Harmonizing Education: Integrating Technology and Outdoor Learning for Enhanced Child Development

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Abstract

According to the literature, Scratch software, when used in educational contexts, has been shown to enhance learning in various areas such as mathematics, science, arts, languages, and music. Additionally, education in natural environments has been the focus of several studies, which have provided evidence of its potential for curriculum development, as well as for promoting health and well-being.

The study investigates the effects of PRO(g)NATURA (PgN), which blends Scratch programming and nature-based learning for 1st Cycle students. It aims to assess how this approach complements traditional classroom education. PgN targets 1st Cycle students, employing a student-centered methodology that integrates nature education with Scratch programming, aligning with Portugal's curriculum flexibility guidelines for the 1st year of Basic Education.

The study includes 56 students in the PgN program during the 2018/2019 academic year. It aims to evaluate the program's effectiveness in improving children's learning and development. Upon completion, parents/guardians were invited to participate in a feedback questionnaire.

Preliminary data analysis from the responses of 33 caregivers indicates that PgN had a positive impact on the participants' learning and development. Moreover, there were perceived improvements in the children's skills as a result of their participation in the program.

Key concepts:

Flexible Program Structure; Digital Skills Training; Environmental Education, Knowledge Acquisition; Scratch.

Introduction

To promote a more integrated and meaningful learning process, Portugal has implemented the Curriculum Autonomy and Flexibility Project (CAFP). This initiative focuses on student-centered organization and curriculum development, empowering schools to manage their curriculum and subject areas to achieve the competencies outlined in the "Student Profile on at the end of Compulsory Education" (SP). Through the implementation of flexible management plans, the project emphasizes interdisciplinary collaboration and curriculum integration within the framework of "Curricular Autonomy Domains" (CAD). By fostering a stronger connection between individuals and society, the goal is to prepare students for the evolving challenges of a rapidly changing society, both in terms of knowledge and technology (Palmeirão & Alves, 2017; Santos & Leite, 2018).

In the 1st Cycle of Basic Education (CBE), learning is active, meaningful, and integrated, guided by an integration code. The challenge is integrating innovative approaches that promote research and extend learning beyond the classroom, namely through outdoor education (Machado, 2017; Neves & Morais, 2006).

Recognizing that early experiences significantly impact children's future lives, PRO(g)NATURA (PgN) is an educational program designed for children in the 1st CBE (ages 6-10). Aligned with the goals of the CAFP, this program integrates three educational environments: the classroom, Scratch programming, and outdoor settings. The aim is to engage students in playful and motivating learning experiences that imbue learning with meaning and promote better outcomes, particularly in terms of competency development as outlined in the SP (Almeida et al., 2019).

This paper seeks to present the preliminary findings of the impact of PgN during its inaugural year of implementation on children's learning and development, as perceived by their parents/guardians.

1. Exploring Nature and Technology

In an increasingly technology-driven society, the significance of computers and other technological tools in students' daily routines cannot be overstated. In educational contexts, programming software like Scratch is vital for cultivating crucial 21st-century skills. Developed by MIT's Lifelong Kindergarten Group, Scratch offers a user-friendly platform for learning various subjects and fosters problem-solving

abilities, as evidenced by different studies (Ferrer-Mico, Prats-Fernandez & Rendo-Sanchez, 2012; Kalelioğlu & Gülbahar, 2014).

There is a growing awareness in scientific and educational circles of children's reduced exposure to nature in recent years, which has been associated with an increase in health issues like obesity, asthma, and attention deficit disorders. Outdoor education programs, inspired by Scandinavian models, have garnered attention for their positive effects on children's health, motor skills, and cognitive development, including problem-solving and creativity (Dalaney & Smith, 2012; Erikson & Ernst, 2011; Fjørtoft, 2001; Muñoz, 2009; Dismore, 2005; Wahyuni & Suana, 2017).

