TRANSFORMING EDUCATION BETWEEN PEDAGOGY, ARCHITECTURE AND NATURE: AN ACTION-RESEARCH CASE STUDY

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Abstract

The processes of interdisciplinary interaction between pedagogy and architecture increasingly sensitive to the issues of "learning environments" investigate the school as an ecosystem which is perceived as an open cultural project. School communities are so seen as a dynamic educating landscape in which to cultivate research, exploration and elaboration of cultural heritage. This contribution focuses on the school development processes conveyed by the dialogue between pedagogy, architecture and nature.

The interdisciplinary laboratory EDENLAB (EDucational ENviroments with Nature - edenlab.unibz.it), settled at the Faculty of Education of the University of Bolzano, has been promoting action-research projects since 2019 on the topics of pedagogical and architectural qualification of educational spaces. Since 2022 it has also been interested in developing new interdisciplinary relationships with other disciplines to analyze the possibility to extend the concept of learning landscape to nature. Due to this concept, plants are seen as mediators in the exploration and appropriation of indoor learning spaces and extraordinary tools for changing traditional didactics and promoting project oriented learning and nature based learning.

In the development plan of the EDEN laboratory there is the aim of developing models, methods and devices to study and synthesize the outcomes generated by the different action-research projects implemented with schools.

The analysis is not limited to the innovation realized but implies verification of the transformation of the context and the processes of change in the ways of doing and thinking of the school actors (teachers, children, parents). At a second level, the role of researchers, who are directly interested in studying the effectiveness of their own work as facilitators-trainers, is investigated, and it is verified how it is possible to produce knowledge corroborated by empirical data and potentially capitalizable.

The contribution intends to present the case study of an action-research project carried out with the school community "Aldo Moro" in Terni (Italy) composed from 4 kindergartens and 2 primary schools from September 2023 to June 2024.

Keywords: Pedagogy, architecture, plants as mediators, action-research, school development.

1 INTRODUCTION

At the Faculty of Education of the Free University of Bozen-Bolzano, research has been conducted for several years on the relationship between pedagogy and architecture in the construction of school buildings (Weyland & Attia, 2015, Weyland & Falanga, 2023) and interdisciplinary process methodologies and mediation tools have been developed to explore the spaces of education from a material, physical and sensory perspective (Weyland, 2017). This research led to the creation of an interdisciplinary laboratory called EDENLAB (EDucational ENviroments with Nature - edenlab.unibz.it). The research and actions have benefited from the experience of active interaction between different South Tyrolean institutions focusing on the qualification of school buildings in the region. At the same time, the proposed joint design paths, flanked by a profound pedagogical-didactic rethinking of actions in educational contexts, have aroused the interest of various school communities from all over Italy, especially school leaders and teachers who are keen to explore new ways of engaging in dialogue between spaces and teaching methods.

Since 2019, the collaboration with the interdisciplinary research group now meeting in the EDENLAB laboratory has transformed into action research, with the aim of overcoming the conditions of discomfort and creating situations of well-being through the creation of more comfortable environments capable of supporting an open didactics focused on exploration and collaboration. With the post-pandemic recovery in 2022, the schools conducting research with EDENLAB also explored a form of closer micro-

relationship with nature, in which plants were considered as mediators in the exploration of spaces and didactics (Weyland, 2022).

The significant changes that the Earth's ecosystems have undergone as a result of human intervention are now well documented through the research work of the numerous international scientific programmes dealing with global environmental change. In 2013, the ten-year Future Earth programme was launched, initiated and funded by the International Council for Science (ICSU), with which the International Social Science Council (ISSC) collaborates, and which aims to identify targets within which human societies can live in health and well-being without incurring serious risks (Rockstrom et al., 2021; Folke et al., 2021). In the education and training context, declinations have evolved with a new sensitivity to the relationship between education and nature (Guerra, 2020) and an increasing orientation towards outdoor education (Bortolotti, 2019). The interdisciplinary approach of the researchers grouped around the EDENLAB laboratory draws on a number of well-known studies, including in particular the "Clever Classroom" research (Barrett et al., 2015), which shows how the design of comfort conditions that mimic natural conditions (air quality, lighting, temperature, materials) and that are stimulating and customisable have a significant impact on the quality of learning. This fact is reinforced when plants are present in the environment. This is already known from natural science contexts, which note the benefits of the presence of plants indoors to ensure humidification and air exchange in rooms, but also because they promote attention and concentration as well as a widespread sense of perceived well-being (Mancuso, 2017; Kuo, 2015). The exquisite humanistic goals are seen in the pursuit of the objectives of developing global competences and in particular the "Green Comp" (Bianchi et al. 2022) defined by the European Commission in its institutional documents for the universe in the field of education.

