims to understand the impact of PgN on the development of GS that this program proposed to develop with the students, from the perspective of the parents/ guardians of the participants.

At the beginning of PgN (phase I), in 2018/2019, and at the end of the school year, in 2019/2020 (phase 2), the participants' parents had access to a questionnaire focused on GS indicators. Of the participating students on this study, 22 parents/guardians answered the questionnaire in phase I and 23 parents/guardians answered the questionnaire in phase II. For this reason, in this study, we considered only the responses from the questionnaires for which we have responses to the two phases, initial and final. Thus, only the responses to 22 questionnaires in the study are considered. Consequently, those questionnaires, reveals data about the impact of this educational program on 22 students, 12 female and 10 male.

The questions posed were aimed at understanding how the parents/guardians assessed the class at the level of competence development of the GS: related to the effective use of codes that allow the expression, representation, selection and dissemination of knowledge: Languages and texts; Information and communication. Those competences were grouped by having as a starting point the operative descriptors of the ME. The Likert scale used in the answers was defined in 4 categories: (i) Nothing, (ii) Little, (iii) Any (iv) Very. The preliminary analysis of the data was performed using Excel, which allowed us to reach some results about the parents' perception about the impact of the children's participation in the program, in terms of their GS's development.

3 RESULTS

To understand the perception of the parents/guardians about the impact of the educational program on the development of GS, in terms of language and texts, considering the indicators relative to the ability to communicate ideas and opinions, the following question was formulated: (A) Does your child share with you their experiences about their different living contexts?; (B) Does the child express their opinion about the experiences shared?; (C) Does the child value some experiences more than others?

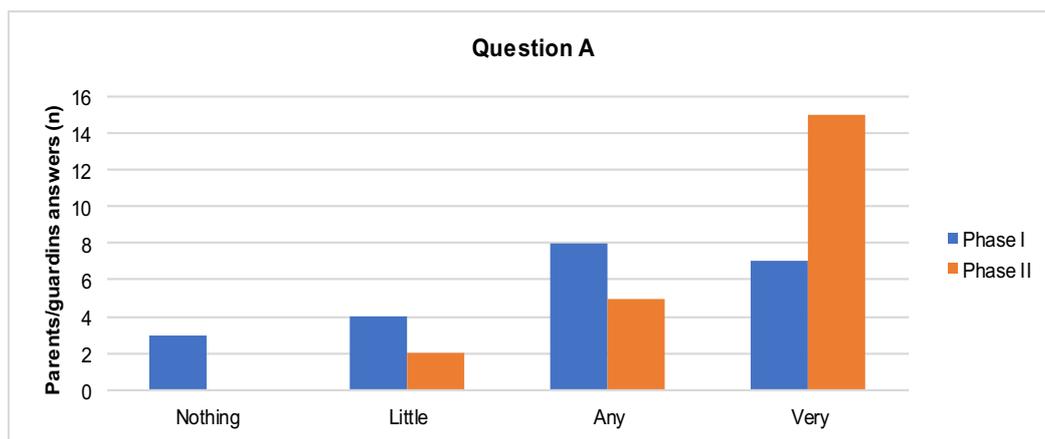


Figure 1. Ability to communicate ideas and opinions: Does your child share with you their experiences about their different living contexts?

As we can see on Figure 1, according with the parents/guardians, formerly (phase I), to the question "Does your child share with you their experiences about their different living contexts?", 3 parents/guardians revealed that the child did not share at all, 4 parents/guardians revealed that the child shared little, 8 refers that the child has made some shares and 7 reveal that the child shared extensively their experiences about their different living contexts. According with the parents/guardian's answers to the questionnaire on phase II, the number of children sharing their experiences grew significantly. At the end of the school year of 2019/2020, no parents/guardians revealed that the child didn't make any sharing. Only 2 parents/guardians said that the child shared little, 5 revealed that the child made some sharing and 15 revealed that the child made significant sharing.

