Pilot landscape and design-based programme to foster student environmental literacy

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Abstract: This paper reports a pilot programme conducted in a Hungarian school to foster environmental literacy among students using landscape design principles. This programme utilized a design-based learning approach and incorporated soft skills to develop students' environmental understanding and engagement. In the period of four weeks, participants autonomously designed solutions for their schoolyard while following the design process. Data collection methods included questionnaires, interviews, observation, and analysis of the productions. The results indicated improved understanding of landscape design, increased awareness of the schoolyard, and enhanced soft skills among the participants. The findings provide insights for future programme iterations.

Keywords: design-based learning, future skills, landscape–human connection, environmental education, landscape design

1. Introduction

In the last 30 years, the UN and other organizations over the globe have been showing a growing concern about the climate crisis and the necessary measures to address this issue. Among many targets, the improvement and dedication to environmental education are considered core measures to tackle this challenge under the sustainable development perspective [1]. Environmental education is a lifelong, transdisciplinary process, where learning the natural systems, their networks, and the resulting issues should lead to agency supported by knowledge [2]. In this way, it should lead to forming environmentally literate people.

Likewise, achieving environmental literacy can be seen as the last step of the environmental education process ladder. In the first step, there is a rise in awareness, through concern for the environment. This is commonly followed by the pursuit of a broader environmental understanding, that is, the accumulation of environmental knowledge – reaching literacy when meaningful action towards the environment is realized. Consequently, environmental literacy can only exist in the presence of these three elements: concern, knowledge, and motivation [3, 4].

On account of being a long process, environmental education needs to start at an early age. Several authors support that schools are the most promising spaces to form involved citizens and create behavioural change [5, 6, 7], and the establishment of efficient and transformative environmental education in such settings is a critical imperative for ensuring the preservation and enjoyment of our natural heritage by present and future generations [6, 7]. The careful and thoughtful planning of public environmental education programmes holds the potential to significantly shape the future quality of life and environmental stewardship [6].

Conversely, environmental issues hold no simple answers [8]. The high complexity of the systems and their interactions makes it a wicked challenge, hard to be addressed by both educators and professionals. In this way, forming environmentally literate citizens involves transdisciplinarity, systems thinking, future skills, and resilience to deal with complex challenges.

Such intricacy requires a plastic methodology. The design process, known for its capacity to comprehend systems, is inherently interdisciplinary, encompassing perspectives from the physical, cultural, and social domains [9]. Design-Based Learning is a pedagogical approach that employs the design process as a means of instructing curriculum in an applied, hands-on manner [10]. In addition, the skill set of the 21st century is deeply rooted in the design process [9]. These skills are summarized as the 4 Cs: critical thinking, creativity, collaboration, and communication. The implementation of this set of skills in the educational setting has been advocated by influential educators, such as Paulo Freire, for at least a century [5].

The present paper describes a pilot programme applied in a school setting in Hungary. The main aim was to test the efficacy of the design process and landscape principles and ideals to the fostering of environmental education in a school community. And additionally, introduce landscape design practices to promote connectedness with the local environment and inspire advocacy for future sustainable developments [11]. The programme was student-centred, with the educator being a facilitator in the process. In this way, students should analyse and conceptualize solutions for the schoolyard autonomously and through practice. Additionally, the pupils had to explore how to exhibit aspects of sustainability and multi-functionality in their designs. By implementing carefully selected activities, it was expected to collect feedback and best practices to be updated and reassessed in future iterations of the project.

2. Materials and methods

The proposed methodology involves integrating landscape architecture and design concepts into the learning environment, with a focus on practical application. By directly addressing the proposed design challenges, students actively participate in the design process, creating a sense of ownership and connection to their surroundings. In addition, one of the principles of landscape architecture is to understand, read, feel, and transform a place [12], the transference of which skills to the new generations through practical activities can be a first step in creating a sense of belonging to a place to develop a chain of behavioural changes. Through this approach, participants strengthen their bond with the landscape and gain a deeper understanding of the factors at play and the potential effects of their proposed changes. Moreover, the integration of landscape architecture knowledge into real-world contexts serves to bridge the gap between theoretical concepts and practical applications.