According to the United Nations Sustainable Development Solutions Network, the role of the university is to contribute to the maturation of sustainability awareness, in the dual capacity of agent of change and subject of change (SDSN, 2017).

In the first case, the role of universities is to support the transformation of society by educating to deal with the socio-environmental critiques in their context, supporting social debate and promoting the development of socio-economic and environmental strategies. As early as 2001, Joseph Stiglitz, Nobel Prize winner in economics, argued that in a time of deep economic and political crisis, the tertiary sector in general and non-profit organisations such as universities in particular are the only social actors capable of bringing about a turnaround towards new sustainable balances, because they can free themselves from the perverse logics that have led us to where we are now. As for the university as a subject of change, it is essential to consider the institution's contribution to rethinking the strategies to be implemented and the measures to be taken. Everyone who studies, works or collaborates with the university can become aware of the benefits that can be achieved through sustainable behaviour and action.

External leadership, cultural promotion and public engagement are therefore the framework within which EDENLAB, as a university, participates in public life to support the design of policies of didactic, spatial and material innovation and sustainable development, promoting an inclusive and value-based culture supported by sound scientific research. In fact, due to their role, universities contribute to the social, political and cultural development of the reference context, both at local, national and international level, facilitating intersectoral dialogue and cooperation and promoting the dissemination of knowledge and tools to achieve the Sustainable Development Goals.

The knowledge derived from scientific research combined with the skills acquired in the connection with the territory, in relations with stakeholders and local communities, can generate new partnerships and spread the logic of value creation and sharing.

The action-research projects in the field of education promoted by the interdisciplinary laboratory EDENLAB of the Free University of Bozen-Bolzano have a particularly innovative character: the interaction between schools/contractors and university is in fact requested and financed by the applicants themselves.

It is the schools, cooperatives, training institutions and also private organisations that, through an agreement and a "research contribution", become sponsors and clients of research specifically tailored to the needs of the educational community. The increasing sensitivity to the issue of "learning environments" (Biondi et al., 2016; Castoldi, 2020; Biancato, 2024) and the need to combine it with a general rethinking of the organisation of school time lead to requests for advice and support in this sense, which are then transformed into institutional alliances of joint research actions that invest energies and resources to elaborate new paths for school and education in an experimental and exploratory way (Weyland & Falanga, 2023).

Primarily, the research-training and/or action-research projects developed in the Italian context focused on the not-so-obvious questions of where and how to educate, how and where one thinks one should learn, if, where and, above all, when it is important to include the dimension of play, reading, exploration, free research, etc. (Weyland & Galletti, 2018).

The activities therefore focused on the development of the schools' pedagogical identity, on the maturation of the competence to recognise the qualities of the architectural spaces in time, and finally on the concrete experiences of appropriation of the educational and teaching space.

In this process, it was found that indoor plants can be valuable allies both for the exploration and appropriation of space and for achieving the goals of transforming teaching and promoting acts of care (Weyland, 2022) and a new connection with nature (Jones, 2021) in line with the 2030 goals and Green Comp (Bianchi et al., 2022).

2 METHODOLOGY

The following is a case study of action research and experimental teaching with plants carried out in the Aldo Moro Directorate of Education in Terni, central Italy. It was an experience that involved four kindergartens and two primary schools during the 2023-2024 school year in the experimentation of the EDEN project in a choral and comprehensive way.