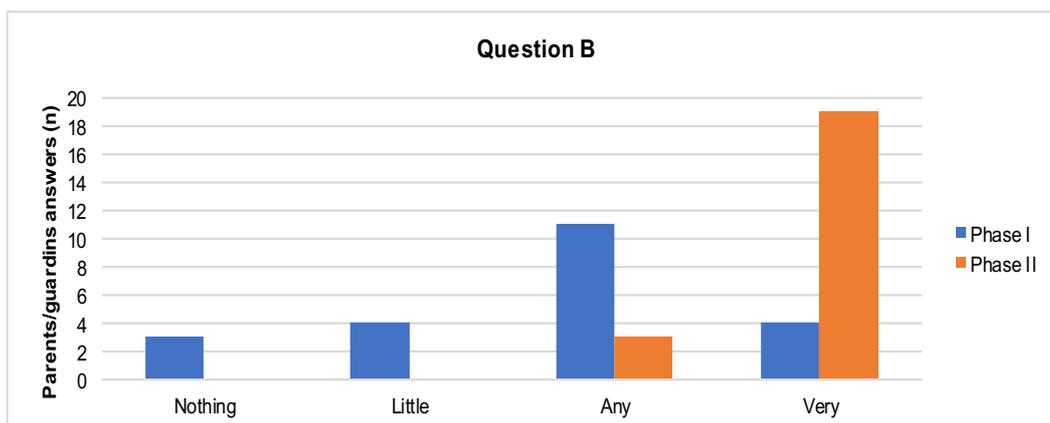


Figure 2. Ability to communicate ideas and opinions: Does the child express their opinion about the experiences shared?

According with Figure 2, in the parent's perspective of phase I, 3 children didn't use to express their opinions about what experiences they shared, 4 did it in a small amount, 11 expressed them multiple times and 4 expressed them significantly. From a different perspective, to the same question on phase II, parents/guardians revealed that only 3 children gave them their opinion multiple times and 19 children expressed extensively their opinion about their shared experiences.

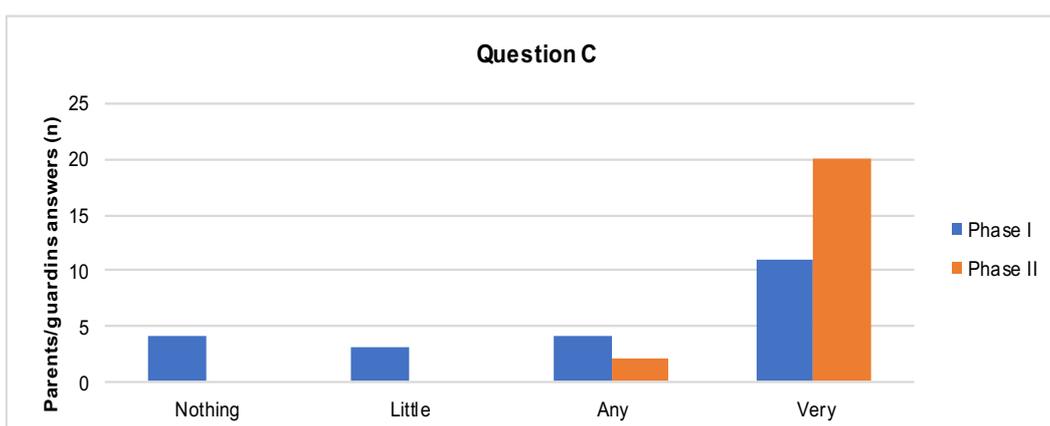


Figure 3. Ability to communicate ideas and opinions: Does the child value some experiences more than others?

Figure 3 allowed us to understand that, in phase I, parents considered that 4 children did not value some experiences more than others, 3 children valorised a little more some opposed to others and 4 valorised multiple ones instead of others, with 11 children doing this discrepancy a lot. When the same question was asked in phase 2, we saw an increase in parents showing that children valued some experiences more than others. All the children, according to the respondents, started to do this, 20 of them very recurrently.

As we can understand by reading the graphs above, PgN can present itself as an educational program capable of enhancing the development of the child's skills to communicate ideas and opinions. According to data, children show an increase in the three parameters assessed by parents.