PgN integrates Scandinavian outdoor education principles, influenced by Denmark's "udeskol" approach. Supported by government and educational institutions, it emphasizes integrated learning through outdoor exploration. The Udvikling af Udeskole Project oversees this approach's advancement, with increasing school adoption from 290 to 344 between 2007 and 2014, focusing on achieving curricular objectives through outdoor activities. (Bentsen et al., 2018; Ejbey-Ernst & Bentsen, 2015; Bentsen & Jensen, 2012).

In the context of PgN, outdoor activities are carefully planned in collaboration with classroom teachers, with a focus on aligning them with ongoing curriculum themes. These outdoor experiences are then complemented by activities using the Scratch programming language, providing opportunities for students to apply and reinforce their skills in an interdisciplinary and authentic learning environment.

2. PRO(G)NATURA: Bridging Education with Nature

PgN, a collaborative initiative, which involves three projects: Trampolim E7G, Limites Invisíveis, and All in Scratch. Trampolim E7G, sponsored by Coimbra Municipality and managed by CASPAE, funds PgN and supports social inclusion. Limites Invisíveis, with IPC/ESEC, Aveiro University, CASPAE, and ICNF, enhances outdoor education. All in Scratch, by CASPAE with IPC/ISEC, promotes digital inclusion and supports Scratch programming at 1st CBE. PgN combines outdoor activities with Scratch programming, enhancing classroom learning. Students explore nature weekly from 9:00 am to 3:00 pm and spend an extra 60 minutes on Scratch, aligning with the curriculum and promoting transdisciplinary learning. Activities are student-driven and connected to the curriculum, fostering transdisciplinary learning and student motivation.

During the academic year 2018/2019, the PgN was implemented in three classes of a school cluster in Coimbra. As part of the Priority Intervention Educational Territories Program, the school benefits from support provided by the Trampolim E7G Project, which aims to promote the social inclusion of children and youth from vulnerable backgrounds.

to natural and technological environments, coding, decision-making, and social integration. PgN aims to promote collaboration, interdisciplinary knowledge, creativity, environmental awareness, and digital literacy, fostering computational thinking, motor skills, resilience, and critical thinking. Additionally, it addresses specific SP areas like language proficiency, information literacy, reasoning, problem-solving, and interpersonal skills.

Figure1: Children in free exploration in nature

Figure2: Child programming experiences in nature, using Scratch

PgN, in alignment with the CAFP, targets CAD development through SP-based learning outcomes. It emphasizes competencies in adapting

3. Contextual Framework and Methodological Approach

The study, part of a broader investigation, occurred during the first year of the four-year PgN program, involving 56 children and their

teachers across three 1st grade classes in the 2018/2019 academic year. Class A (15 students) had 27 outdoor sessions and 26 Scratch programming sessions, Class B (17 students) had 21 outdoor sessions and 26 Scratch sessions, and Class C (24 students) had 24 outdoor sessions and 26 Scratch sessions. Each outdoor session lasted about 5 hours weekly, with Scratch sessions lasting approximately 60 minutes. Outdoor sessions were aligned with the goals designed by based on the SP, while Scratch sessions aimed at developing basic digital skills and integrating outdoor experiences.

In this study, we opted to employ a survey as our primary instrument for gathering information due to its effectiveness in capturing a wide range of data in a structured manner. Surveys provide a systematic approach to collecting responses from a large sample size, allowing for efficient data collection and analysis. Moreover, they offer the advantage of standardization, ensuring consistency in the data obtained across different respondents. This standardization facilitates the comparison of responses and enhances the reliability and validity of the findings. Additionally, surveys afford respondents the opportunity to provide anonymous responses, which can encourage honesty and reduce social desirability bias. Overall, the use of a questionnaire in this

research provides a robust means of obtaining comprehensive and reliable data to address our research objectives (Fowler Jr, 2013).

In this scope, at year-end, parents were surveyed to assess PgN's impact on children's learning. 33 parents responded (3 from Class A, 10 from Class B, and 20 from Class C). The questions were graded on a 5-point Likert scale from "Very negative" to "Very positive." Parents also rated pre/post-program skills (scale 1-5), including emotional well-being, social interaction, creativity, critical thinking, problem-solving, and environmental awareness. Analysis aimed at identifying skill level changes post-PgN.

