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RESEARCHING BY DESIGN: METHODOLOGIES TO EXPLORE DESIGN-BASED INSTRUCTION FOR YOUTH RESILIENCE TO ENVIRONMENTAL CHALLENGES

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Abstract: *Environmental education is not aligning with the sustainability and educational needs of the 21st century. Design-based learning emerges as a viable solution, fostering problem-solving and experiential learning in the environment. With its constructivist approach, it has the potential to improve environmental literacy across diverse social contexts. This research explores the use of research by design and design-based learning to develop extracurricular programs in schools in Brazil and Hungary. The analytical framework is developed through a literature review and systematic case analysis. The program's objective is to engage the school community in redesigning their environment, following the design-based instruction framework, and incorporating the community's context and landscape architecture and design principles. Program efficacy will be assessed through participant production, outcome analysis, observation, surveys, and performance on the design activities. The findings will contribute to understanding and evaluating program effectiveness in improving environmental education.*

Keywords: *research methodologies; experimental educational program; design process as pedagogical method; design process as research method; environmental education*

1. INTRODUCTION

Although having the concepts of environmental education and climate change since the 60s [1, 2], a growing concern has been observed over the last 30 years about the state of the environment and how to achieve sustainable development. Many approaches to accomplish

such are in evidence today, nature-based solutions and circular economy are a few examples. The 1992 Earth Summit in Rio de Janeiro, was believed to be the catalyst of a revolution in the global thinking of environmental education, increasing the awareness that to tackle these issues, all the sustainability imperatives need to be addressed in education, not only the environment but the socio-economic dimensions as well [3]. Additionally, international UN efforts such as the Sustainable Development Goals, Green Deal, and Agenda 21, to name a few, continue the attempts to change the pessimistic climate prospect by bringing attention to the importance of environmental protection and education, among other socio-economic dimensions, while also highlighting the importance to attend to those comprehensively [4].

Moreover, at the heart of the sustainability issues faced in modern societies is the profound disconnection between humans and natural systems [5]. Due to the development of technology and the major growth of urban populations, people do not have enough contact and connection to nature to know how the natural systems operate [1]. As a result, there is a tendency to disregard the reality that societies are bound by the limitations and dynamics of the biological and ecological aspects of our environment [6]. Meanwhile, in school environments, opportunities to create such experiences are being neglected by the curricula commonly constrained to classic expository teaching methods.

In this way, environmental education is not evolving in accordance with the pressing sustainability needs and the educational needs of the 21st century, there is a gap between the way these issues are addressed in educational settings and the fast-changing state of the ecological, and socio-economic systems. Furthermore, to be continuously relevant, the concept of sustainable development, and environmental education for that matter, should be viewed as an ongoing process rather than a fixed objective. It is a dynamic and ever-changing goal, where the boundaries and scope of its key components, represented by the three imperatives of sustainability, continuously evolve in response to their shifting dynamics [7].

This article presents the methodology to be employed in a Ph.D. research on Landscape Architecture and Landscape Ecology which was envisioned as a reaction to the pressing issue of environmental crisis and the need to adapt environmental education to current and future needs. Additionally, to develop an understanding of the interdependence between human and natural systems, and how this notion is important to act in response to sustainability issues [7]. Considering the problem space, it is relevant to take steps to close the environmental education gap by making students capable of solving wicked problems, equally relevant is considering how to make this possible for school settings considering their socio-economic, local, and cultural backgrounds. The presented research utilizes research by design approach and design experiments to develop educational programs focused on landscape design projects. These programs aim to promote the creation of interventions or the redesign of schoolyards in partner schools by the students. While fostering an understanding of the local environment by giving pupils autonomy, promoting self-learning, and encouraging the design of a place of daily use. It is expected to initiate experiences in and the comprehension of the local environment throughout the process of designing. As it requires an understanding of the immediate landscape and its systems.