A. The partner school

The study was carried out in partnership with the Polytechnic of Economics high school. Founded in 1991, it is a bilingual school that follows alternative pedagogical movements and continuously integrates modern pedagogical methodology into the daily teaching practice aligned with 21st-century skills. The school is maintained by a foundation, and the student community is formed mostly of upper and medium-income Hungarians [13]. The school is in District 9 of Budapest, on 3 Vendel Street, located in an urban, densely built area, surrounded by a municipality, residential buildings, and two other educational institutions.
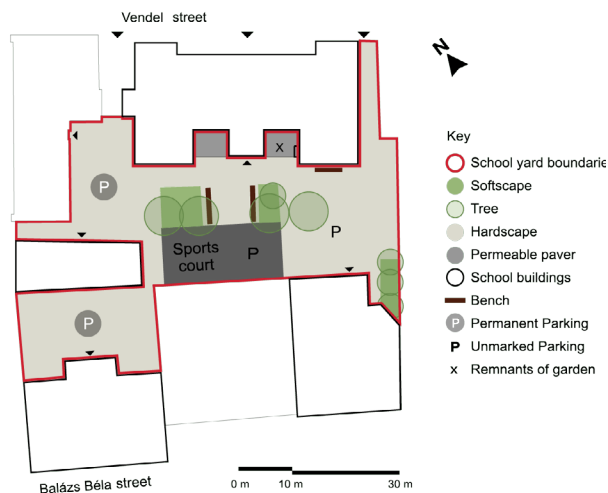

Figure 1. School grounds plan

During a guided visit, we could learn about the schoolyard structure (presented in *Figure 1*) and get to know the school community's assessment of the place. On this occasion, it was discussed that the schoolyard lacks social spaces for students, and there was a dissatisfaction with the sports court due to its appearance and location occupying a significant open space, as well as its secondary function as a parking area. The administration acknowledges the surplus of parking spaces, and there is a consensus on the need to enhance green areas in the yard. Additionally, the area is very enclosed by the surrounding space walls, resulting in limited sunlight and lacking attractive features for the students.

B. Programme outline

The design process is flexible and often adapted to fit the project to which it will be applied. For the development of the programme, a non-linear 6-step design process was followed, according to *Figure 2*. It also illustrates how the framework was expected to follow the process on each occasion. A total of four weekly meetings were held, with a planned duration of 1 hour and 30 minutes per session. The average attendance was 9 students, with ages between 14 and 17 years old.
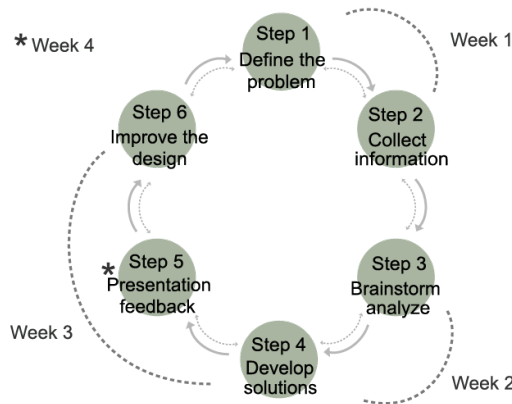

Figure 2. Design process and the following outline

On each occasion, except the last one, two or three activities were held, with the addition of homework. The final occasion was reserved for the student presentation of the results and the group assessment of the programme.

The data collection methodology employed in this study involved a mixed methods approach, incorporating various techniques such as questionnaires, interviews, observation, analysis of programme productions, and visual documentation.

In addition, a qualitative analysis was conducted to identify patterns and characteristics within the data, following specific assessment guidelines. This analysis encompassed aspects such as the timely completion and submission of assigned tasks, the effective application of the information received in previous meetings and assignments, improvements in students' understanding and perception of the schoolyard, advancements in their 4 Cs skills, and the progression and refinement of design concepts over time. The activities, homework, and their expected outcomes are described in the following.

On the first occasion, 9 students joined the activity.

Activity 1: Introduction and abstract relationship with the place: Each participant chooses one picture of objects related to the outdoors and explains their choice in order to initiate communication and interaction, thus creating a board showing students' relationship with the natural environment and landscape.

Activity 2: Never-before-seen design challenge [14]: Students individually create innovative concept 3D models for their ideal schoolyard. It should result in fast, small-scale models reflecting individual wishes for the schoolyard and highlighting functions that are currently lacking.

Activity 3: What can be done with the green: Participants suggest improvements based on pictures shown to them, the task being to replace an industrial element with a green element while keeping the same or similar function. Working individually or in groups, they propose creative and innovative solutions while enhancing critical thinking. In addition, pupils improve their understanding of green possibilities and acquire critical evaluation of mundane landscapes and an expanded sense of possibilities.

Homework: Students take pictures of their favourite and least favourite places in the schoolyard and propose improvements by sketching them. This assignment connects learnings from previous activities with the real-life environment. This results in the visual documentation of the schoolyard's values and problems and the integration of knowledge into students' daily lives.

Expected results of Session 1: The first week aims to establish a baseline understanding of the participants' relationship with the landscape and create a collection of innovative ideas related to the schoolyard. The activities also foster the use of the 4 Cs skills and improve knowledge in environmental education, landscape, and design. These outcomes lay the foundation for future weeks and further development of the participants' understanding and skills.

