Integration of Environmental Sustainability Issues In Design Education Curriculum

By Marianna Kafaridou[1], and Kika Ioannou Kazamia[2]

Abstract

An early acquirement of knowledge on sustainability can bring a change in how young people act. The focus of this paper is first to evaluate the current knowledge of first year design students on environmental sustainability and second to assess if students consider environmental issues in the approach and resolution of a design project. The research elaborates through a questionnaire given to students of the graphic and digital design program and interior design program which result in a quantitative and qualitative understanding of the focus of the research. Sustainability - based on environmental, social, and economic pillars - is a big concern in the design discipline. Moreover, environmentally sustainable issues are of great importance in design education curricula as most of the design briefs that students receive require the inclusion of sustainability issues. According to the results, this research will attempt to propose the design and implementation of an introductory course for first year students of both programs. The educational benefits of an early introduced course on sustainability are essential for developing the designer's perception of the design scheme today.

Keywords: sustainability, design, education, environment, course.

1. Introduction

Design education that integrates sustainable design, contributes to the development of the environ-mental awareness of students. The importance of this study is to evaluate the current knowledge of first year design students on environmental sustainability and assess if students consider environ-mental issues in the approach and resolution of a design project. The attempt is the integration of environmental sustainability issues into the design curriculum of two programs, the Graphic and Digital Design and Interior Design, of the University of Nicosia. Beginning with the term sustainability, this paper explores the design field regarding sustainability and environmental sustainability. Furthermore, design and design education are discussed, emphasizing that design education should offer course/s with topics on environment, society, and economy, allowing students to learn and adapt to change. Besides, there is a reference to the current courses currently offered by the two programs to pinpoint the absence of courses on the topic of sustainability and the need for a new course. The questionnaire is the tool used in this research, which offers insight into what this study attempts to propose, the design and implementation of an introductory course for first year students of both programs.

| [1]Associate Professor in the Department of Design and Multimedia of the University of Nicosia in Cyprus.
 [2]Associate Professor in the Architecture Department at the University of Nicosia.

2. Literature review
2.1 Sustainability

The term was defined as "the development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs" World Commission on Environment and Development (1987). Moreover, Kotob and Styger (2011) discuss that governments could take extensive actions to support delivering sustainability goals, and these actions should incorporate global governments as influencers with a leading goal of achieving sustainability. "Sustainability is not about one limited range of thought or interaction. Instead, it is a holistic attempt to mimic the best behaviors of the natural environment" (Boylston, 2009, p. 36). It requires people to engage in symbiotic relationships with the natural world. Moreover, the discipline of design for sustainability has emerged, and as Vezzoli et al., (2018) write "in its broadest and most inclusive meaning could be defined as a design practice, education, and research that, in one way or another, contributes to sustainable development."

2.2 The design field and sustainability

"It will be understood that no design stands on its own: all design has social, ecological, and environmental consequences that need to be evaluated and discussed in a common forum" (Papanek, 1995, p. 48). The field of design (and all of its subsidiary professions: architecture, industrial design, interaction design, engineering, etc.) has become a focal point for sustainability, which is not surprising since poorly designed industrial systems, products, and buildings can greatly contribute to environmental and social degradation, to a great extent (Stegall, 2006). Stegall further notes that the weakness of this perspective is that even if the companies adopt appropriate manufacturing processes for the production of products, if the user does not use it responsibly, and does not return it for recycling at the end of its life, this is not truthfully sustainable. The impact of a product has an ecological footprint, that relies not only on the particular technology utilized for its manufacturing but also on the product's usage. Considering the above, it is obvious that we need to create a framework in design education in the field of sustainable development. The acquirement of this subject of interest is the channel that will build connections among manufacturers, designers, and users. Design education grounds the foundations for knowledge on design thinking and skills on the one hand and values and attitudes towards sustainability on the other hand.