To understand the perception of the parents/guardians about the impact of the educational program on the development of GS, related to information and communication, was considered the following indicators: (i) reading and writing skills; (ii) research skills in different media, as well as critically evaluating information, and (iii) ability to share knowledge, using different languages. According to that, the following questions were respectively formulated:

- (i) Reading and writing skills: (E) Does the child show interest in representing their experiences and learning in different ways?; (F) Does the child show interest in researching to deepen the learning undertaken?;
- (ii) Research skills in different media, as well as critically evaluating information: (G – phase I) Did the child research, using the internet, books or other means, on topics of interest to him/her?, and

(G – phase II) Has the child started to use the internet resources more for their researches; (H) When the child does it, was it of their own volition or due to the adult's suggestion?; (I) Does the child understand that not all information on the internet is trustworthy?;

(iii) Ability to share knowledge, using different languages: (J) Does the child share the results of their research spontaneously?

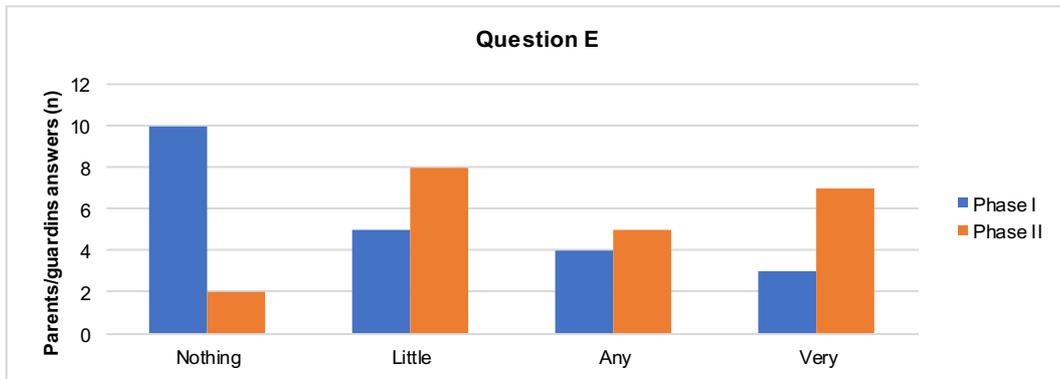


Figure 5. Reading and writing skills:
Does the child show interest in representing their experiences and learning in different ways?

The Figure 5 allowed us to understand that children became more interested in representing their experiences in different ways. According to the parents, in phase I, 10 children were not interested in representing their experiences in different ways, 5 had little interest in doing it, 4 had some interest and only 3 children were very interested in performing these representations. In phase II, the number of children with no interest in representing their experiences in different ways was reduced to 3. The little interest in making these representations started to be verified in 8 children, 5 children show some interest on doing it and 7 children show a lot of interest in using these different ways of representation.

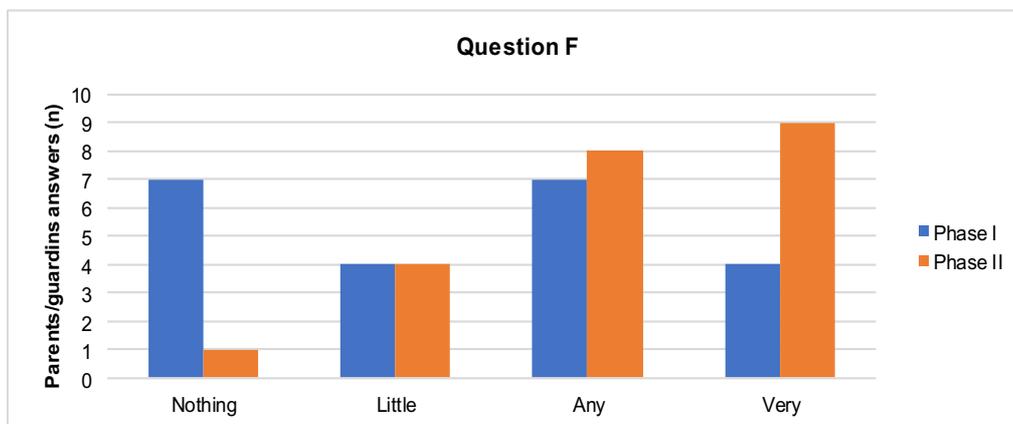


Figure 6. Reading and writing skills:
Does the child show interest in researching to deepen the learning undertaken?