3.1. Results

The results section provides a detailed overview of the parental assessments conducted to gauge the development of children enrolled in the program. Through the lens of parental perception, this analysis delves into various dimensions of growth encompassing emotional sharing, autonomy, self-confidence, self-regulation, creativity, critical thinking, argumentative skills, problem-solving abilities, adaptation to new situations, social interaction, communication skills, conflict management, motor development, and environmental awareness. These parental evaluations offer valuable insights into the progress

made by the children across diverse areas of development, highlighting both areas of improvement and potential areas for further focus. By examining parental perspectives, this section aims to provide a comprehensive understanding of the holistic development of the children within the program.
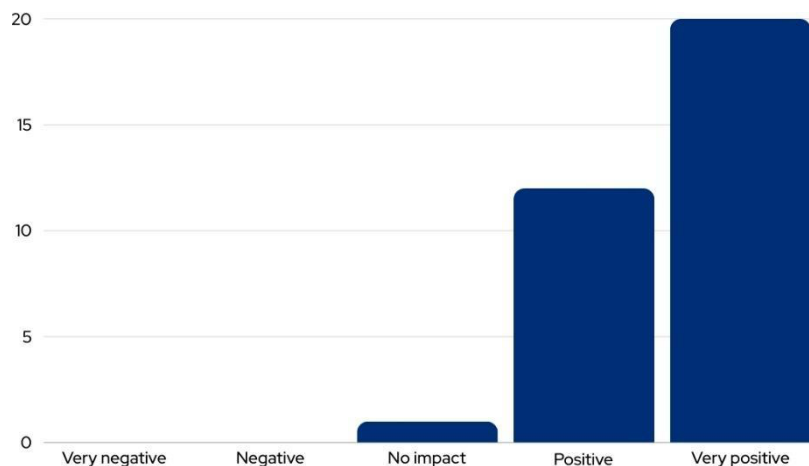
Graph 1: Impact on child's learning and development

Graph 1 summarizes parental perceptions of PgN's impact on children's learning and development. Among 33 respondents, 20 parents/guardians perceived a very positive impact, 12 noted a positive impact, and only 1 reported no perceived impact. Notably, no negative

impacts were reported.
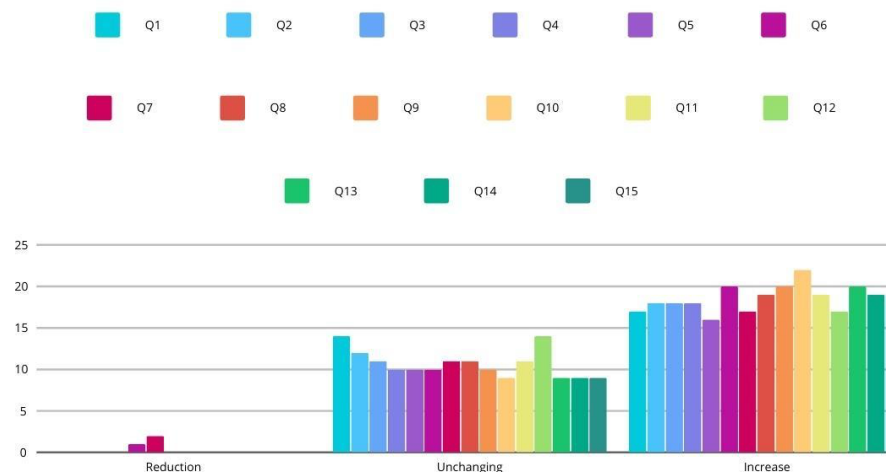
Graph 2: Parental perspectives on their children's multifaceted development

Graph 2 serves as a comprehensive snapshot of parental evaluations concerning various facets of their children's development. Delving into the specifics, it becomes evident that parental perceptions are varied yet consistently focused on growth.