1.1. *Environmental Education and Environmental Literacy*

Environmental Education is an ongoing learning process that is not limited to the school years, but rather a process for the entire life [8]. Transdisciplinary in its nature [6]

environmental education urges diverse methods to facilitate decision-making at both individual and societal levels. It draws upon integrated knowledge from various fields, fostering the development of attitudes and action strategies aimed at effecting positive change in the world [8]. The ultimate goal is to inform people to be aware of and concerned about the environment, and motivated to work individually and collectively toward the resolution and prevention of environmental problems [9]. To describe the goals of environmental education is to depict the definition of environmental literacy, both entail an awareness, concern, knowledge, skills, and motivations towards environmental issues [10]. As Davis (1998, p. 118) puts it, this encompasses "values, attitudes, ethics, and actions", functioning as both a mindset and a practical approach [6]. Also, it fosters an understanding of the intricacies of natural systems and environmental challenges [8]. However, it is worth emphasizing that environmental awareness alone does not equate to environmental literacy. True environmental literacy entails the manifestation of all three aspects: awareness, understanding, and action [11]. This comprehensive perspective aligns with Freire's (2000) notion of the power of literacy, cited by Dale and Newman (2005), which underlines it as the active use of the capacity to learn to shape one's own life, which is fundamentally connected to their identity [7].

The complexity of issues related to the environmental crisis and all its connected systems necessitates novel approaches to problem-solving. These complex problems defy conventional thinking and require counterintuitive strategies and the development of new knowledge. They post no simple solutions and require continuous concern [12]. Traditional educational methods face difficulties in adequately addressing this complex interaction [7]. Design, with its ability to foster creativity and innovation in thinking and problem-solving, becomes an apt approach for addressing these challenges [12].

Additionally, to effectively cultivate environmentally literate individuals, environmental education must embrace a student-centred learning process [13]. This approach acknowledges the needs of the twenty-first century and fosters a comprehensive understanding of natural systems and human interdependence, while also promoting immersive outdoor experiences [3]. Adopting a student-centred approach is necessary so environmental education succeeds in bridging the gap and equips future generations with the skills and mindset required to become environmentally literate problem solvers. As stated by Davis (1998 p. 122) there is a "need to reinforce the values of cooperation and shared responsibility and to encourage children to become social and environmental problem-seekers and solutions-creators" [6].

Furthermore, it is necessary to recognize the significance of education in the modern world. In today's setting, information is readily accessible, and the focus has shifted from mere acquisition of knowledge to the ability to effectively apply it. Instead of simply memorizing facts, the emphasis is on utilizing knowledge wisely and taking appropriate action based on it [3].

1.2. *Design-based instruction and landscape design*

And so, quality environmental education in the early years is a very important strategy to tackle present and future sustainability challenges. Among many pedagogical approaches, the design-based instruction, or design-based learning methodology stands out because it involves the introduction of the design process as a pedagogical method [14]. The design process can be understood as the method of solving a problem that is applied by designers. The process is no definitive formula, being constantly updated to each context [3]. It breaks down problem-solving into different steps. These can be simplified as identifying and studying a problem,

developing solutions, testing the solutions, and improving and implementing the solutions [3, 15]. A compilation of different approaches to the design process is illustrated in Figure 1.

