

INTEGRATING CITIZEN OBSERVATORIES INTO SCHOOL ENVIRONMENTAL EDUCATION FOR SUSTAINABILITY: DESIGN AND EVALUATION OF A CASE STUDY ENGAGING STUDENTS WITH PL@NTNET AND ODOURCOLLECT

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Abstract

Environmental Education for Sustainability (EEfS) seeks to facilitate people's learning about environmental and sustainability issues, not only to enable the development of fundamental scientific concepts, content knowledge and skills for understanding and dealing with current environmental problems, but also to cultivate ecological values and foster diverse competences for a responsible and democratic participation into more sustainable futures. Citizen science also focuses on engaging people with science and community action over local and global environmental and sustainability issues and topics. Defined as work undertaken by, or within, citizen communities supported and moderated by scientists and other community stakeholders, citizen science aims to advance science, foster scientific literacy and research competences, encourage community engagement and empower people to join ongoing debates about these issues. However, although education and learning are not among citizen science's first and explicit goals, there are commonalities shared between the two fields. It is argued that synergies need to be further explored and strengthened with new learning designs and opportunities.

In this paper we first outline the general approach and strategy taken by Cos4Cloud, a European Horizon 2020 project, that supports the integration between EEfS and citizen science through collaborative research, technological innovation and educational design and praxis. The project builds on Citizen Observatories (COs), i.e., technological platforms and tools that facilitate the development of citizen science projects, particularly those whose main objective is large-scale citizen participation, by digitally connecting citizens, supporting their observational competences, and providing information flows. However, a second goal is to broaden the current scope of citizen science based on COs through their integration into school based EEfS and create more opportunities for testing their integration and the new services in terms of the experience they offer. We illustrate this approach through a case study designed to engage Greek primary school children with two citizen observatories, PI@ntNet and OdourCollect, as educational tools with added value in a school EEfS project. A new-materialist approach was chosen, building on children's encounters with their more-than-human local environments and the intrinsic value of nature, while exploring biodiversity and environmental quality and highlighting various threats to their environments' ecological balance. Finally, we report findings from a study conducted to investigate the children's experience with their more-than-human nature world. We argue that technology can become an important non-human agent in experiencing the world and offer new perspectives to both citizen science and EEfS.

Keywords: environmental education for sustainability, citizen science, citizen observatories, Cos4Cloud European project, PI@ntNet, OdourCollect, new-materialism, nature.

1 INTRODUCTION

On 13 January 2022, the European Commission issued a draft Council Recommendation regarding learning for environmental sustainability [1]. The Recommendation recognizes that the planet is at a critical turning point in relation to the disruption caused by human activity and regarding human existence and well-being. It also identifies appropriately conceived educational designs and as among the urgent actions to put society on a sustainable path. This document adds to the many international scientific declarations and policy papers pointing to Environmental Education for Sustainability (EEfS) as a lifelong learning process, with practice-oriented, participatory, action-based learning modes aiming to foster, i) knowledge,

understanding and critical thinking (cognitive learning); ii) the development of practical skills (applied learning); and iii) empathy, solidarity and care for nature (socio-emotional learning) for environmental sustainability. Among others, EEfS seeks to facilitate people's learning on environmental and sustainability issues, to enable the development of scientific concepts, content knowledge and skills for understanding and dealing with current environmental problems, while also to cultivate ecological values for a responsible and democratic participation into more sustainable futures. It emphasizes the value of supportive learning environments, is learner-centred, participatory, empowering and based on real-life experiences, it enhances collaboration and partnerships in the local and wider community, and engages young people in developing sustainability skills in meaningful ways ([2], [3], [4]).