The preschool and primary school A. Moro in Terni (IT) is part of the national network of green schools (https://www.retescuolegreen.it/) and thanks to the national PON (National Operational Programme) funding, edugreen has created educational vegetable gardens in some complexes.

The school headmaster had learnt about the project thanks to the headmaster of Umbertide (who had launched another project in consultation with the EDENLAB laboratory in the 2022-2023 school year) and decided to enrol all teachers in the EDEN project. The aim was to bring plants into the classrooms (usually one plant for each child and teacher) to qualify the environment and develop educational activities that address the presence of plants in the school and bring students closer to green issues and sustainability.

The overall mission of the Institute is to transform teaching through active methods based on discovery, problematization, research and planning.

As Peter Reason and Hilary Bradbury (2013), who are among the leading theorists of this method, explain, action research is a collaborative process in which researchers and participants work together to address a problem or issue of common concern. Through an iterative cycle of planning, action, observation and reflection, complex problems can be tackled and contextualised knowledge generated. By going beyond the description of reality, action research aims to promote change and empowerment of participants.

At A. Moro School, the action research approach favoured the applicability of the results, which were immediately implemented in the school context based on the concrete needs of the teachers and the project objectives negotiated with the teachers and the school headmaster at the beginning of the project.

The project included an input activity to justify the proposal to see in the plants an opportunity to reconnect with nature, a chance to improve the quality of the spaces and a way to orientate teaching towards a spirit of enquiry and active exploration.

Through rhythmic support and monitoring of teacher-sponsored activities, we have collected data on the connection between the school's educational goals and active interaction with plants.

The research data was collected by administering an inbound and an outbound questionnaire to the school teachers. The questionnaire contained both multiple-choice and open-ended questions. The questionnaire was divided into the following sections: the first section on teachers' green biographies, the second section on intentions and motivations for introducing indoor plants into the school space, the third section on school spaces with plants, the fourth section on school spaces and the final section on research questions and future perspectives of the project.

The first questionnaire served as an initial overview of the topics of the action research process. The final questionnaire had the function of monitoring the project activities in the educational spaces also through the presence and active interaction with the plants. The voices of teachers and managers are fundamental for a comprehensive understanding of the process, its impact and the suggestions that can be drawn from the experience.

An analysis of both quantitative and qualitative research data was conducted. The analysis of the qualitative data has not yet been finalised and will then be compared with the quantitative data.

The initial sample comprised 66 teachers and the final sample 60.

Over the course of the school year, monthly coaching and feedback sessions were held between teachers and researchers to take stock of the progress of the transformative measures being promoted.

For the qualitative documentation of the project, logbooks were filled out electronically by each team of teachers every ten days using a Google form. In the logbook, the teachers collected both the objectives of the research project to be carried out during the school year and the actual experiences made during the research in the school, which were updated every two months, such as the design of plants and field trips.

All materials related to the planning and implementation of the pedagogical and didactic trails, both textual and photographic material, were collected on the Padlet electronic noticeboard to present and share with all teachers. Padlet was divided into columns, each dedicated to a specific theme: presentation of the schools of the institute, photos of a place the school likes and dislikes, photos of classrooms and rooms with floor plans, declarations of intent, projects to be implemented during the school year, logbook, project work and research documents.

3 RESULTS

This section presents some of the research findings, focusing on the data collected from the structured questions in the questionnaires distributed to the participating teachers at the beginning and end of the EDEN project.

The EDEN laboratory has provided itself with a model suitable for identifying and evaluating the results of the ‘shared research’ projects carried out with the school communities (Weyland & Zini, 2023; Zini & Weyland, in press; Zini, in press), both in terms of learning, which "is not limited to the innovation carried out, but involves a transformation of the context and a change in the actors' ways of acting and thinking" (Cardarello, 2018, p. 61), as well as at a second research level, where the researcher is directly interested in investigating the effectiveness of their own work as a facilitator-trainer. For this reason, in the questionnaires completed at the beginning and at the end of the project carried out jointly with the "Aldo Moro" school, some indicators of the remarkable results from an internal point of view were examined, taking into account different levels of the context in which the project itself was located. Below, some of the collected results are analysed in relation to some key factors on which, according to the adopted model, depends the general objective that should be pursued by the EDEN action research projects, i.e. the "realisation of educational landscapes that support the well-being and quality of the educational relationship" (edenlab.unibz.it).