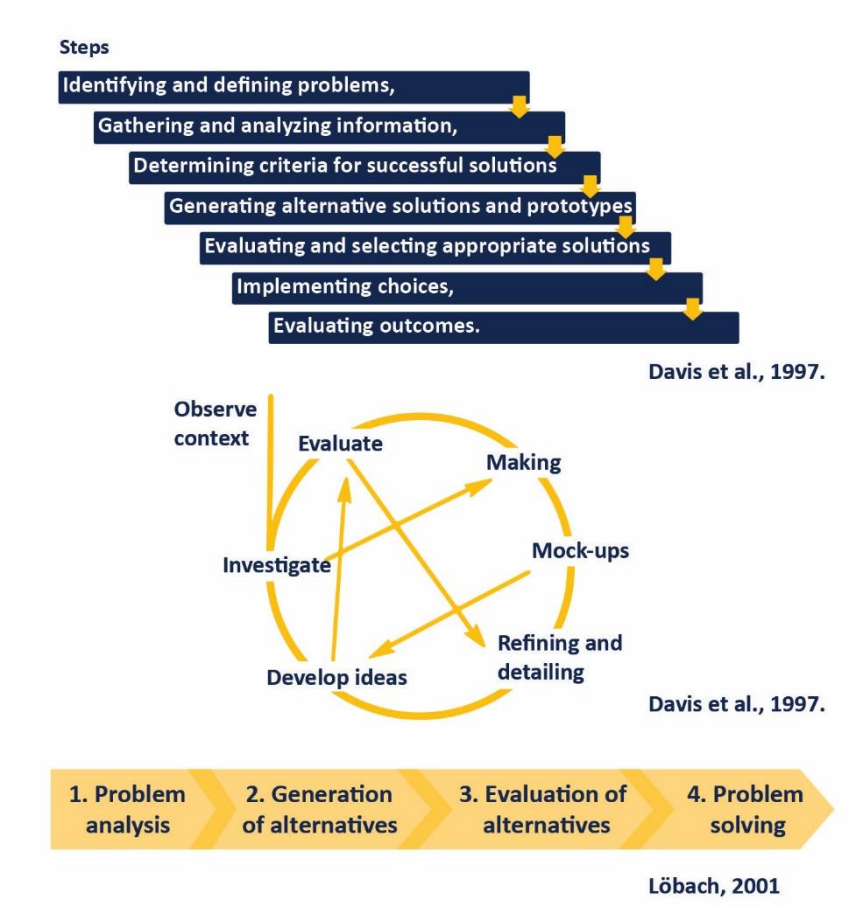

Figure 1 Compilation of design processes [3, 15]

Design integration in curriculum and teaching nurtures flexible thinking, self-directed learning, interpersonal skills, and responsible citizenship. Its interdisciplinary nature encourages systems thinking. It integrates concepts from art, science, and diverse contexts, increasing effectiveness as an instruction methodology [3], and showing meaningful strengths to be applied for the improvement of environmental education.

Furthermore, beyond introducing more problem-solving effective tools and fostering soft skills development in learning environments, design-based instruction can encourage the much-needed creation of real experiences in and for the built and natural environment [14, 3, 1]. This connection between curriculum content and real-life context improves student learning [16], since adhering to a constructivist approach, which considers the learners' prior knowledge and social and physical context, and self-directed learning, can provide meaningful benefits, particularly, for underserved communities [17].

Finally, one very important aspect of the methodology is understanding mistakes and errors as a part of the practice, the need for feedback and redesigning is inherent to the act of design

[14]. This aspect of the process fosters resilience as students move away from memorization and single correct answers, engaging in experimentation and exploration to find multiple solutions for a given problem. There is no definitive solution, and through experimentation and iterative attempts, they become more innovative, leading to improved outcomes and a transformed relationship with the process of problem-solving. This resilience is a meaningful skill for dealing with wicked problems. Ultimately, as stated by Dale and Newman (2005, p. 355), "the ability to solve a problem is a better measure of literacy than mastery of individual skills" [7].

However, also important is to address the expected role of landscape architecture and landscape design principles in the application of design-based instruction in the context of this research. Landscape Architecture as a field, is integrative in its concepts and approaches, combining ideas and methods from various disciplines, including the arts, sciences, humanities, and technology. The broad scope of landscapes and their complex relationship with human interactions contributes to the expansive nature of this subject field [18]. Additionally, the landscape architect is a professional who, possessing complex expertise, plays a pivotal role in shaping liveable and sustainable landscapes and structures, fostering functional communities, and balancing social, environmental, and ecological interests [19].