As a response to the urgent call to put society on a sustainable path, education draws on existing practices, develops synergies and search for new opportunities to engage people with learning for environmental sustainability. Citizen science is among such potential synergies to create, since much of its practice also focuses on engaging people with science and community action over local and global environmental and sustainability issues and topics. Defined as work undertaken by, or within, citizen communities supported and moderated by scientists and other community stakeholders [5], [6], citizen science aims to advance science, foster scientific literacy and research competences, encourage community engagement and empower people to join ongoing debates about these issues. This is mainly through the use of customized digital devices and technologies for data collection and sharing. In doing so, it aims to increase scientific and environmental literacy and develop global citizenship through the active participation of citizens in local issues. Education and learning may not be among its first and explicit goals; however, there is an inherent link between participation in environmental citizen science projects and environmental learning.

These are some of the many commonalities citizen science shares with EEfS. However, the synergies between the two fields remain largely unexplored [7]. Moreover, synergies among already existing practices need to be framed under new schemes of engaging people, especially the younger generations, with environmental sustainability. In recent years, new, alternative approaches have emerged in education that are compatible with the promotion of learning for environmental sustainability. Among these are post-humanist and new-materialist approaches aiming at the emergence of more holistic models of thinking and pedagogical practice on the basis of more authentic combinations of life and knowledge ([4], [8], [9], [10]). The basic principle of these approaches is, on the one hand, the recognition, both epistemologically and ethically, of the equal status of human and non-human elements in the world, and on the other hand, the pursuit of a more expanded experience of the world [11]. Shifting the focus from the human to the relationships between human and non-human elements in the context of complex socio-ecological networks [3], [8], the notion of 'assemblages'¹ [12] of human and more-than-human entities and materialities and the mapping of their relationships through lived, embodied experiences in local environments emerges as central. Approaches of this type prompt an understanding and sense of attachment with the world and our participation in it [13], and offer new starting points for defining human experience. They also pave the way for the introduction of new pedagogies [11] built on the idea that children learn through their engagement with the various 'materialities' of their world ([3], [10], [14], [15]).

The educational case study presented here aims to build such synergies between EEfS and citizen science and to put forth post-humanist and new materialist conceptions and approaches. It also promotes the pedagogy of attuning with the environment ([16], [17]), through the pedagogical encounters of children/students within immediate nature places in their area, including both designed activities and favoring children's unexpected moments/experiences with their more-than-human world [18]. This approach, which is philosophically based on the concept of "assemblages of bodies" of all types (material, discursive, technological, etc.) ([4], [19]), seeks to nurture an ecological way of thinking, co-existing and co-evolving not only with other humans but also with more-than-human entities ([3], [16], [20]). Both the educational case study and the research conducted and reported here were designed and implemented in the framework of the European project Cos4Cloud.

¹ As Mannion [4] points out, the concept "assemblage", coined by Deleuze and Guattari [12], is an adaptation of the translation of the French word "*agencement*". The connotation of the word is deliberate, suggesting "an active coming together of things". Consequently, any assemblage, be that a place or a project, is "a coming together" of various human, more-than-human and material elements that influence, affect and involve each other in their encounter [4]. In line with Jukes et al., [19], we find the concept useful to consider that people and places are composed of dynamic heterogeneous relationships of human and more-than-human actants.

1.1 Building synergies to promote environmental sustainability in Cos4Cloud project

Current environmental issues, such as climate change, biodiversity loss and environmental pollution, are placing a significant burden on life and quality of life on a global scale, by affecting human and ecosystem health and activity and by undermining the function and cohesion of local communities. As a response to this urgent call, synergies need to be developed among existing practices fostering environmental sustainability, and new opportunities need to be explored for people to reevaluate their relationships with nature and develop new ways how to deal responsively with the new sustainability challenges [21].

EEfS is an educational area that seek to facilitate people's engagement in learning about these issues. Without downgrading the acquisition of scientific knowledge and skills, EEfS emphasizes the cultivation of values and competences that feed processes of individual and collective inquiry and the active and critical construction of knowledge as prerequisites to democratic participation for more sustainable futures ([22], [23]). On the other hand, much of current practice of citizen science focuses on engaging people in science and action on specific environmental issues and topics, in collaboration with scientists and local stakeholders ([5], [6]). Community-based monitoring of the local environment with the use of customized digital devices and technologies for data collection and sharing may lead to enhanced scientific and environmental literacy and the development of global citizenship through the active participation of citizens in local issues. Education and learning may not be among its first and explicit goals; however, there is an inherent link between participation in environmental citizen science projects and environmental learning.