The answers to some of the questions in the questionnaires show that teachers' personal attitudes towards plants and their inclusion in educational spaces have changed. There is a significant association between the experience with the EDEN project (before/after), the preference for plants and the enjoyment of their presence in their own working environment (Figure 1).

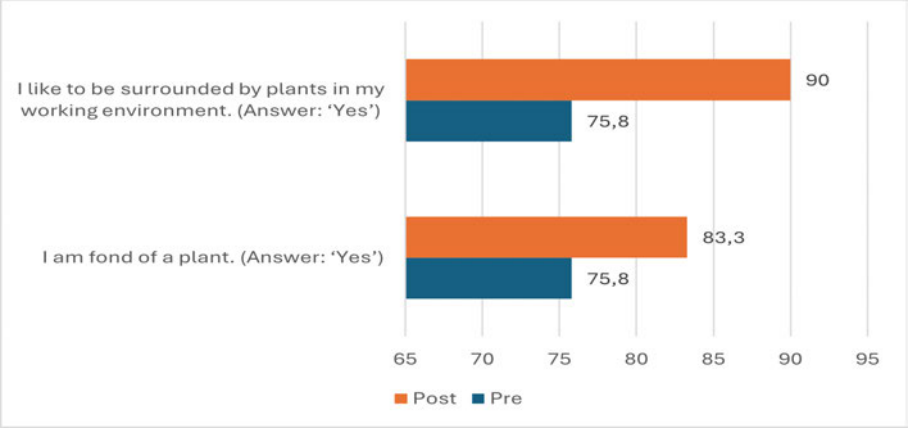

Figure 1: Affection for plants and enjoyment of their presence in the working environment.

In the schools involved, the EDEN project seems to have had a particularly strong impact not only on the actual presence of plants indoors, but also on the educational value attributed to this presence, as can be seen from the fact that teachers consider it to be more closely linked to teaching (Figure 2).

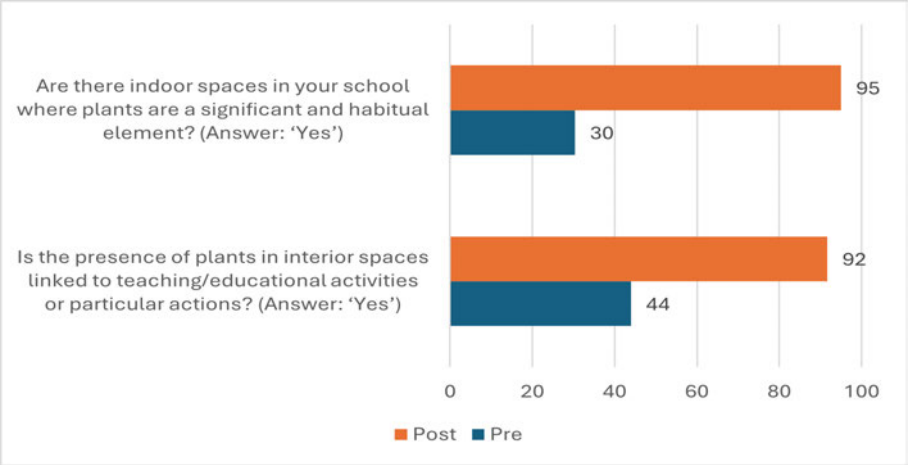

Figure 2: Presence of houseplants and their association with educational activities (percentage of 'yes" answers).

Both at the beginning and at the end of the action research project, teachers were asked to indicate the main motivations or intentions for introducing houseplants in the classrooms, choosing a maximum of two response alternatives from a given set (Figure 3). The variation in the choice of some motivations (before and after the experience with the EDEN project) makes it possible to draw some conclusions about the results of the project in terms of perceived well-being in the educational spaces involved ("to improve well-being") and their functionality for the design and implementation of educational activities particularly focused on the development of "green competences".