Sustainability knowledge is important to all sectors of the education system and research sectors. Increasingly, countries started to adopt sustainable development in their pedagogy. In 2002 under the framework of the Baltic 21E program, the countries of the Baltic Sea Region (BSR) carried out a national survey concerning the implementation of the Education for Sustainable Development (ESD). Finland was the first country to start the implementation of ESD with particular attention to higher education. It was promoted in its development plan in 2003 (Kaivola & Rohweder, 2007). Moreover, Unesco is targeting the implementation of environmental education as a core curriculum component in all countries by 2025 (Unesco, 2021). Therefore, we also consider it important to proceed with relevant actions of introducing courses on sustainability, in our university's programs, Graphic and Digital Design, and Interior Design.

2.3 Environmental sustainability

According to Goodland (1995), the meaning of environmental sustainability is that "environmental sustainability (ES) means natural capital must be maintained". He explains that "ES itself seeks to improve human welfare by protecting the sources of raw materials used for human needs and ensuring that the sinks for human waste are not exceeded to prevent harm to humans" (Goodland, 1995, p. 3). Amongst others, environmental sustainability is concerned with the following issues: Air quality (ozone depletion, global warming, acid deposition, air pollution); Water quality and quantity (water pollution, user management); Soil quality and quantity (soil depletion and pollution, use, and management); Wildlife and habitat; Energy; Land use; Human population and health; Waste and Resource consumption.

As Harper (1995) notes, there is a duality of human life. He explains that biologists and ecologists emphasize the first part of the duality where "humans and human systems are embedded in the broader webs of life in the biosphere" (Harper, 1995, p. 34). Moreover, he argues that social scientists emphasize the second part of the duality, which reflects humans as creators of sociocultural environments that among others they have the power to change natural environmental limits. Designers need to keep a balance between the two. This balance is what we want to bring into the scope of design teaching and learning. In doing this, environmental issues like waste management and resource consumption can be elaborated in the design process alongside specific steps to enable a more sustainable design of artefacts. Above all is important to secure that design students are aware of the meaning of sustainability and conscious of how they can apply their knowledge. Students well-informed about such issues can contribute to a more positive impact on the environment.

2.4 Design and design education

Design is a discipline that refracts in society and captures all the changes that occur. These changes refer to social, economic, environmental, and technological subjects. The design discipline is broad and its boundaries become fluid to evolve, adapt and integrate with other disciplines. "The future of design is bound up with the key role of synthesis between the various disciplines that make up the socio-economic-political matrix within which design operates" (Papanek, 1995, p. 48).

Design education provides hands-on, place-based project learning that originates from direct connections and interactions with the world. Design connects horizontally with diverse fields of information and creates critical awareness of our built and natural worlds (Keane & Keane, 2013).

Therefore, design education today is not an isolated discipline. Design education captures the complexity, and multi-functionality of design. It draws knowledge from topics on the environment, society, and economy, allowing students to learn and adapt to change. As Papanek (1995) notes, designers must be aware of the consequences in the world of the things they design. Moreover, Grant and Fox, (1992) underpins the responsibility of design educators of adapting particular methods to constitute young designers that are competent in critically assessing their production and its purpose in industrial culture. Traditionally, designers approached design in the context of aesthetics and canons that shape specific styles and idiosyncrasies (Grant & Fox 1992). "As we move towards the 21st century, there

will be an increasing need for some - a few - designers who are specialists in ecological design" (Papanek, 1995, p. 48).

2.5 Graphic and digital design and interior design curriculum

"The University of Nicosia (UNIC) is one of the leading universities in the Mediterranean region, committed to teaching, research and innovation, sustainability, societal engagement, and contribution to culture. The University offers more than 100 programs at the Bachelor's, Master's, and Doctoral degree levels, hosting more than 14,000 students" (UNIC website).

Among the eight Schools of the University of Nicosia, the School of Humanities and Social Sciences accommodate six Departments, among them, the Department of Design and Multimedia where the program of Graphic and Digital Design belongs, and the Department of Architecture, where the program of Interior Design belongs. In the academic path of the four-year programs of Interior De-sign and Graphic and Digital Design, a course on sustainability does not exist in the first year of studies. The design courses of the major requirements, currently offered for both programs are indicated in the table below (Table 1).