In the second week, four participants rejoined, while five participants were newcomers, totalling 9 participants.

Activity 1: Plan and post it: Students introduce and evaluate homework ideas using different coloured sticker notes. The expectations were to have a diverse collection of ideas that would provide insights into the schoolyard from different

perspectives. The students would then analyse and discuss different points of view, connecting them to the landscape and applying their acquired knowledge.

Activity 2: World Café [15]: Students participate in roundtable discussions on various topics related to the workshop in order to foster detailed discussions on key features of the workshop, such as the benefits of a greener schoolyard, the design process, and new functions or activities for the schoolyard, and to reinforce group communication, encourage contributions from all participants, and share learnings.

Activity 3: Design and landscape principles: This activity involved an explanation of design methods, landscape architecture principles, and design principles based on [16], [17], and [12]. Students then had to find examples of these elements within the schoolyard so as to connect theoretical knowledge with real-life examples, enhance their perception of design elements and behaviour in the schoolyard context.

Homework: In groups, participants were tasked with choosing a location in the schoolyard and creating a concept design for it. They had to test the feasibility of their ideas by acting on the experience of the proposed design, documenting it through photos, videos, and notes, and preparing a pitch presentation of the concept design with differentiated tools and mediums.

The expected outcomes of Session 2: This meeting aimed for an improved understanding of landscape design possibilities and an expanded awareness of schoolyard improvement opportunities. The students' work demonstrates the application of theoretical knowledge to real-life contexts, emphasizing the connections between landscape, design, and the environment. Additionally, the week aimed to promote communication and collaborative work among students, leading to more complex tasks and the integration of greenery with positive implications.

On the third occasion, there were present three participants who attended all previous sessions, five returned after missing the second week, and three of the five newcomers from week 2 returned, totalling 11 students.

Activity 1: Presentation and six thinking hats [18]: Students present their findings and pitch their ideas. After each presentation, a "hat session" is conducted where the ideas are analysed from different perspectives using the Six Thinking Hats method. The expectations are to improve the students' production by providing meaningful insights, addressing problems, presenting viable solutions, and reinforcing empathy and critical thinking skills.

Activity 2: Prototype: Students work in one group to merge or further develop the ideas from the previous activity and create a final solution. They prototype their idea, considering the strengths and weaknesses identified in the analysis from the previous activity. The expected outcome is for students to collaborate, apply advanced communication and collaboration skills, and project their knowledge to create an intervention that positively impacts the schoolyard environment.

Homework: As a homework, students are expected to finalize their prototypes, if necessary, and prepare a pitch to sell their ideas to the school community. They

can use various creative tools. The goal is to engage and inform stakeholders by presenting the results in an engaging and informative manner.

Expected outcomes of Session 3: The aim was to advance the concepts to be more realistic and impactful, to merge or further improve the concepts based on feedback. The proposals should reflect the students' growth and improvement throughout the workshop, incorporating the 4 Cs and addressing the needs and functions of the schoolyard environment.

On the final day, there were present two participants that joined all the previous sessions, four of those who returned after missing the second week, and three of the five newcomers from week 2 returned a second time, thus 9 being the total number of attendants.

Activity 1: Final analysis of the pitches: In this activity, each group presents an improved version of their ideas from the previous week, and the pitches are analysed based on various criteria as suggested by [19]. The expectation is to gain a realistic understanding of how the concepts can be realized and to identify the next steps to make them a reality.

Activity 2: Right for yes, left for no: Students answer questions related to the workshop by positioning themselves between two walls, each representing agreement or disagreement with the statement, their responses being represented on a Likert scale. The purpose is to gather visual responses to important questions about the workshop experience, the landscape, and the results. This activity aims to confirm the effectiveness of the programme and to assess the students' understanding of and feelings about the workshop.

Activity 3: Focus groups: Participants are divided into small groups to discuss specific questions related to their learnings, favourite and least favourite parts of the workshop, expectations, and satisfaction with the results. The goal is to encourage open and honest sharing among the participants and gain insights into the most effective aspects of the workshop and the students' overall satisfaction.

Activity 4: Summary in one word: Students are asked to write and show one word that summarizes their feelings during the entire experience, finishing with a quick sentence to explain their choice. They are expected to learn in simple terms what the most memorable moment, aspect, or learning from the workshop was from each participant's point of view.

Expected outcomes of Session 4: The main expectation was to see the development and evolution of the students' works, as well as the application of ideas gathered during the process and the integration of newly acquired knowledge. The goal was to identify strengths, weaknesses, and the next steps necessary for future implementation. It sought to answer questions about the valuable information learned by the students, their overall experience and feelings, the challenges faced, and the outcomes achieved. The evaluation also aimed to assess the students' awareness of what they had learned and to identify areas for programme improvement.