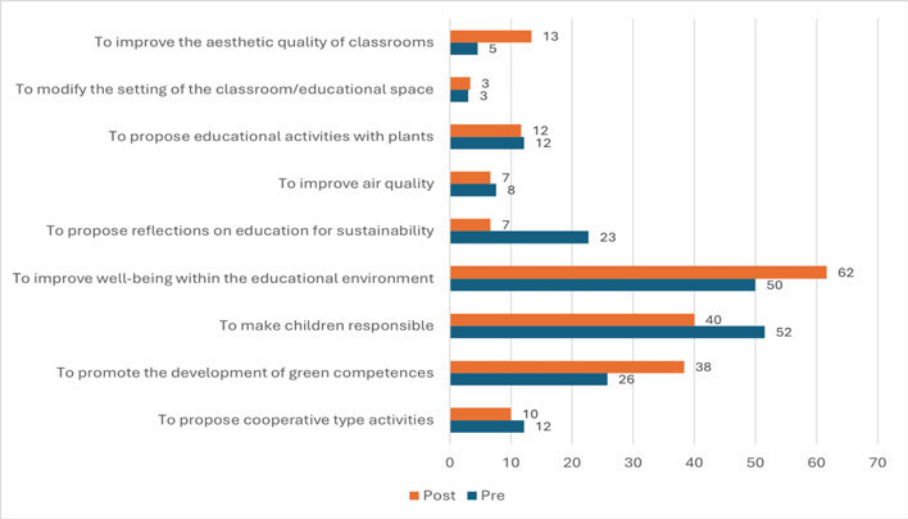

Figure 3: Main motivations or intentions for the introduction of indoor plants in schools (percentage frequency).

The EDEN projects promoting the inclusion of plants in educational spaces, including the one discussed here, are based on the hypothesis that - starting from this element of innovation - processes can be set in motion that lead participants to "question the qualities of the educational space and unhinge organisational and temporal automatisms of education" (Weyland & Falanga, 2023, p. 80). To test the effectiveness of the project in this aspect, teachers were asked a series of questions at the beginning and end of the project about their assessment of the pedagogical quality of the spaces in their school and the collective processes that determine it. To this end, a small number of indicators were selected from the literature on assessing and improving the pedagogical quality of learning environments in educational institutions for children (Bondioli & Savio, 2018) and used with adaptations. These items consisted of statements where respondents were asked to indicate their agreement or disagreement on

a 5-point Likert scale ranging from value 1 ("Definitely not") to value 5 ("Definitely yes"). In particular, a significant difference (measured using the non-parametric Mann-Whitney U test) is found between the distributions of points assigned to two items in the data collected at the beginning and end of the project:

1 The organisation of the school's spaces is the result of recent joint planning by the teachers ($p = 0.001$);

2 Teachers carry out observations on how the children use the rooms to reorganise them ($p = 0.012$).

The change in these indicators (Figure 4) suggests that the EDEN project has contributed significantly to raising awareness and improving the collegial behaviour of teachers with regard to the pedagogical quality of the classrooms.

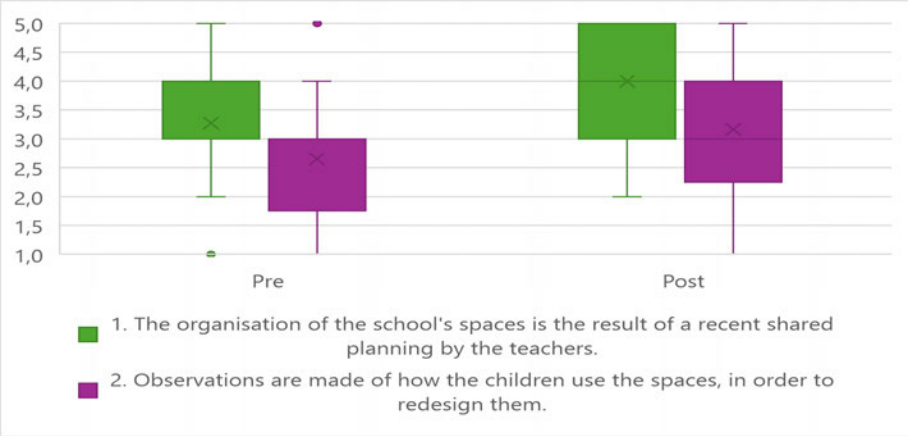

Figure 4: Box plot showing the distribution of the pre- and post-samples for the two items.

