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Seeds for Climate Action: Schools as Ecosystems for Change
Semillas para la acción climática: las escuelas como ecosistema de cambio

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Abstract- Climate change is an increasingly visible phenomenon in cities. However, there is still a lack of awareness in society about its causes, effects, and the actions that can be taken to mitigate it. School ecosystems can be an enabling context to accelerate this awareness, as they are places where different stakeholders come together and join forces to support climate change mitigation. This paper aims to present an activity carried out as part of a service-learning project that focuses on raising climate change awareness among children. This activity was carried out with the support of university students who received training on climate change. After receiving this training, these beneficiaries became trainers and gave workshops on climate change to primary school children. The learning methodology included innovative tools such as learning by doing, cooperative learning, and gamification.

Keywords: Climate change, capacity building, stakeholders, school ecosystem, service-learning.

Resumen- El cambio climático es un fenómeno cada vez más visible en las ciudades. Sin embargo, aún existe una falta de concienciación en la sociedad sobre sus causas, efectos y las medidas que pueden adoptarse para mitigarlo. Los ecosistemas escolares pueden ser un contexto propicio para acelerar esta concienciación, ya que son lugares en los que diferentes partes interesadas se reúnen y aúnan esfuerzos para apoyar la mitigación del cambio climático. El objetivo de esta contribución es presentar una actividad realizada en el marco de un proyecto de aprendizaje-servicio centrado en la sensibilización de los niños ante el cambio climático. Esta actividad se llevó a cabo con el apoyo de estudiantes universitarios que recibieron formación sobre el cambio climático. Tras recibir esta formación, estos beneficiarios se convirtieron en formadores e impartieron talleres sobre cambio climático a niños de primaria. La metodología de aprendizaje incluía herramientas innovadoras como el learning by doing, el aprendizaje cooperativo y la gamificación.

Palabras clave: Cambio Climático, capacitación, stakeholders, ecosistema escolar, aprendizaje-servicio.

1. INTRODUCTION

The latest report of the Intergovernmental Panel on Climate Change (IPCC, 2023) states that the transformation of urban systems is essential to achieve drastic emission reductions and to promote climate-resilient development, especially when it involves integrated planning that includes physical, natural, and social infrastructures. For this reason, in order to mitigate the alarming phenomenon of climate change, it is necessary to activate integrated actions that, on the one hand, contribute to reducing the effects of this climate challenge through direct actions in buildings and the urban environment. On the other hand, these direct actions must be accompanied by activities that empower citizens to make lifestyle changes that can help mitigate climate change.

Universities have an important role to play in setting strategic frameworks in the cities and rural areas where they are located and in proposing solutions for their sustainable and inclusive transition. NGOs are relevant actors that bring innovation to civil society, translating complex debates into non-technical conversations that can be useful in raising awareness of climate change. Academia and NGOs constitute key and complementary stakeholders to set and activate holistic initiatives for climate action.

In this context, schools have been identified as an urban nexus that can play a key role in the transformation process to be achieved. Indeed, schools are the educators and trainers of our present and future generations. Moreover, they represent a social microsystem (Devecchi et al., 2024) that brings together the main actors present in urban environments: institutions, NGOs, public and private bodies, neighbors, parents, teachers, and children, among others. In this way, educational spaces can become transformative environments for urban areas and the communities in which they are located. In other words, they are nodes of transformation for the community as a whole.

This study proposes a service-learning strategy on climate change that can support capacity building in society on climate change and transform stakeholders into key actors in climate action.

2. CONTEXT & DESCRIPTION

The aim of this contribution is to present an educational strategy to enable mitigation actions and capacity building on the causes and effects of climate change. This initiative is addressed to the different stakeholders involved in the school ecosystem. The strategy has been successively validated in a learning and service project developed as part of a fourth-year

course at the Escuela Técnica Superior de Arquitectura de Madrid of the Universidad Politécnica de Madrid.

A. Context and social needs

Climate change is a complex phenomenon affecting the entire planet, and its effects are increasingly being observed. Anthropocentric actions have caused and continue to cause changes in nature that will increasingly affect millions of people around the world (UN environment programme, n.d.).

It is therefore important to be able to counteract their effects as soon as possible, and society now has a key role to play in helping to mitigate them through everyday actions (European Commission, n.d.). It is therefore important that society understands the seriousness of the situation and takes action to reduce greenhouse gas emissions.

