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Sustainable Principles Implemented in Architecture and Interior Design through Eco Pieces of Furniture and Lighting

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Abstract

Objective: The research presents the efficiency of the studied topic, the theoretical and practical polices applied in ecological architecture and design, the importance and priorities of a healthy interior environment. The main statement that motivated this qualitative study is to explain clear principles of recycling and reuse through sustainability, supported by the high school curriculum.

Methodology: The study focuses on developing awareness of critical thinking in society and academia, for recycling and reuse, - a process that leads to reducing environmental pollution, and waste emissions for the future of our descendants. The paper follows two directions for analysis. First of all, the ecology principles implemented by EU and fully supported by the Republic of Moldova through recent state directives and polices toward the sustainability. Secondly, the inclusion in the high school curriculum the projects concentraded on sustainability. Some examples of functional furniture, lighting and interior design pieces elaborated by students-architects and designers, promoting the possibility of recycling and reuse the waste materials, were presented.

Findings: The analysis of the situation and the sustainable approach revealed three major postulates: First of all, the awareness of the attitude towards the environment and critical thinking of sustainability for future generationsб plausible messages both for the Moldovan society and for the academic environment. Finally, the implementation of critical awareness towards recycling and reuse of waste materials in the curriculum strategies for architects and interior designers led to development of future specialists in the field such as of sustainable products design.

Keywords: recycling, sustainability, interior design, eco architecture, creativity, thinking, project concept

1. Introduction

Since the industry evolution, humanity is facing the problem of waste that brings a negative ecological impact on the environment and consequently affects every aspect of human life. The demands in the daily comfort of mankind claim growth of interior space and a higher consumption of processed natural materials, conditioning a large environmental impact factors through gas emissions (Mereniuc, 1991), depletion of resources, waste pollution. Thus, more and more attention should be paid to the ecological problems. It is necessary to find the new approaches and design solutions in the field of interior architecture and design based on sustainable principles, leading to a reduction in the consumption of materials, energy, etc.

Thus, as mentioned by Verina, Cravcuc, and Besleaga (1988 p.15), *to formulate regional and local action plans for environmental protection and the development of concrete projects for conservation and improvement of the environment*. Therefore, by changing the way we think and approach limiting wasteful consumption through recycling and reuse, with a comprehensive structured processing program, we develop a sustainable economy of a prosperous country, of a social conscious for a future of planet Earth (Capcelea, 1995). The principles of approach and planning developed by the Ministry of Health and the Ministry of Environment of the Republic of Moldova, evolved into a set of programs and laws described in the "environmental code", followed by the ban of some negative environmental activities (Ministry of Health, 1999, p.36). Projects that follow the principles of eco-friendly architecture and interior design in the field of construction in the Republic of Moldova reflect the harmony with the surrounding world. Therefore, the architecture of the residential or public interior space must offer the beneficiaries security and comfort, a

pleasant psychological and emotional state, harmonious stylistic aesthetics adapted by all means: optimal and functional distribution, furniture, wall, and floor finishes, textiles, and colors, and the principal concept and most importantly, it is the healthy interior based on the sustainable materials used, (Stepanov, 1993) ensuring a lively interior design and environment. The new fundamental technique that appeared in the urban environment *"wild jungle" - green architecture*, is an innovative theme implementing in the design the energy efficiency and the best practices of landscape architecture. It is an important way of thinking of specialists, which would condition a minimal exploitation of natural resources, conservation of heat in the winter and cooling in the summer etc. The principle of place preservation offers a vision of the Eastern philosophy of nature - the unity and fusion of human beings with their natural environment. Professor Emeritus Christopher Martin mentions in his research, *"we learn to live together,"* and nature should be considered only a resource used for the benefit of humankind. The transition to sustainable architecture is an exhortation for specialists in the field and society, contributing to the present and future of humanity (Christopher, 2000).

2. Sustainable Approach, eco-Sustainable Principles

Our vision presented in this paper is the recycling and reuse of materials, which leads to a sustainable life. Lasting capacity, the quality of an anthropic activity to carry out without exhausting the available resources and without destroying the environment, without compromising the possibilities to satisfy the needs of the next generations. According to environmental analyst Lester Russell Brown (b. 1934, USA), *sustainability is the effective solution for a bright future for mankind*, being nowadays an acute research topic for scientists around the world. Lester Russell Brown has written more than 50 books on global environmental issues, such as global warming, water depletion, food and energy shortages, the need for smart, sustainable architecture and design, which were translated in more than forty languages. He introduces the concept of eco-economy, which can be developed in the long run without affecting the environment, described and analyzed in one of his works: *"Eco-Economy: Building an Economy for the Earth"*. Thus, Lester Russell Brown comes up with proposals for resolving the conflict between industrial civilization and the environment, (Figure 1) mentioning the correlation of aspects of resource use volume (Lester Russell Brown).