4 CONCLUSIONS

The conclusions present some preliminary results of the analysis of the research data and an overview of the action research carried out.

A development of the teachers' green biography after the research project can be observed: many teachers emphasise that they have improved their relationship with plants and their willingness to care for them. In particular, they emphasise a change and intensification of their relationship with plants in school spaces and the ability to grasp the pedagogical significance of plants. There is also a greater awareness of 'seeing' plants both outdoors and indoors, with a decrease in plant blindness. The presence of plants in daily life, both at home and at school, has also increased.

Teachers show that they have picked up on the fact that children's interaction with nature has decreased and have created concrete opportunities for contact with greenery, emphasising the important role of plants in promoting well-being, including in terms of sensory stimulation experiences in play.

In the school, indoor spaces with plants have become a significant and familiar element that has been largely linked to pedagogical-didactic activities. An open question in the questionnaire revealed various experiences with educational and didactic activities, which can be summarised in three categories: educational-didactic activities also with a playful background, plant care, observation of plant growth.

Another focus of the study was the use of specific places in the school, such as studios and laboratories, to carry out activities on the topic outside the classroom. The results show an increased use of the following spaces: the ceramics workshop, the gymnasium and the library. The qualitative data also shows a more active exploration of the spaces adjacent to the classrooms, both indoors (corridor) and outdoors (directly overlooking the corridor), as well as a greater use of the schoolyards and gardens.

The comparison of the data from the qualitative-quantitative research revealed a number of significant results: the processes of affection and attachment to plants are increasing, many teachers stated that after participating in the project they have a desire to spend much more time with plants, including in a domestic context. It is interesting to note the development and recognition of teachers' creative skills in reformulating lesson content to include plants in activities. A surprising chorality emerged in supporting each other to make the school tidier and more welcoming and to make their organisation aware of the

project through objects, materials, symbols and posters. In June 2024, each class group prepared an artefact or activity to make the results of the project visible: a diary, a game, a dance, a story, an installation, ceramic containers were made, and everyone worked to present the results of the year-long project not only to the research team visiting the school, but also to the families and the surrounding community. The EdenLab team has categorised the materials created during the project and is in the process of analysing them in depth.

Pedagogy is at the centre of educational change, and when applied to spaces, it allows us to innovate and make teaching more active. Architecture can play a central role in this transformation, as the space becomes the "third educator" (Malaguzzi, 2012), offering and reinforcing the overall pedagogical messages of the institution. The research action promoted at the A. Moro School had an important impact on the redesign, appropriation and qualification of the space. The teachers were all very committed to tidying up the spaces and embellishing them with plants, they discovered a great entrepreneurial capacity and were satisfied to be able to manage the qualification of the spaces with their own actions.

From the analysis of the answers given by the teachers, it appears that the project also had an impact on school innovation in terms of introducing green themes into the curriculum, which makes it possible to understand how the presence of new living beings in indoor spaces was the fundamental variable for the concrete promotion of the development of green competences and the improvement of sustainability.

As far as future prospects are concerned, the teachers and the headmaster hope to maintain the innovations introduced in the spaces and, in particular, in the care and active use of plants. The intention is to continue the activities in order to achieve a new routine and a different way of encountering spaces and nature in the school.

The experience gained with the Aldo Moro Institute represents an interesting case study for the extension of this method of action and research and of school-university collaboration to other schools interested in developing innovations on the theme of spaces and greenery. The proposed interdisciplinary perspective between pedagogy, architecture and nature offers good opportunities for exchange, allowing education to be considered from different and plural points of view.

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