According with Figure 6, in the parent's perspective of phase I, 7 children didn't show any interest in researching to deepen the learning undertaken. At this stage, 4 children showed little interest in doing these researches, 7 showed some interest in doing it and only 4 showed much interest in this type of activity. In phase II, on the contrary, the number of children with a high interest in carrying out these researches became the most verified. Only 1 child maintained his total lack of interest in this activity, the number of children remained little interested in doing the researches (4 children), 8 children showed some interest in doing them, and 9 children showed high interest in carrying out small in-depth studies of the learning carried out.

According with data presented on Figures 5 and 6, we can claim that the child's reading and writing skills have improved significantly from phase I to phase II. Children showed more interest in representing their experiences and learning in different ways, on phase II. As well as, according to parents/guardians, more children showing interest in researching in order to deepen the learning undertaken.

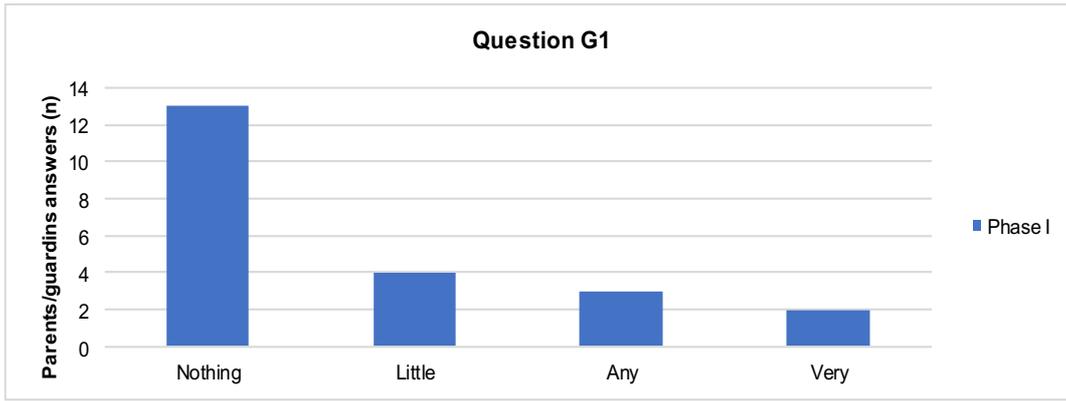


Figure 7. Research skills in different media, as well as critically evaluating information- phase I: Did the child research, using the internet, books or other means, on topics of interest to him/her?

According with Figure 7, in the parent's/guardian's perspective of phase I, 13 children didn't use the internet, books or other means to research about topics of their interest, 4 did it in a small amount, 3 did it multiple times and only 2 did that significantly.

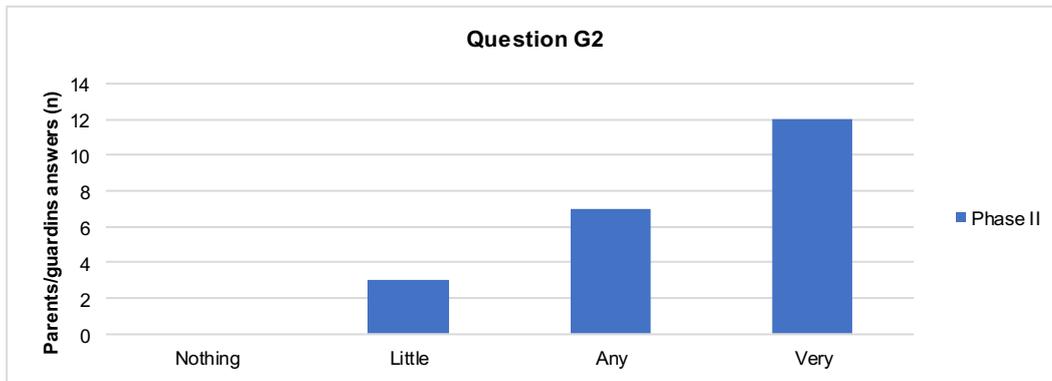


Figure 8. Research skills in different media, as well as critically evaluating information- phase II: Has the child started to use the internet resources more for their researches?