Understanding the causes and effects of this phenomenon is essential in order to understand and address this global problem and to give it a local dimension so that the local dimension can also reach the global scale (Glimäng & Sauro, 2024). If society works together to take effective action to change habits and reduce greenhouse gas emissions, we can succeed in protecting our planet and future generations.

However, despite the urgent need to empower society, there is still a lack of effective climate change awareness activities in both educational institutions (universities, schools) and community centers (Tsalidis et al., n.d.). For this reason, there is a need to create an activity that succeeds in promoting a climate education program that can be permanently installed in these centers, in order to train the users involved in the transition.

For this activity, it is important to remember that the new generations are constantly living in a world that is experiencing "eco-anxiety"(Wheeler, 2024), a chronic fear of environmental doom. Therefore, the most effective way to encourage children and young people is to create activities that can turn this eco-fear into a force for good. To this end, these capacity-building activities can help them to create attractive images and stories of the future that can motivate and empower people.

This research aims to develop an educational strategy that fosters mutual empowerment among participants, laying the groundwork for lasting change at the "glocal" (Glimäng & Sauro, 2024) level. The ultimate goal is to sow the seeds of change at the local level, cultivating sustainable climate action that goes beyond the activity and positively impacts the global level.

B. Methods

The educational strategy developed is based on the main concepts of learning and service activities. On the one hand, these activities allow the recipients to develop specific competences for growth, the development of new skills, and proactive attitudes in response to social needs. On the other hand, they implement direct experiences to respond to social or environmental needs with the aim of improving their condition (Mees et al., 2019). These social and environmental needs are based on the principles of the Sustainable Development Goals (SDG, n.d.).

The educational strategy proposed in the study consists of three steps. First, a training activity on climate change is carried out for university students (stage 1). Once they are trained, they themselves will implement the training activity on climate change using a gamified educational tool in the school ecosystem (stage 2). Once these different actors have been trained, they become key agents of climate action in the urban environment in which they live and interact (stage 3).

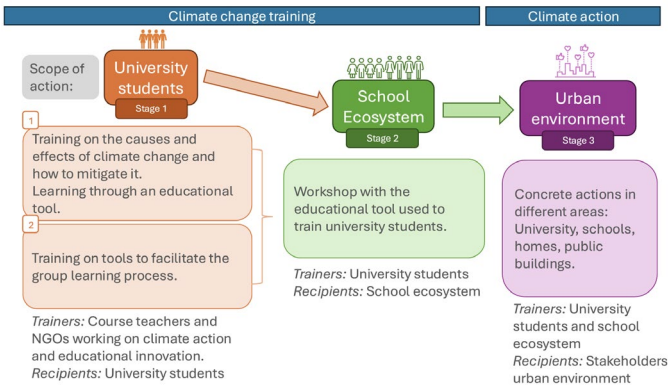

Figure 1-Workflow educational strategy

B.1 Stage 1: University students:

This stage consists of two training phases. The first is a climate change awareness-raising activity incorporating a variety of learning methodologies, including learning by doing, cooperative learning, and gamification. This will enable university students to learn about the causes and effects of climate change in an active way, and to integrate real mitigation actions as they have learnt in the training activity. The subsequent phase of Stage 1 will equip students with the necessary skills to facilitate group training sessions, providing them with methodologies for conducting effective training sessions.

B.2 Stage 2: School Ecosystem:

Upon completion of the training, stage 2 will involve university students leading a climate change awareness workshop in schools, a role they previously experienced as participants in Stage 1. This activity will target the entire school ecosystem, encompassing pupils, teachers, parents, public and private entities, and local community members.

B.2 Stage 3: Urban environment:

Finally, stage 3 will engage the urban environment surrounding the schools in climate action. This stage will be built on the learning and service activity, with empowered individuals disseminating the knowledge gained. This will be achieved through concrete actions (e.g. changing habits, planting trees, improving school buildings, etc.) across various areas, including universities, schools, homes, and public buildings.

3. RESULTS

The validation of this methodology was carried out through its implementation in a learning and service project, part of an initiative promoted by the Universidad Politécnica de Madrid. The activity, titled 'Seeds for climate action: schools as an

ecosystem of change', was designed for students of the Escuela Técnica Superior de Arquitectura de Madrid enrolled in the "Bioclimatic Architecture Workshop Towards the Zero Energy Building" course.