Although EEfS and citizen science are two different practices, there is alignment in the way both see their role, namely emphasizing active participation in individual and collective processes of inquiry on current environmental and sustainability issues. The concept of "environmentally active and responsible citizen" is a central tenet for both and a key tool for promoting sustainability. However, as noted by Wals et al [7], even though there are many common grounds, there have not yet been significant efforts to bring them together. They also argue that creating synergies between them with the use of digital technologies and tools can be to the benefit of science, local communities and educational processes and can certainly enhance efforts towards environmental sustainability. Such synergies can be further enriched if coupled with new educational designs that facilitate more authentic forms of socio-emotional learning in and with nature and the world.

Establishing synergies between EEfS and citizen science towards environmental sustainability is one of the goals of Cos4Cloud (Co-designed citizen observatories for the EOS-Cloud), a European Horizon 2020 project [24]. This goal will be achieved in two ways: first, by creating and supporting a network of citizen observatories through the development of a set of 12 technological services; and second, by aiding and promoting school education to become a key mechanism to introduce citizen science to a wider audience and sow its seeds in new contexts. Citizen observatories (COs) are research infrastructures (e.g., the technological platforms where a diverse range of tools are developed, such as web portals, smartphone apps, electronic devices) that allow the development of citizen science projects, in particular those whose main objective is large-scale citizen participation, covering wide geographical areas and long periods of time. The newest forms of observatories integrate the latest information and communication technologies (ICT) to digitally connect the citizens, improve their observational competences and provide information flows [25]. Among their key features are that they enable citizen participation in environmental monitoring and governance; a bi-directional flow of data and information; "in situ" observations from the citizens; and the use of mobile and web technologies [26]. The technological services [27], which are being co-designed with key stakeholders and carefully tested with end-users, will help improve the practice of citizen observatories, mainly on the levels of quantity and quality of observations and on the platforms' their long-term sustainability. When ready they will become available in the new European Open Science Cloud (EOSC), a virtual space aimed at the European scientific community, so that anyone interested in creating or improving their CO can have access to them.

However, synergies to bring about deeper and more meaningful changes towards sustainability are also promoted by Cos4Cloud project though the expansion of citizen science beyond traditional adult audiences and its integration with school EEfS. To this end a strategy has been conceived and is being elaborated to support such synergies through collaborative research, technological innovation, and educational practice. This strategy encourages the co-design, implementation and evaluation of innovative learning situations and supports in schools. Cos4Cloud aims to roll out this methodology to other citizen observatories to propose a model of integrating citizen science technologies in school EE across Europe. Through setting up networks of citizen observatories and supporting them with

interoperable technology, the gains can be multiplied, and students can take advantage of a more holistic knowledge based on the improved quality and quantity of the data collected [28].

2 THE EDUCATIONAL CASE STUDY

2.1 Context and educational approach

The case study presented here was carried out with Greek primary students aged 8-11 years old, who live in Chios, a Greek island of the Northeastern Aegean Sea. The idea was to bring the children in contact with a wetland area very close to their homeplace, a town of 24,000 inhabitants. This was designed to be done through the students' pedagogical encounters with their more-than-human world supported by educational experiences which triggered their sensory interactions with the 'materialities' of the place, and building on them, evolved into relational meaning-making activities on the inextricable relationships between people and places. Two Citizen Observatories (CO), namely PI@ntNet and OdourCollect, were integrated in educational design, for exploring the wetland ecosystem and for developing scientific skills and literacy. This was based on the consideration that, from a post-humanist perspective, technology is another way of engagement and participation with/in the world, and from a relational materialist educational perspective, it can offer the students the possibility to experience their becoming-with-their-place in more modes [20].