However, as we can understand throughout Figure 8, to the question only applied on phase II - Has the child started to use the internet resources more for their researches? -, parents/guardians revealed that all children started to use the internet to carry out their research. 3 made it infrequently, 7 with some frequency and 12 children started to do it a lot.

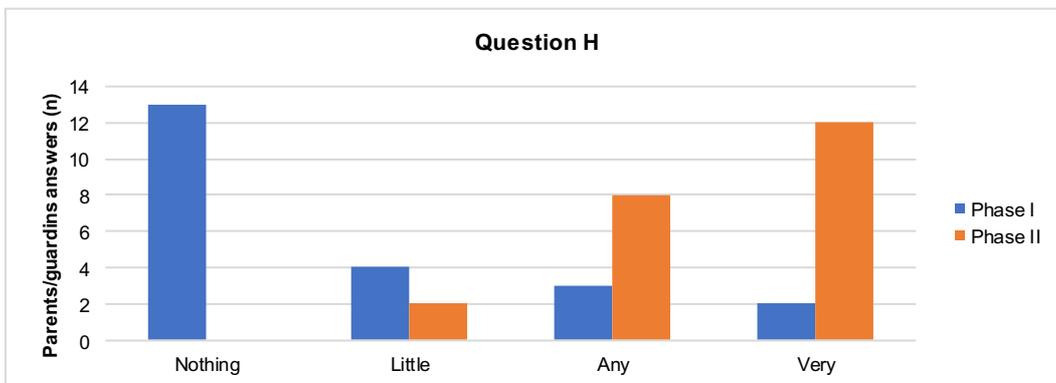


Figure 9. Research skills in different media, as well as critically evaluating information: When the child does it, was it of their own volition or due to the adult's suggestion?

According with Figure 9, in the parent's perspective of phase I, 13 children didn't show any interest in research nor did they have the initiative to carry out their research, not even with the adult's encouragement. At this stage, 4 children showed little initiative in doing these researches, 3 showed some interest in doing it and only 2 showed a significant amount of motivation in this type of activity. In phase II, on the contrary, the number of children with a high motivation in carrying out these researches became the most verified. Only 2 children presented little interest, 8 children showed some motivation in doing them by themselves, and 12 children showed high interest in made their own researches using the internet.

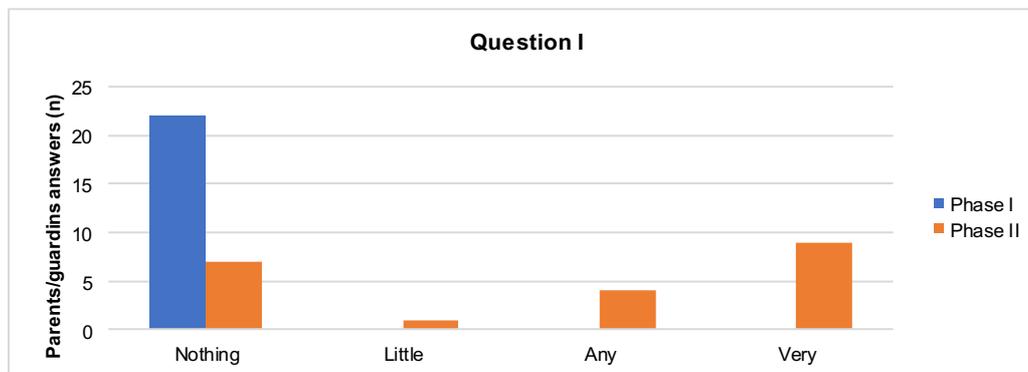


Figure 10. Research skills in different media, as well as critically evaluating information: Does the child understand that not all information on the internet is trustworthy?

The Figure 10 allowed us to understand that children became more capable of evaluating critically the information found on internet. According to the parents, in phase I, no child seemed to understand that not all information that appears on the internet is trustworthy. In phase II, the number of children that showed this understanding grew significantly. According to parent/guardians, just 7 children didn't understand that some information is not reliable. 1 child understood this a little, 4 children understood it somehow, and 9 children understood it completely.

According with the data presented on Figures 7, 8, 9 and 10, the child's research skills in different media, as well as critically evaluating information, improved expressly. Children started to use the internet resources more for their researches, some of them spontaneously. And they improved the comprehension of the importance of critically evaluating the information found.