C.1 Stage 1: University students:

As outlined in stage 1, the university students underwent training on the causes and effects of climate change, using the "Climate Fresk" tool (Ringenbach, n.d.) developed by Cédric Ringenbach. This tool employs a game with illustrative cards to elucidate key climate change concepts, with each card representing an element, a cause or a consequence. This group activity incorporates the following training methodologies: learning by doing, cooperative learning, and gamification.

Following the completion of the workshop, the second step in stage 1 of the program involved training university students in facilitation tools to deliver the Climate Fresk activity. This training consisted of two sessions. The first was led by a member of the Climate Fresk association, who prepared the students to become trainers. After this session, the students obtained the official certification as Climate Fresk facilitators, as required by the association that developed this activity.

The second training was conducted by an entity specializing in non-formal education and an expert in facilitation tools and participatory processes. This workshop focused on icebreaker activities, group cohesion, and role-playing for conflict resolution. In addition to preparing the students to carry out Climate Fresk in a school, this workshop also aimed to foster group cohesion among the students themselves, an essential factor for the successful completion of stage 2.

C.2 Stage 2: School Ecosystem:

For stage 2, a primary school in Madrid located in the Chamberí neighborhood, near the Escuela Técnica Superior de Arquitectura, was selected as the host site. This primary school faces several environmental challenges, including its proximity to a highly trafficked avenue, resulting in significant noise and air pollution. Additionally, the school experiences overheating in classrooms during the summer months. The school has committed to participating in the service-learning project with fifty fourth-grade students. University students facilitated the Climate Fresk activity with a version of the workshop adapted for children (a set of cards with simplified concepts), with a total duration of two hours, including thirty minutes dedicated to examples of climate action.

Figure 2-Climate Fresk activity, receptors school ecosystem.

The workshop was also attended by teachers as observers who were able to understand the activity in order to implement it in the school curriculum in the future.

C.3 Stage 3: Urban environment:

Stage 3 culminated in concrete actions at both the university and the school. In the university environment, students carried out projects (as part of their coursework) aimed at improving the primary school in an architecturally sustainable way. These projects involved designing solutions for the school building and playground. The final projects were presented to the school committee for evaluation and potential implementation.

C.4 Social impacts and activity evaluation

This project ended in June 2024 and trained thirteen students from ETS Architecture and fifty primary school students, generating great interest and active participation in the workshops and promoting sustainable habits. Furthermore, the results of this learning activity were evaluated through various methods.

First, the students were asked to keep a diary documenting all the activities carried out during the project from their point of view. In this evaluation, each student shared their impressions and emotions at each stage of the project, including sharing photos and personalising their diary.

This was followed by an interview, which was then compiled into a video summary of the activity. In this video interview, the university students (thirteen students) and the school teachers (two teachers who participated in the activity as observers) were asked different questions. Mainly, they were asked to evaluate the activity, the sustainability education they had when they were young, and finally, if it was considered a valuable activity to raise awareness about climate change among the new generations and their families. The evaluations were positive and encouraged more activities of this kind to be carried out in schools.

Finally, the university students also evaluated the activity with a satisfaction survey that was distributed. The results of this survey show that 70% of respondents rated the workshop as "very satisfactory" and 30% as "satisfactory" in terms of content, format, and time spent. In general, the importance of being able to deepen the aspects of climate change and make new generations aware of these aspects, and practical tools to mitigate its effects, was highlighted.

4. CONCLUSIONS

This paper presents a three-stage training strategy to empower different actors on climate change, fostering deep awareness that transforms participants into active agents of climate action in the urban environment.

To demonstrate the feasibility of this strategy, a service-learning project was implemented. This project involved students from the Escuela Técnica Superior de Arquitectura de Madrid enrolled in the "Bioclimatic Architecture Workshop Towards the Zero Energy Building" course. They were trained in climate change (Climate Fresk activity) and facilitation tools for group learning (stage 1). Upon completing these activities, the students became trainers and facilitated the Climate Fresk activity at the primary school in Madrid, targeting fifty fourth-year students (stage 2).

After this activity, the students, aiming to contribute to improving the environmental conditions of the school, developed different architectural projects proposing solutions to mitigate the effects of climate change. These projects were then presented to the school committee for potential implementation (stage 3).

Overall, the students provided a highly positive evaluation of the project, highlighting its impact on their understanding and engagement with climate action.

The methodology presented in this paper is a transferable tool to other schools, thanks to its stages based on different training tools and its real example of application to a case study. Indeed, this service-learning project has been replicated in the 2024-2025 school year, with four new schools currently participating (three secondary schools and one primary school).

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