2.2 The educational scenario

The case study was based on an educational scenario designed by the first two authors, members of the NKUA team, fostering learning opportunities aiming to highlight the importance of place with all types of entities and materials, and the interactive practices that are inextricably linked to the past, present and future of children's immediate environments. At the same time, the scenario sought to contribute to the development of synergies between EEfS and citizen science through the adoption of practices that facilitate the production of knowledge about local environment and familiarize students with scientific research. It was centered on highlighting the intrinsic value of a local wetland, and more precisely, through (a) observing and recording the wetland's floral diversity and the threats to it, (b) nurturing olfactory sense of place and olfactory identity, and (c) raising the problem of olfactory pollution. All the above were approached on the basis of the new, embodied connections that are constantly emerging in the diverse intra-actions taking place between human and more-than-human communities.

The scenario includes three phases and can be implemented over a period of three months. In the first phase, students are introduced to the concept of ecosystems in their local environment, floral diversity and citizen science, and become familiar with the COs PI@ntNet & OdourCollect. The second phase involves conducting field studies and collecting empirical material in their local wetland. In the third phase, students analyse the empirical materials collected, draw conclusions and make recommendations. Dissemination of the results to the school and the wider community is also envisaged, as well as the organisation of a BioBlitz, where young and adult generations act for the sustainable future of their local area.

2.3 The two citizen observatories involved: PI@ntNet and OdourCollect

The idea for PI@ntNet came about through the realization that a major obstacle to knowing the different plant species in the world has been their identification. Many diverse species may coexist in one place but be unidentifiable by people without experience or botanical scientific expertise. The PI@ntNet web and mobile platform emerged as a product of an interdisciplinary research collaboration that experimented with new approaches to facilitate species identification, based on recent advances in artificial intelligence, notably automated visual data analysis techniques [29]. New computational approaches to identify, manage and analyse large volumes of botanical visual data have become available through PI@ntNet over the last decade [30], which has led to the simplification of recording high-precision geospatial data on the distribution of organisms, thus contributing to enriching our knowledge on the geographic distribution and phenology of species, and enhancing the potential for education and awareness of non-specialists.

By having active PI@ntNet users share and validate visual botanical data (thus improving the overall performance of the platform), many new research and management activities have been implemented around the world. Since its creation in 2009, PI@ntNet tools have been used by more than 32 million people, including 3 million registered users, in more than 150 countries. PI@ntNet has responded to more

than 700 million botanical identification requests, of which more than 10 million have been shared on the GBIF international platform, which provides researchers with privileged access to large-scale biodiversity occurrences. The implementation of local biodiversity atlases, carried out in cities, villages and nature reserves, promotes the appropriation of this platform, and its use in educational contexts. Several schools have been involved in the implementation of these atlases, thanks to the mobilization of teachers who have structured the implementation of inventories by students at various levels (from secondary school to university). These experiences have demonstrated the attractiveness of young people for this type of citizen science platform, but also the benefit for the scientific community which, through such initiatives, has access to a large amount of new pertinent data to carry out research work in ecology.

OdourCollect is a citizen science project on odour pollution that turns citizens into environmental researchers who explore their environment to map and monitor odours, both nice and foul smells. Inspired by the studies of field panelists, OdourCollect gave the opportunity to obtain for the first time observations about diverse odour incidents in real time and space through citizen science methodologies. Via the project's mobile application and website, more than 2,150 users have already recorded around 11,600 such incidents worldwide. Assessing odour pollution is a really complex process, and there is currently no technique that allows to fully determine it. This is why scientific data and knowledge gained from odour impact management plans need to be complemented by experiential data shared by lay citizens who have an active involvement in improving the quality of life in their communities. Moreover, since olfactory sense is the most primitive and powerful sense in humans, with a direct connection to our memories and strong cultural and anthropological components, it can be integrated in educational and community-based projects that explore, experiment and map unusual and unpleasant odours to identify the manifestation and sources of environmental problems related to traffic, solid waste or water effluent, or in order to map pleasant environmental paths. The use of the app brings students closer to technology and science, and odour identification allows experts behind the platform to develop a better olfactory vocabulary. The experience and use of OdourCollect has also been brought to Museums and libraries, as intergenerational spaces that can multiply citizen engagement.