Figure 1. Lester Russell Brown, the concept of eco-economy - circular economy

As shown in Figure 1, Lester Russell Brown analyzes the concept of eco-economy- circular economy.

In conclusion, this concept adopted by environmental analyst Lester Russell Brown, one of humanity's greatest voices for the environment, points to the importance of recycling and waste processing. However, in the opinion of theorists (Hesselgren, 1975; Lester Russell Brown, 2001), a conscious society must analyze, weigh, and plan the use of natural resources for economic and social balance.

It is necessary to emphasize that sustainability must become a principle and a way of life for 21st-century humanity. Sustainability is also a current issue for the government of the Republic of Moldova and researchers who come up with sustainability solutions supported by the European Union and the Romanian Government for environmental projects. The most important thing to be considered is the construction field, focused on green urban architecture - a principle applied by Moldovan architects in contemporary urban planning projects. (Figure 2).

Figure 2. Urban green architecture project for Chisinau, Republic of Moldova

The approach to the position of designing a green architecture gives the priority to the technics reducing pollution and heating of the city, trying getting closer to the natural environment. It is important to educate the future architects by promoting the sustainable architecture. A trimendous example can be considered the lectures holded in the specialized classes of architectural design in the Department of Architecture, Faculty of Urbanism and Architecture (FUA), Technical University of Moldova (TUM), through involvement in real projects coordinated with the City Hall of Chisinau, Union of Architects of the Republic of Moldova (FUA-UTM student-architects, 2021).

Table 1. Benefits of recycling and reuse

The benefits of recycling
• Decreasing the volume of energy and raw materials needed to manufacture new secondary products
• Mitigation of the volume of waste through a manager of the important economic circuit
• Conservation of the planet's natural resources
• Minimizing risks to human health and the environment
• Limiting greenhouse gas emissions from the atmosphere minimizes water and air pollution

As shown in Table 1. The benefits of recycling and reuse reduce environmental pollution

3. Eco Design - Creativity - Reuse - A New Life of a Product

Thus, extensive eco-themed projects are studied and applied in practice in lectures and seminars by student-architects and master-designers of FUA, TUM. Wonderful and creative works are the results of sustainable concepts - various pieces of furniture, decorative objects, and lighting. Chairs and stools, transformable and multifunctional armchairs with storage spaces, tables for newspapers and coffee, table and floor lamps, etc., great results, presented during the event started several years ago. The Scientific-Practical Seminar "Sustainable Eco Design" is already in its 3rd edition in 2022. The message of this event is to communicate the importance to have a clear vision on the waste that can serve as a source for new design products that will last in the home longer (FUA-UTM, 2021).

The theme we researched on the ecological field included the feasible actions of recycling waste/secondary materials for a sustainable and functional interior object. The challenge was a tailor-made one, and the students had the opportunity to create a custom design concept by using affordable recyclable materials. The aim of the project was to create the sketch of the object through original, bionic, or parametric forms, having multi-functionality, aesthetics, durability, with the final stage of adaptation in an interior space (Figure 3 a, b).

Figure 3. a. Project proposal - furniture drawing made from recycled materials

Figure 3. b. Project proposal - bunk dwelling completed with durable furniture

The aim of this paper is to reduce the impact of waste and emissions by converting the secondary materials in useful objects implemented in the interior and being an example of sustainability. The main purpose of environmentally friendly design is to anticipate and reduce the negative impact on the environment through the manufacturing process of furniture or lighting from recycled materials from construction, finishes, etc., used, and then completely eliminated from its life circuit. At the same time, the eco-design maintains the quality level of the product depending on its use. The responsibility and importance of future specialists from the FUA, TUM, program Architecture and Interior Design (Munteanu, 2020; Munteanu, 2021), is to protect the environment. Thus, of all the arts, architecture and design are the most strongly associated with the real material world and human life. The solutions for both utilitarian and creative tasks are inseparably combined in each architectural structure.

Designers and architects are professional creators of the living space, cleverly applying the reuse of waste through sustainable and durable materials. Inspired students came up with proposals for eco-projects using the materials they collected: paper and cardboard tubes, old projects, tree sticks, and roots, tires, wood, crates, and pallets from construction, window panes, industrial mechanisms from warehouses, everything useful for reuse. The resulting reuse of materials gives to old, stored objects a new life, taking into account environmental, social, and economic benefits as well as an appealing design. These original works are examples to be followed for the whole society and academia. Usage of recycled materials get us a chance to promote the green innovation in sustainable design (Figure 4 a, b).