Landscape architecture relies on two interrelated fundamental proficiencies: the mastery of planning, design, and management principles to enhance or preserve landscapes, intricately intertwined with a comprehensive understanding of the essence of landscapes, their temporal and spatial perception, as well as the influences and compelling factors that shape them [18]. Therefore, through the implementation of projects of landscape design into the proposed educational program these competencies should be self-learned, to a degree, by the students. By acting in the project as landscape designers, through analysis, planning, and design experimentation, students should develop a deeper understanding of the landscape and its multi-faceted character and network of systems.

2. MATERIAL AND METHODS

Moreover, for the research methods, design experimentations will be conducted with partner schools from Brazil and Hungary. For each national context, at least two experiments will be conducted with contrasting social groups, resulting in a minimum of four rounds. Each program outline will be planned to follow the design-based instruction framework and reflect a local context assessment for defining landscape challenges and activities appropriate for each partner. Each round of the experimentation (each school application) will provide comparable data and feedback for revisions for the following experiment, establishing an iterative process in the research. This research approach follows the research by design approach, as it constitutes an investigation where design plays a significant role throughout the process [20].

The program will have a minimum of four iterations. Each iteration will be constituted of designing the program and accommodating the design challenge and activities to the local context, followed by the application of the program, then a feedback session will be conducted with the community, to finally have a reflection on the process and definition of strengths and weaknesses of the iteration. The following iteration will consider the learnings from the previous round and apply the necessary changes. The summary of the methodological process can be visualized in Figure 2. Guided observation, surveys, design activities, and facilitation techniques will be key means for achieving and assessing results.

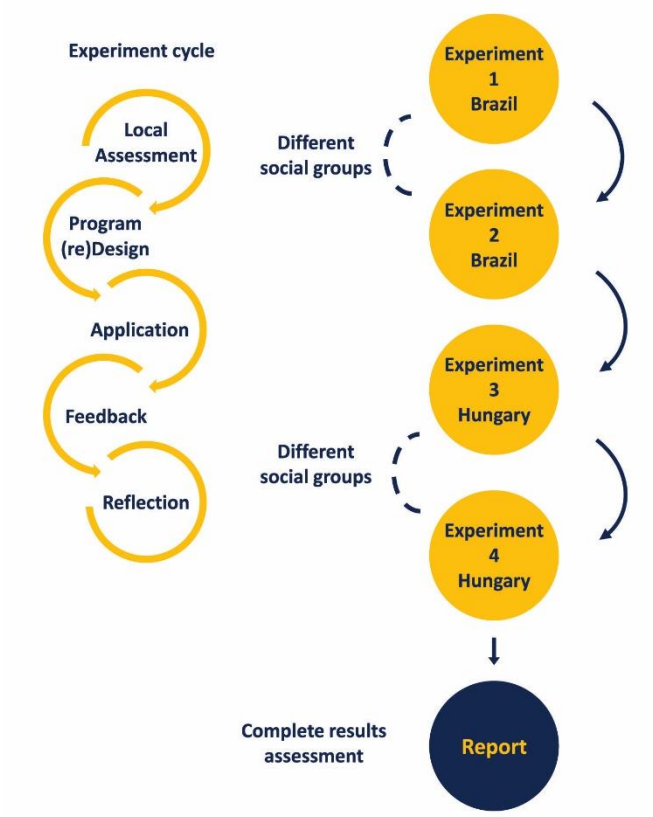

Figure 2 Research work methodology visual summary

To keep the research attainable, five phases will be followed corresponding to the time frame of four years: problem definition (years 1-2), literature review and case studies analysis (years 1-2), analytical framework and program outline definition (years 2-3), design experimentations (years 2-3), and results' analysis and documentation (years 3-4).

2.1. *Source materials*

Additional bibliographic research and the collected information will give the background for further analytical framework definition, to select pertinent data collection and analysis tools. Before the experimentation with the schools, an assessment will take place. Each context will be investigated from the individual to the social level using mixed methods. Landscape in the three systems will also be used as a parameter for national and local analysis: landscape as a natural system, socio-economic system, and cultural system.

For gathering the materials, mixed techniques will be utilized, accessing a variety of data that is divided into the following categories, problem space and core concepts study (Table 1), community analysis (Table 2), landscape analysis (Table 3), and program design and assessment (Table 4).