2.4 Participants and implementation

The educational case study took place between March and May 2022. A total of 64 students, 31 girls and 33 boys of the 6th Primary School of Chios participated. The students, aged 8 to 11 years old, came from 4 different classes: Grade 2 (n=13), Grade 3 (n=14), Grade 4 (n=16) and Grade 5 (n=21). The introductory phase was carried out during March 2022, while the wetland excursions were held in April and May 2022. Students were divided into four groups consisting of students from all grades. Each of the four field trips was run on a weekend, lasted 7 hours (from 9.00 am to 4.00 pm), and children took part in a range of activities, with a one-hour break for lunch and relaxation at locations chosen by the children themselves. The project was completed in May 2022 with the third phase.

In this section, we briefly present two activities that were designed and implemented during the second phase of the scenario, during the 4 visits to the wetland. In the first activity the children made use of PI@ntNet, while in the second they used OdourCollect. In both activities the goal was to develop synergies between EEfS and citizen science, which would build on and promote more-than-human, place-responsive educational experiences for the young students in their pedagogical encounters with place as emerging assemblages of the children's bodies co-existing, affecting and being affected by and with the different kind of materialities of the wetlands and the technologies used [12]. To this end, children were given ample time to attune with the place the more-than-human entities, comprising of both environmental and technological materialities.

2.4.1 Educational activity 1: "My own private 1m²"

In the wetland, children were asked to choose their own "1 m²" of land or territory (1 m² was mentioned as a token, as it could be up to 4 m²) and to spend some time observing it. They were encouraged to choose different spots, with different topography and plant species diversity. At their chosen spot of land, they had to watch the different colors, shapes, plants and animals to realize how many different kinds of more-than-human life and materialities coexist in it. As part of this observation, the children took pictures of the different kinds of plant species and identified them with PI@ntNet. After immersing themselves with the place through both their senses and the PI@ntNet app, each student standing in a circle introduced to the others the more-than-human world identified in "their own 1 m²" and all children shared their observations, thoughts, feelings and ideas.

2.4.2 Educational activity 2: “Scenting around-the-walk: the environmental odours’ trail”

This activity involved pairs of students taking sensory walks following the shoreline of the wetland and exploring various points of interest in the area. The children took pictures of the spots where they detected specific odours and recorded them on the OdourCollect platform. The walks were carried out with the eyes blindfolded for one student and the other as a guide. The non-seeing student identified and described odours based on the properties requested in the OdourCollect platform. The guide recorded the olfactory data in the app in real time. Together they attempted to spot the origin/cause of the odours they recorded and took photos. By recording olfactory events through the OdourCollect mobile app, they participated in the creation of a collaborative digital map on the International Odour Observatory platform, adding their own olfactory experiences and sharing them with others.

3 RESEARCH METHODOLOGY

3.1 Collection of empirical materials

Following a post-humanist/ new materialistic school of thought, we adopted a place-based participatory research methodology with a walking narrative perspective (as described in [8] and [31]), to explore as authentically as possible the children’s relational intra-action with the social and material world of their close environments. Through walking-in-place, children have the opportunity to interact with the materialities that make up the place and to engage in the research procedures as co-researchers [8].

The empirical materials collected were of a qualitative nature and of more than one kind. All were gathered during the pedagogical encounters in the wetlands. They included: narratives and stories shared by the children as well as images and video footage that captured the children’s actions. They were collected through participant observation and were based on the 2nd author’s research journal and field notes, the walking conversations conducted with the children as they explored the wetlands, and during the plenary field sessions with all children, in the course of the activities and after completing them.