Table 1: Major requirements year 1 (Graphic and Digital Design and Interior Design)
https://www.unic.ac.cy/school-of-humanities-and-social-sciences/

Section A : Major Requirements Year 1			
Graphic and Digital Design		Interior Design	
DES-116	Fundamentals of 2D Design	ARCH-141	History of Architecture I
ART-135	Fundamentals of Drawing	INT-141	Fundamentals of Design
DES-260	Photography I	INT-161	Representation I
MULT-160	Introduction to Multimedia	INT-101	Introduction to Interior Design
ART-281	History of Art	ARCH-142	History of Architecture II
DES-126	Introduction to Typography	INT-162	Respresentation II
DES-156	Fundamentals of 3D Design	INT-112	Materials for Interiors I
MULT-161	Interactive Design for Social Media	INT-102	Interior I
		INT-172	Drafting and Communication Skills

It is noted that lecturers refer to the sustainability concept in several courses of the two programs offered to the students, during the four years of their studies. It is clarified that there is a course on sustainability under the code INT 322 named Sustainability in Interior Design in the core requirements of the academic path of Interior Design program. This course is offered in the Spring semester of the third year of the program.

2.6 Design process in the resolution of a problem

The design process is clarified to facilitate the aim of this study. Analysis and synthesis are the two core stages that constitute the design process. It is acknowledged

that the approach to a design project is relevant to the analysis stage and the resolution of a design project is relevant to the synthesis stage. As Allen P. S et al., (2000, p. 9) note analysis focuses on discovery. "Analyzing a design project requires collecting information, understanding goals and aims, researching related codes and other technical data, understanding the design problem, and defining the design standards. Once this information is adapted, designers begin to synthesize". He further refers that the synthesis stage requires a vast amount of reflective thought, where designers stretch their imaginations and develop alternative solutions to the design problem.

In this study, the analysis stage of the design process assists to find out if students consider environmental issues in their thinking and collecting the relevant data, and the synthesis stage of the design process assists to find out if students consider environmental sustainability when they develop alternative proposals.

3. Methodology

This research proposes the design and integration of an introductory course on sustainability for first year students of graphic and digital design, and interior design programs. The focus is first to evaluate the current knowledge of first year design students on environmental sustainability and second to assess if students currently consider environmental issues in the approach and resolution of a design project. The research elaborates through a questionnaire. As noted by Taylor-Powell (1998), a questionnaire can assist in obtaining information about what people do, what they have, and what they think, know, feel, or want. Further, questionnaires are the medium where responses are recorded to facilitate data analysis. In this survey, the students' responses were anonymous. The questionnaire was composed of compulsory single-choice questions and open questions. The single-choice questions were prepared using a five-point Likert scale, ranging from 1 (negative answer) to 5 (positive answer), and resulted in quantitative analysis results. The open questions complement the quantitative findings. Further, questions in the form of yes/no/no opinion were also included to take responses on sustainability in education.

The sample of this research is the population of forty-two first-year students from both programs which resulted in the collection of 38 completed questionnaires. This study utilised all the population and different forms of questions to manage the collection of more and diverse opinions, as we have small numbers of students in our programs. A similar example of a study in Cyprus explores the opinions of twelve teachers participating in an in-service training program and explores the links between visual arts and environmental education (Savva, et al., 2004).

 The questionnaire was designed by the researchers and tested before reaching its final form. The students were informed that their participation is voluntary, and they consented to participation. Moreover, all participating students are above the age of 18, and there was not any real risk of any participants experiencing either physical or psychological distress or discomfort.