Figure 4. a. Table for the living room, furniture board made of recycled materials, braided crate made of rug

Figure 4. b. Project board of the interior with table for the living room made of recycled materials

Our research focuses on developing awareness of critical thinking in society and academia, for recycling and reuse of waste materials. The example of practical seminar work performed by the team of fifth year students consist of: 1. Designing the concept of a living room furniture - armchair; 2. Selection of recycled material - a tire, Cover - an old towel; 3. Sketching the piece of furniture; 4. Making upholstered furniture with the following criteria: comfort, durability, easily accessible materials (car tire), functional, aesthetic appearance (figure 5).

Figure 5. Living room armchair, work steps

These sustainable pieces of furniture do not require large expenses, as all materials are on the hand and easily accessible. They fit easily into the living environment and perform the same functions as the furniture from specialized shops, are mobile, appropriate in any corner and area of our home (Figure 6).

Figure 6. Work team, sustainable furniture framed inside

In the result, besides the students satisfaction, has been acquired the formation of new concepts of thinking towards a sustainable design through the use of waste materials, transformed into environmentally efficient, social, and economic added value. The seminars "Interior Architecture", gain a strategic role in the practice of contemporary design architecture, in addition, it is an applicable study, based on the continuous progress of cultural and technological theories and practices. Therefore, through critical contributions on this topic students can play a relevant role in dissemination of knowledge and encouraging progress in the field.

Eco-design is an evolving concept over time, which is considered an affordable solution to reduce the negative impact of materials on the environment. Using the recyclable materials we get a chance to promote eco-innovation. The event always gathers a curious audience from all fields, it presents useful, functional and original students works - tables, chairs, armchairs, lamps, etc. appreciated by visitors.

As in any other field, in architecture and interior design, the appreciation of beauty is strongly influenced by education, ideology, social environment. But in this case, we are talking about a rational beauty, which harmoniously combines the useful and the beautiful.

The philosopher Paul Souriau (1852–1926), mentioned in his works on inventions and aesthetics (Souriau, 1904 p. 56). *"... everything is perfect in its own way, when it is suitable for its purpose… There can be no clash between useful and beautiful. The object acquires its beauty when its form is the open expression of its function".* Identifying the senses and thinking about the objects and phenomena from the surrounding reality, through direct reflection - principles of beauty and usefulness, can be applied in education as a key point for sustainable future development (Souriau, 1904).

"Man can master nature as long as he obeys its laws" /Gr. Antipa/

Today, the importance of sustainable thinking in academia through education towards the formation of professional concepts of sustainability of specialists in interior design and architecture is imperative. At the Technical University of Moldova we consider the importance of motivation in affording the sustainable theme. Being halped by guests from

various fields, the project led to formation of clear concepts and visions, based on a strategic plan, and got a large media coverage.

The first thing to be considered for sustainable interior-green object creation, is the working plan containing the concept of ideas, the model, sustainable materials, work steps and the end a functional life-size object with aesthetic appearance and located in an indoor environment. The project was organized for the teamwork of 3-4 people each, with well-defined work stages. Initially a research on the ecological situation in the region was done (Aloone & Bey, 2009), followed by estimation of the impact factors of recycling and reuse of waste materials, personalized and creative form of the work concept but also inspiration from natural formal, parametric architecture concept (Table 2).

Table 2. The concept of furniture from recycled materials

Purpose: Development of a concept of furniture from recycled material: unique, functional, aesthetic and ecological		
Objection: -We offer a second life to used furniture; -We use recyclable materials; -We ensure the proper use of the developed concept; -We frame the concept in a suitable environment, in our case the piece of furniture for the children's room.		*The actuality of the subject:* -Currently, recycling is a necessity but also a rising trend in the arts industry, interior design, fashion, etc.

As shown in Table 2, these are the stages of a recycled furniture concept

Another example of a sustainable object framed in a public or private interior space is the modular armchair, the work of 5th-year students, the academic group ARH-151. In the beginning, recycled materials were selected: sheets and tubes of pressed, colored cardboard and cardboard for resistance. Then the concept of the armchair followed a shape inspired by the snail shell, perfectly inscribed in the Fibonacci spiral (Eves, 1990), where the construction of the object also obtains a circular unfolding, through a set of colored modules. A result that embodies the principles of sustainability of a piece of furniture functional and harmonious with the interior space (Figure 7, 8).