Aspect of research	Source material
Problem definition and core concepts bibliographic research (Publications with an overview on:)	environmental education, environmental literacy, design-based learning, landscape architecture applied knowledge, landscape design, design process, design attitudes, constructivist pedagogy, and future skills, but not restricted to.

Table 1 – Compilation of source materials for core concepts study.

Aspect of research	Source material
Environmental Education policies (national and local)	Environmental laws and policies databases
Social groups analysis (school community identity); Socio-economic and cultural background	Questionnaires, interviews, guided observation, historical, cultural, and political publications, and databases
Connection with the environment (understanding of natural systems and local natural resources)	Questionnaires, interviews, guided observation, previous studies

Table 2 – Compilation of source materials for community analysis.

Aspect of research	Source material
Landscape as a natural system (national and local)	topographic and geographic maps
Landscape as a socio-economic system (national and local)	land use maps, census information, and comparison of historic maps
Landscape as a cultural system (national and local)	land use maps, historical maps, and historical publications

Table 3 – Compilation of source materials for landscape analysis.

Aspect of research	Source material
Landscape architecture, landscape design, and design-based learning tools	Case studies analysis of previous similar programs and publications
Efficacy of the experiments	Design experiment, questionnaires (test-retest), focus groups feedback sessions, participants' design solutions

Table 4 – Compilation of source materials for program design and assessment.

For the validation of the results, an important factor is to have comparable data. Participants and school communities will be surveyed in a test-retest manner, while guided observation, focused interviews, and the projects' production will be analysed and serve as material for comparisons for the validation of the method. Having different sources of material, coming from the experiments and the research study is fundamental for the successful triangulation of each step in this study and for achieving valuable and trustworthy results.

2.2. *Pilot program*

A pilot program was conducted at Polytechnic of Economics Alternative High School, in Budapest, Hungary. The design-based learning methodology and landscape design principles were incorporated to assess the level of improved environmental literacy and students' connection with their local landscape using the schoolyard as an object for the association. The program consisted of four sessions designed to guide students through the design process, with a focus on addressing the challenges present in the schoolyard and proposing design interventions.

The program design included pre-selected activities for each session, allowing students to develop their own designs while improving their understanding of the place, natural elements, and design attitudes. As the program progressed, there was an increasing emphasis on exploring 21st-century skills and utilizing time pressure as a tool for fast-paced learning and fostering creativity. Figure 3 illustrates the base concept of the program and shows a summary of the selected activities.

The results demonstrated an increase in students' understanding of the provided information, critical thinking skills, and motivation to improve the schoolyard. Three out of four proposals incorporated green elements and effectively addressed the needs of the schoolyard. The participants exhibited strong communication and collaboration skills, showcasing their ability to achieve results despite limitations.

The program evaluation indicated positive outcomes in terms of fostering critical thinking, analysis, problem-solving, and innovation. The students developed a deeper understanding of analytical practices, followed a structured design process, identified solutions, and recognized the potential of different spaces and interventions. The experience received high satisfaction levels, with participants appreciating the general information and its impact on them.