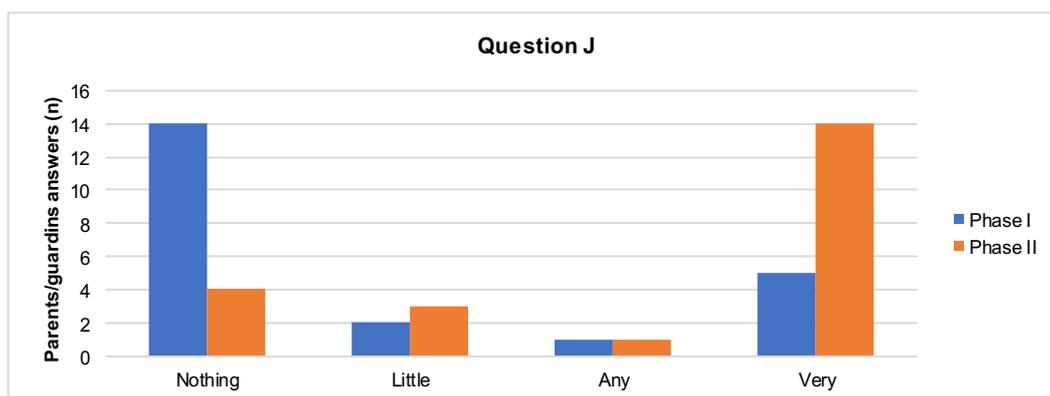


Figure 11. Ability to share knowledge, using different languages: Does the child share the results of their research spontaneously?

According to Figure 11, in the parent's/guardian's perspective of phase I, 14 children didn't share the results of their research spontaneously. At this stage, 2 children did little sharing spontaneously, 1 child did it more often and 5 children did it a lot. In phase II, on the contrary, the number of children with a high interest in sharing the results of their research spontaneously grew: Only 4 children didn't become interesting on doing it. 3 presented little interest, 1 child showed some motivation in doing it, and 14 children shared the results of their research spontaneously a lot.

This data allowed us to understand that the child's skills to share knowledge improved significantly. Since there was a very significant increase in children presenting these skills, from phase I to phase II.

4 CONCLUSIONS

We have seen the standardization of curriculum development across schools in recent decades. We also witness the management of the curriculum centered on the adult, with a load of activities planned and digested by them. We know the benefits of meaningful learning, centered on the child's exploration of themes. We also understand that the discovery of knowledge by the child makes a greater understanding of the concepts possible [11]. And it is exactly in this sense that the CAFC was proposed by ME in 2017, as an educational reform [20]. According to the guiding documents, the new way of thinking the Portuguese education system alert for the need of schools understand themselves as institutions capable of autonomously taking their decisions. In order to individualize and collectivize the curriculum, teachers and students are considered as individuals with a heritage of knowledge, individual and collectively (e.g. [11] [20]).

PgN proposes starting from the child's free play in nature to build the planning of educational intentionality. A plan that supports students in their development process matching the benefits of contact with nature and the child's free play. They also combine the benefits of the technological environment with an educational practice in the classroom that respects the interests and knowledge of students [11].

The present study bring forward that PgN can be considered an educational program capable of enhancing the development of the child's skills to communicate ideas and opinions. According to data, we can claim that, according with parents/guardians, the child's reading and writing skills have improved significantly during the program. This study allowed understand that the child's research skills in different media, as well as critically evaluating information, improved expressly. Children started to use the internet resources more for their researches, some of them spontaneously. And they improved the comprehension of the importance of critically evaluating the information found. Furthermore, this data allowed us to understand that the child's skills to share knowledge improved significantly.

This study makes part of a larger investigation that aims to better understand the impact of using child's outdoor free play in articulation with the curriculum in the nature, the technological environment and the classroom. The evaluation of the impact of transversal and specific skills on child development is also part of this broader study that aims to assess the potential of this educational program in the development of CAFC.

The impact' evaluation of PgN to the child' development of transversal and specific skills is also part of that larger study. This larger study aims to evaluate the potentiality of this educational program on the development of the CAFC.

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