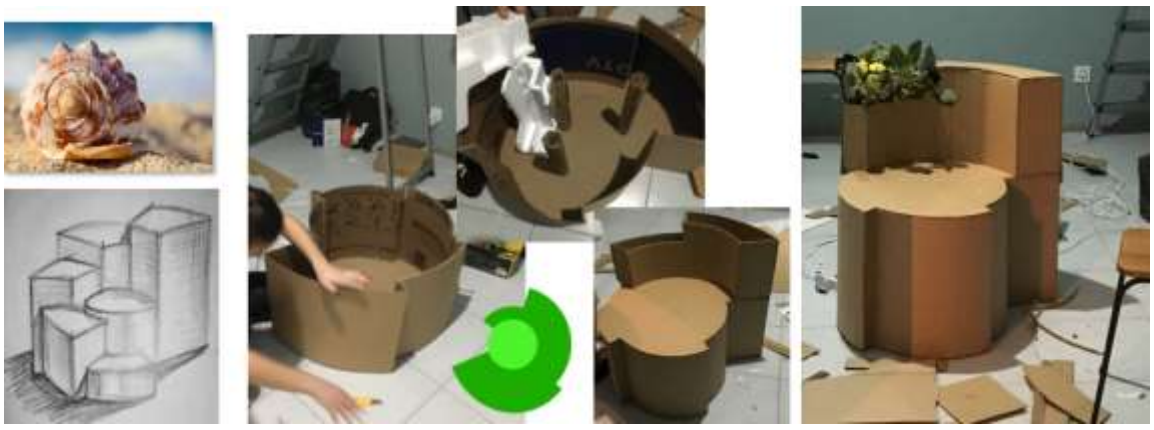

Figure 7. Armchair - Concept and idea, sketches

Figure 8. Armchair - bionic shape, sustainable final result framed in the interior space

Another unique and creative work is the coffee table, colorful work of a group of student architects, academic group ARH-152. The finesse, femininity, and elegance of the decorative table are welcome for any area in the interior. Selecting a part of a worn chair, namely the structure of the legs, with fantasy and creativity for the decorative object were reused recycled materials: colored cardboard for waves of various sizes, threads from old clothes, then applying the weaving technique feet in the colors of the sky (figure 9).

Figure 9. Sustainable piece of furniture - decorative table

Another special table created from recycled materials, reminiscent of rustic-eco styling with modern elements, is the living room table, made by students of the ARH-153 group. The paper implements the sustainable principles (Shedroff, 2009) of construction and selected materials from dry tree branches, tied with sackcloths for the concept of sustainable design (figure 10).

Figure 10. Sustainable living room table

Addressing and solving sustainable development issues is responsible and requires the involvement of both designers and conscious society, producers and consumers alike, challenging to consider environmental values and operating methods alike. A designer is in a key position to influence the functioning, in our case the architect students and master students had the theoretical and practical educational task, to promote a change of professional and civic thinking of the society.

"Those who have the privilege of knowing have the duty to act" /Albert Einsten/

Based on the theme of recycling and reuse of secondary materials from waste into an eco-sustainable object for interior space, researched and applied by us in a long-term project each time demonstrates the change of thinking and caring attitude towards the environment of the young generation of student-architects and designers, real projects discussed in this presentation. At the end of the work stages, students mention that this experience motivates and inspires them for further and deeper study of ecology, to think about tomorrow, to accept that in the future the architects and designers will be responsible for the environment around us to a greater extent than any other professions. From now, they will participate in national and international sustainable education projects in a new way, caring about the usefulness, cleanliness, ecology, and the sustainability – a way for the success.

4. Conclusions

Finally, we can conclude that raising the awareness of society's thinking, through concept projects implemented in the curriculum, with practical exercises in recycling and reuse, lead to the new ideas quickly and efficiently. The sustainable principles are in the key position to influence, produce and operate environmentally friendly objects. Principles for eco-friendly architecture and interior design are based on the circular economy, on strategies whose aim is to provide products with an unlimited lifespan in a closed-loop, without waste; any form of interior design that facilitates recycling and reuse of materials should replace non-renewable ones; the use of fewer materials and resources to manufacture products; the production of less waste and pollution possible; minimizes environmental impact through integration with living processes. At the same time, green design and architecture also maintain the quality level of the product according to its ideal use.

Ecological thinking comes with new challenges and offers completely new opportunities. Today, in the process of training future architects and designers, within the Technical University of Moldova, we pursue education applied on principles of sustainability for students specializing in architecture and interior design through theoretical-practical projects with works-eco concepts presented in Scientific-practical seminars on sustainability, blessed in society and educational institutions. The message of the event is manifested on the ecological issue, transmitted through examples of works designed by the sustainable design of students, starting from the green stereotype, to a practical application through technology.

And finally, we mention that our project aims to come with an educational message for society, to appreciate nature, to reduce the consumption of natural resources, to become a skill recycling and reuse to preserve and maintain all the richness and beauty of environment: *"A cleaner and healthier environment start with you !"*

Confirmation

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