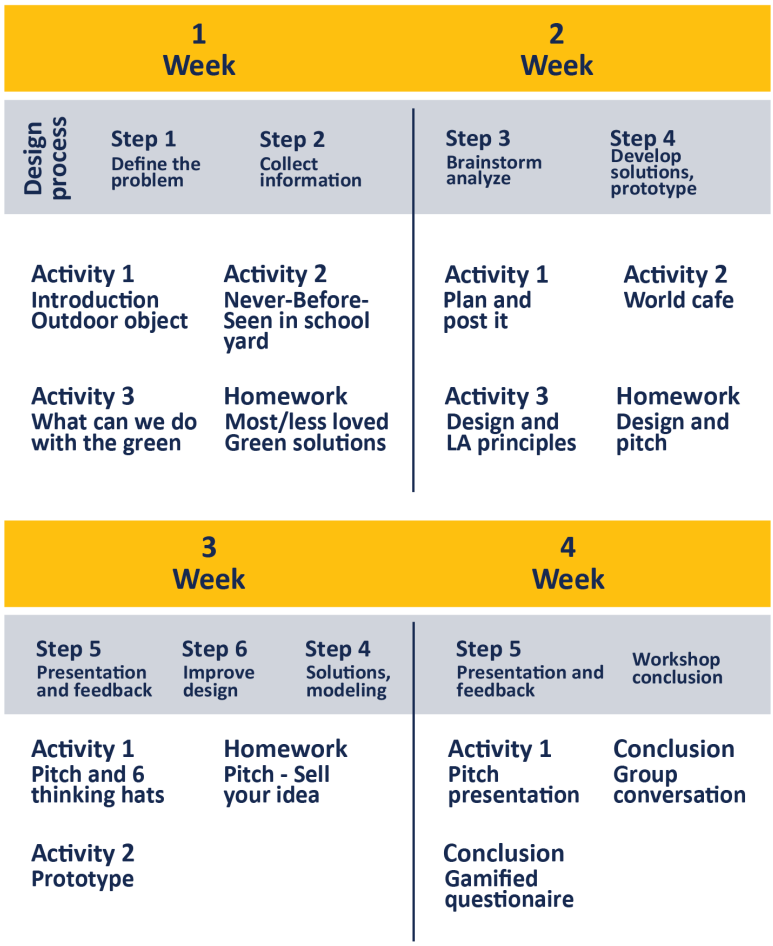

Figure 3 Pilot program summary

The conclusion highlights both positive and negative outcomes of the pilot program to be considered for future iterations. The design-based learning methodology and framework proved highly valuable in achieving the program's objectives, providing an engaging and enjoyable experience for students. The iterative nature of the design process empowered students to think innovatively, collaborate effectively, and make meaningful contributions.

3. EXPECTED RESULTS

By the completion of the proposed program iterations, it is expected to collect analytical and project-based tools to support the initiation of context-appropriate educational programs leading to improvement in environmental literacy in school communities in a variety of settings. To identify best practices in the teaching of environmental education in schools, extending it to the discovery of the most effective aspects of design-based learning and landscape architecture principles and competencies that can be used for such.

Identifying instruments that should help understand how to level environmental education in communities with different backgrounds, in a way to assist all settings to have the same peak in the learning curve. Additionally, it is expected to inspire the students, and local community, into being active citizens, to be involved in the maintenance and sustainable development of the environment, and to start acting, even if modestly. Since even the smallest attitudes initiate a chain of behavioural changes leading to more sustainable outcomes [13].

Creating a comparison between the application of the proposed method in the Hungarian and Brazilian contexts, and with the contrasting social groups in each, can be beneficial to create insights on the positive and negative implications of different educational environments, cultural backgrounds, and educational methodologies to spot the best and poor practices attributed to each.

Such results can be used for future researchers and educators to practice and continue developing environmental education programs applied with design-based instruction and landscape design competencies since educational methods should evolve together with the environment's changes and needs. The continuation of the research has the potential to add more layers to the framework and instrumentalize how to make it more adaptable and suitable for each environment in which it can be applied. Furthermore, the research, rather than reaching a result, proposes to be continuously redesigned in future implementations to be considered continually relevant in the ever-evolving state of education and the environment.

4. CONCLUSION

Therefore, the main expected output of this research is a landscape-oriented design-based learning instrumental guideline that can be adaptable to various educational settings, thereby facilitating the improvement of environmental education in schools, not only in Brazil and Hungary, and not only for a specific social group, but also in other contexts globally. Methodologically, the objective is to explore an action-based and continuously evolving approach following the design process, emphasizing the importance of the circular process of learning, experimentation, feedback, and redesign. The methodology of both, the program, and the research, align in their iterative nature, prioritizing continuous improvement and application rather than seeking final solutions.