3.2 Analysis

Following the prompting by Gough [32] and Mannion [4], we adopted a relational materialistic analysis procedure (see [9], [19], [33], [34], [35]) of the photographic material and the conversations with the children in the wetland area from a post-humanist perspective [34]. Relational materialism is taken up by philosophers such as Deleuze and Guattari ([12], [36]), Haraway [20] and Barad [37]. Drawing on Hultman and Lenz Taguchi [36], Gough [34] explains how a place-responsive relational materialist EEfS involves thinking of participating learners as members of assemblages, emergent within more-than-human places and mutually creating new ways of thinking and learning.

The analysis of empirical material was based on the stories emerging from each pedagogical encounter about the students’ embodied intra-actions with/in the world [38]. These stories were co-created from the photographs taken from each encounter, the video footage, the children’s narratives and discussions, that gave shape to the human-place-technology assemblages. Our interest laid in exploring the realities that each story highlights, and what is produced within the human-place-technology assemblages ([9], [19], [33]).

4 FINDINGS

In this section, we present some of the findings of our analysis in the form of vignettes, which refer to the thoughts and feelings of students who took part in the educational case study. The vignettes provide ways of exploring the relationships between people and the more-than-human world and make visible how the more-than-human world creates opportunities and tensions for the students’ engagement, learning and becoming in the wetlands [39]. More specifically, by analysing the students’ stories we identified three dominant manifestations of what is produced in/through the assemblages of children-place-technologies: (a) the expression of a sense of place and a sense of belonging to that place among the students, (b) evidence of an emergent understanding of a more-than-human agency, and (c) the lived experience of an active citizenship.

4.1 Vignette (1): “We are-all-our-own-place, aren't we?”

The first vignette highlights the children’s nurturing of a sense of place, the emergence of a sense of wonder for their own homelands and the expression of feelings of comfort, ease and relaxation, as well as the identification of themselves in connection with these places (sense of belonging). This is a profound emotion that gradually leads children to a sense of awareness that they are inextricably linked with the entities and materialities of their immediate environments.



(Fig 1)



(Fig 2)

In the activity "My 1m²" (Fig 1), the boy has taken the photographs sitting down, laying close to the ground, plants and flowers, immersing himself in his small paradise—he is blurring boundaries and bodies, revealing intimate relations with wetland kin and a sense of unity between bodies. On a sensory walk with OdourCollect (Fig 2), as they walked-with-the-wetland, they all shared the embodied experience of immersing to place by paying attention to the sensory, by smelling, touching, hugging, feeling, and embracing the uniqueness of the wetland.

"It's nice to share the smells and beauties of your place because in that way you share your own heart and you love the whole world because we are all our own place, aren't we? At least, that's how I feel." (Kostantis, 11)

"I felt beautiful when I was immersed in all those scents. Do you know how I felt? I think they were soft and I felt so relaxed" (Maria, 10)

"I admire it, I love it and I share its beauties with the whole world" (Konstantinos, 9)

"We are so proud to belong to this unique place! May the children who will come to this world after us experience this! Our children, that is" (Athina, 11)

(Extracts from the walking narratives and discussions with the children)

(Extracts from the 2nd author's journal)

4.2 Vignette (2): “We are not alone! We all live together and it's so beautiful!”

In the second vignette, the more-than-human actants become catalysts for teaching and learning. Children function in unison with the parameters the elements allow (Fig 3), where they "become-together-with-the-forest", they "become-together-with-wetlands", they "become-with-the-people", they "become-tree", they "become-rock", etc. (Fig 4). Children participate in intra-actions with the socio-material aspects in new assemblages of bodies and meanings. The 'materials' are thus catalysts for learning and initiating dialogues and discussions about places in the children's immediate environments ([2], [19]).