3. Results and discussions

The four-week workshop aimed to engage students in the process of landscape design and promote their understanding of the schoolyard environment. As a product of the programme, instead of one final concept created by the entire group, four concepts were created by the students and evaluated during the session based on feasibility, sustainability, and multifunctionality criteria [19]. Overall, the productions showed that the proposals incorporated diverse green elements, considered user needs and emotions, and showcased various functions for the schoolyard. Most importantly, the participants demonstrated a strong motivation to improve the schoolyard and a deeper understanding of key learning outcomes related to integrating green elements, connecting with the landscape, and developing soft skills. The final concepts were presented at an event hosted by the school. Each group created a poster for an exposition, involving the community and informing them about the students' ideas for the schoolyard.

On the other hand, limitations were experienced, mostly connected to the students' engagement with homework, which hindered the programme and prevented the successful completion of some activities that relied on this production. Communication in English seemed to be a factor of concern, but it did not have a significantly negative impact.

This section highlights the assessment with the students and the lessons learned for future applications of the programme in different settings. The fourth week of the workshop focused on providing a final overview of the workshop's production and gathering feedback from the students to evaluate its impact.

The results from the *Right for Yes, Left for No* activity (*Figure 3*) indicated that the students had a positive experience overall. They demonstrated good communication and collaboration skills, felt connected to their surroundings, and showed an understanding of the use of green elements and the design process. However, there were mixed responses regarding critical thinking and learning about landscape architecture, suggesting potential gaps in the students' expectations of learning or their perception of their own development during the workshop.

The focus groups provided an opportunity for students to share their thoughts in smaller groups. They discussed the main learnings from the workshop, their favourite and least favourite parts, whether the workshop had met their expectations, and their opinions on the workshop's results. The discussions (shown in *Table 1*) revealed that the students enjoyed the workshop, found it fun and positive, and they expressed a desire to continue working on the concepts they developed. The students also acknowledged that they had learned how to spark change for a sustainable future, which represents a proper step in the improvement of environmental literacy.

Figure 3. Results from *Right for Yes, Left for No*

Table 1. Results of the focus groups

1. Main learnings, conclusions	2. Most enjoyed and less enjoyed aspects	
How to analyse and improve ideas. How to use a process to create. Growing ideas, improvement. Communication, expressing ideas. Even small places have many opportunities and possibilities. Even great ideas might not be realized.	Most enjoyed	Less enjoyed
	Prototyping (3D). Collaboration. Communication. Creativity under pressure/innovation. Useful process.	World café activity (too theoretical). Short time. Lack of material. Not going straight to the action.
3. Expectations for the workshop	4. Rating the workshop production	
To learn more about the landscape. More time in the yard, field search. Going beyond the conceptual phase. Engagement of the school community.	Liked the productions. Considered the whole process useful. Considered it a creative activity performed under pressure and found it positive. Applied the process consciously.	

Furthermore, based on the results from the final week, several lessons can be learned for future iterations of the programme. Firstly, it is crucial to communicate the workshop's goals and objectives clearly to the students to align their expectations with the intended outcomes. This can help bridge any gaps between what students expect and what the workshop aims to achieve.

The cumulative character had a positive feedback with regard to using green elements and applying the design process. Future iterations of the programme should continue to emphasize these aspects to enhance students' understanding and practical skills. Additionally, the programme provided opportunities for students to develop their communication and collaboration skills through group work and discussions. These aspects should be further emphasized and integrated into the programme, as they are highly appreciated by the participants and are valuable skills for future professionals in any field.

The results indicated that English proficiency posed a challenge for some students, particularly in fully understanding certain tasks. Future workshops should consider providing additional support or alternative communication methods to ensure that language barriers do not hinder students' participation and learning. And, finally, the closing week's assessment activities allowed for student perspectives to be heard and considered. It is essential to create space for students to reflect on their experiences and provide feedback, as this can inform programme improvements and enhance overall satisfaction.

4. Conclusions

In conclusion, the pilot landscape and design-based programme offered some improvement in student environmental literacy in the given environment and conditions provided by integrating landscape architecture and design concepts into the context. The programme engaged students in the design process, promoted their understanding of the schoolyard environment, and developed their future skills. The results and discussions highlighted the positive impact of the programme, including the generation of innovative ideas, the integration of theoretical knowledge with practical applications, and the promotion of communication and collaboration. These outcomes emphasize the importance of schools as spaces for environmental education and the potential of design-based approaches in shaping environmentally literate students. Further research and implementation of similar programmes are being conducted to create an iterative guideline to have programmes more impactful and to explore different social groups and cultural backgrounds.

Acknowledgements

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