REFERENCES

[1] **Toorn, M.,** Environmental education and design: the role of landscape architecture. In proc. *5th WSEAS International Conference on Environment, Ecosystems and Development. (2007) 451-462.*

[2] **Léger-Goodes, T., Malboeuf-Hurtubise, C., Mastine, T., Généreux, M., Paradis, P.-O., Camden, C.,** Eco-anxiety in children: A scoping review of the mental health impacts of the awareness of climate change, *Front. Psychol. Volume 13 (2022) 1–21.*

[3] **Davis, M., Hawley, P., McMullan, B., Spilka, G.,** Design as a catalyst for learning. Alexandria: ASCD, 1997, pp. 147.

[4] **Barrable, A.,** Refocusing Environmental Education in the Early Years: A Brief Introduction to a Pedagogy for Connection, *Education sciences. Volume 9 (2019), No 1, 61–69.*

[5] **Liefländer, A.K., Fröhlich, G., Bogner, F.X., Schultz, P.W.,** Promoting connectedness with nature through environmental education, *Environmental Education Research, Volume 19 (2013), No. 3, 370–384.*

[6] **Davis, J.,** Young Children, Environmental Education, and the Future, *Early Childhood Education Journal. Volume 26 (1998) No 2, 117-123.*

[7] **Dale, A., Newman, L.,** Sustainable development, education and literacy, *International Journal of Sustainability in Higher Education. Volume 6 (2005) No 4, 351–362.*

[8] **Meredith, J., Cantrell, D., Conner, M., Evener, B., Hunn, D., Spector, P.,** Best practices for environmental education: guidelines for success. Akron, OH: Environmental Education Council of Ohio, 2000, pp. 65.

[9] **UNESCO, UNEP,** The Belgrade Charter: A Framework For Environmental Education, 1975.
[10] **McBride, B.B., Brewer, C.A., Berkowitz, A.R., Borrie W.T.** Environmental literacy, ecological literacy, ecoliteracy: What do we mean and how did we get here? *Ecosphere. Volume 4 (2013) No 5, 1-20.*
[11] **Roth, C.,** Environmental Literacy: Its roots, evolution, and directions in the 1990s. Columbus, OH: ERIC Clearinghouse for Science, Mathematics, and Environmental Education, 1992, pp. 51.
[12] **Roggema, R.,** Research by Design: Proposition for a Methodological Approach, *Urban Sci. Volume 1 (2017), No 1, 1–19.*
[13] **Gamage, S.,** Environmental education for sustainability: environment literacy and action-oriented teaching. In: Verma, M., (ed) Environment and Sustainable Development: Perspectives and Issues. New York: Routledge. 2022.
[14] **Raber, C.,** Design-Based Learning for the Elementary School Classroom: Critical & Process Document. Vancouver: Emily Carr University of Art and Design, 2015, pp. 127.
[15] **Löbach, B.,** Industrial Design: Bases for the configuration of industrial products. São Paulo: Edgard Blucher Ltda, 2001 pp. 208.
[16] https://www.edutopia.org/inquiry-project-learning-research
[17] **Macpherson, I., Arcodia, C., Gorman, S., Shepherd, J., Trost, R.,** Collaborative Action Research: Learnings from a social sciences project in a secondary school, 212-238. In Atweh, B., Kemmis, S., Weeks, P., (eds) Action Research in Practice: Partnerships for Social Justice in Education. London and New York: Routledge, 1998, pp. 350.
[18] **Bruns, D., Ortacesme, V., Stiles, R., de Vries, J., Holden, R., Jorgensen, K.,** Tuning Landscape Architecture Education in Europe. Europe: ECLAS-LE:NOTRE, 2010, pp. 60.
[19] **BOROMISZA, Zs., Kollányi, L., Jákli, E., Földi, Zs.,** Education with the landscape – challenges in science communication and ecotourism, *4D, Volume 55 (2020), 3-11.*
[20] **Hauberg, J.,** Research by Design – a research strategy, *AE... Revista Lusófona de Architectura e Educação. (2011) No 5, 46–56.*