(Fig 3)



(Fig 4)

"Really? Does our place have so many fragrant flowers and trees? I hadn't thought about it." (Eleni, 10)

"I never realized that trees have a scent. I thought that only flowers smell." (Kostas, 8)

"I was struck by how many wonderful flowers and plants there are in such a small piece of land. Before the PI@ntNet activity I hadn't even imagined it! We are not alone. Amazing!" (Aris, 9)

"I realized that it is necessary to respect and appreciate our own place and its creatures. We all live together, and it is so beautiful. This is how it should be forever!" (Giorgos, 9)

"My place taught me to appreciate life itself." (Elli, 10)

4.3 Vignette (3): "I felt so good as a researcher and explorer!"

The third vignette highlights the synergies between EEfS and citizen science. Children get in touch with their environment through a new kind of lens. They experience active citizenship in practice (they 'become-researcher', they 'become-active citizen'), and reflect on the different dimensions associated with potential threats. Moreover, acting as agents of change, they feel the need to increase their awareness, information and participation in community issues.



(Fig 5)



(Fig 6)

"I felt good as a researcher and explorer and for sharing things with the rest of the world." (Anna, 11)

"The rest of the world gets to know my place, learns to love it and so will learn to love and appreciate our own place as well." (Marina, 8)

"I want to do so much for our place, and I believe that it will not stop here! Can we do it more often?" (Anastasia, 9)

"I learned to explore in a different way! I was able to do other things in my exploration with PI@ntNet and OdourCollect." (Antonis, 11)

(Extracts from the walking narratives and discussions with the children)

5 DISCUSSION

Deleuze & Guattari [36] argue that “nature is like art” (p. 186): it exerts an influential force that can change perspectives, perceptions, and worldviews, as it has the power to capture the gaze, draw attention, affect and impact on multiple levels of existence, knowledge and becoming ([19], [17]). From a pedagogical perspective, by emphasizing and paying attention to the materiality of the world and our intrinsic human engagement with it, it enables students to explore the world through the ways in which matter acts internally with (or without) them; and teachers and educational researchers to explore the pedagogical use of ‘*people-places-technologies*’ assemblages. (Human) subjectivity is situated and understood through multiple social, material and affective processes [16], and it is interesting to seek what the developmental and learning benefits are for children.

Following the pedagogical design we adopted in this case study, children experienced practices of “knowing in being” [37] in the wetland as part of their assemblages of human and more-than-human entities and materialities of place. They learned “with experimentation in contact with the real” ([12], p.12), taking their time to realise their connection within *the child-place-technology assemblages* and to *attune with* the elements of the environment. They had the opportunity for direct, experiential contact with the place through pedagogical encounters with the human and the more-than-human world, and to understand the world as an exchange between human and more-than-human actants [8]. As Kostantis exclaimed, “Look at me! I’m becoming-rock so as not to disturb the herons! Soon I’ll become-heron and fly high with them!” (Fig 4).

In this paper, through the various vignettes presented above, we have partially analysed such assemblages created in this EEfS project in the children’s local wetland while making use of citizen science tools. Applying a posthumanist/relational materialist lens we aimed to try out new pathways of studying children’s experience. We suggest that such an approach provides opportunities to decentre humans, incorporate more-than-human entities and technologies in our conception of the world and view places as assemblages of various kinds of materialities. *Thinking with the concept of “assemblage”* through such a posthumanist/ relational materialistic lens opens up new avenues for alternative pedagogical approaches in the Anthropocene era..

Synergies between the natural and the digital world allows for different and diverse experiences to take place. Children learned to use their smartphones in a different way than their ordinary ones, to identify the presence of more-than-human beings and introduce them to their student mates. Smartphones became in essence an extension of the children’s senses and assisted them in better learning their place. They gave them new opportunities to experience multiple new ‘becomings’ and live themselves through new experiences (becoming-flower, becoming-wetland, becoming-researcher, becoming-active citizen). This case study is suggested as an example of how to forge synergies between existing practices fostering environmental sustainability and how to integrate new learning designs that allows for more ways of conceiving and experiencing the world.

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