Starting with emotional sharing skills, 18 out of 30 respondents noted improvements in their child's ability to express and share emotions effectively. Conversely, 12 parents didn't perceive any notable

changes in this area.

Moving on to autonomy, a similar trend emerges among 29 respondents, where 18 parents observed positive strides in their child's independence and decision-making capabilities, while 11 reported stagnation.

Self-confidence, a crucial aspect of a child's overall well-being, saw 18 out of 28 parents recognizing an uptick in their child's self-assurance, while 10 observed no discernible changes, indicating a mixed landscape of growth.

Self-regulation skills, essential for managing emotions and behavior, were evaluated by 26 parents. Of these, 16 noted improvements in their child's ability to regulate themselves, whereas 10 reported no noticeable changes during the assessment period.

Creativity, a hallmark of a child's imaginative prowess, garnered responses from 31 parents. Impressively, 20 parents witnessed their child's creativity flourishing, while 10 saw no shifts, and one parent even noted a decline, highlighting the complexities inherent in creative development.

Critical thinking, vital for problem-solving and decision-making, was evaluated by 30 parents. Here, 17 observed enhancements, 11 saw no changes, and 2 even noticed a decline, underscoring the nuanced nature of cognitive development.

Similarly, argumentative skills, problem-solving abilities, adaptation to new situations, social interaction, and communication skills, as well as conflict management skills, all displayed patterns of improvement among varying proportions of respondents, reflecting a dynamic spectrum of developmental progress within the cohort.

Furthermore, motor development and environmental awareness skills also exhibited positive trajectories, with a significant number of parents noting improvements in their child's physical prowess and ecological consciousness.

In summary, Graph 2 encapsulates a rich tapestry of parental perspectives on their children's multifaceted development, illustrating both areas of growth and areas needing further attention, thus providing valuable insights into the diverse trajectories of childhood development.

The evaluation of PgN's influence on children's environmental awareness included 28 parents/guardians. Graph 16 shows that 19 of them perceived a rise in their child's environmental knowledge after engaging in PgN, while 9 didn't note significant changes.

Preliminary analysis of parental responses indicates that participation in PgN facilitated children's learning and development. Parents perceived enhancement across all fifteen competencies considered in the analysis.

Conclusion

In recent years, extensive research (cf. Duque et al., 2020) has highlighted the benefits of outdoor learning, including positive impacts on health, environmental awareness, and the development of personal, social, and academic skills. Concurrently, technology-enhanced learning environments, such as Scratch software, have gained recognition for their positive effects on children's learning. PgN uniquely combines these environments within the CAFP framework, creating an integrated curriculum that caters to children's interests.

Based on child-led exploration of nature, PgN promotes emergent themes and projects that guide adult planning. Adults identify opportunities for SP development from children's actions, shaping educational initiatives accordingly. Student experiences in nature seamlessly transition to the classroom and Scratch programming, facilitating ongoing exploration and leveraging existing knowledge.

Initiated in 2018/2019 as part of the CAFP development in three schools within the Rainha Santa Isabel school cluster, PgN has been implemented with three 1st-grade classes and is slated to continue throughout the first cycle of studies, spanning four years.

At the end of the inaugural year, parents/guardians overwhelmingly perceived PgN positively, with 96% highlighting its role in enhancing essential skills. Specifically, improvements were noted in emotional well-being, critical thinking, conflict management (55%), emotion sharing, autonomy, self-confidence (58%), self-regulation (51%), creativity, problem-solving, motor skills (65%), argumentation, social interaction, communication, environmental awareness, interdisciplinary knowledge (61%), and adaptability to new situations (68%).

Preliminary findings underscore PgN's potential as an impactful educational initiative. Informed by participant feedback and input from school stakeholders, including principals and teachers, the program is expanding to additional classes, promoting student-centered learning methodologies.

Exploring nature-tech synergy in education is crucial for enhancing children's learning. Understanding its impact could aid widespread

adoption in schools, aligning with education goals and CAFP directives.

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Curricular Note

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