4. Results

The presentation of results is in four parts following the structure of the questionnaire. Part A presents data collection on the demographics for archive purposes of the research, and is not focused on the analysis of the place of residence or gender in relation to environmental sustainability. Part B1 (Statements 1-5) presents results on how much students consider environmental issues in the approach of a design project. Part B2 (Statements 6-9) presents results on how much students consider environmental issues in the resolution of a design project during the analysis stage. Part B3 (Statements 10-13) presents results on how much students consider environmental issues in the resolution of a design project during the synthesis stage. Part C presents the results of open questions related to students' current knowledge on sustainability, and suggests a qualitative understanding of the focus of the research. Lastly, part D presents the results of questions related to sustainability and education. Overall 32 students out of a total of 38 registered in the first year answered the questionnaires and responded to the open questions. The results of Part B present answers related to current students' consideration of environmental issues in the approach and resolution of a design project. The results of part B1 reflect the participants' approach to the design project and reveal that most students strongly agree with statement 1, the importance of integration of sustainability approach to design (number of students 17); statement 4, the importance of reducing reuse, and recycle in design (number of students 19); and statement 5 the importance to integrate longevity in design (number of students 14). Further, students mostly agree with statement 2, the importance to integrate environmental issues when given a new design brief (number of students 16), and statement 3, the importance to consider resource consumption issues in design (number of students 14). However, there are answers with no opinion for all statements and some with disagree for statements 3 and 5 (Figure 1).
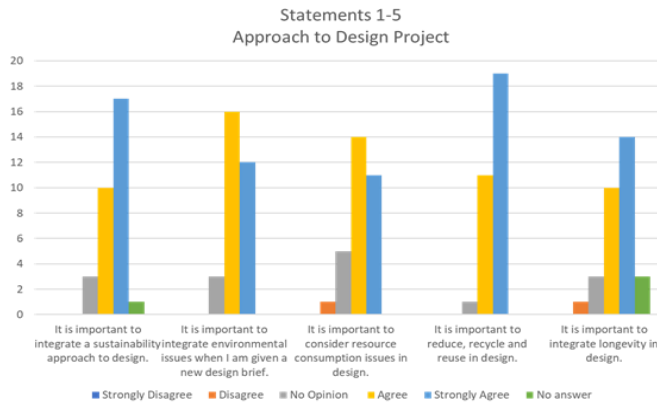

Figure 1: Part B1. Approach to design project

The results of part B2 reflect the analysis stage of the resolution of the design project and reveal that students agree with statement 7, to use recycled and reclaimed materials for mock-ups during the design process (number of students 16). With statement 6, to never print research except if asked to do so, almost similar numbers agree (number of students

12) and disagree (number of students 11). With statement 8, to use materials that can dissolve or biodegrade when working on my projects, several students agree (number of students 10), others with no opinion (number of students 9), and others disagree (number of students 7). While with statement 9, I consider water-based adhesives when working on my projects, the majority of answers (number of students 15) are of no opinion (Figure 2).
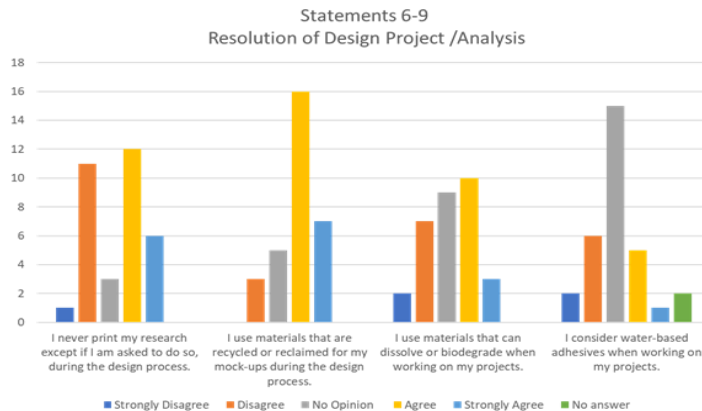

Figure 2: Part B2. Resolution of design project analysis stage

The results of part B3 reflect the synthesis stage of the resolution of the design project and reveal that students strongly agree with statement 13, I consider minimization of material waste for the design of the final artefact (number of students 15). Further, students agree with statement 10, I consider concepts for final artefacts that entail aspects of environmentally conscious design (number of students 13); statement 11, I consider the use of reclaimed materials for the final artefact (number of students 15); statement 12, I consider the use of eco-friendly materials for the final artefact (number of students 14). However, in all four statements no opinion answers occur, and for statements 10, 11, and 12 there are 2, 3, and 3 correspondingly disagree answers (Figure 3).
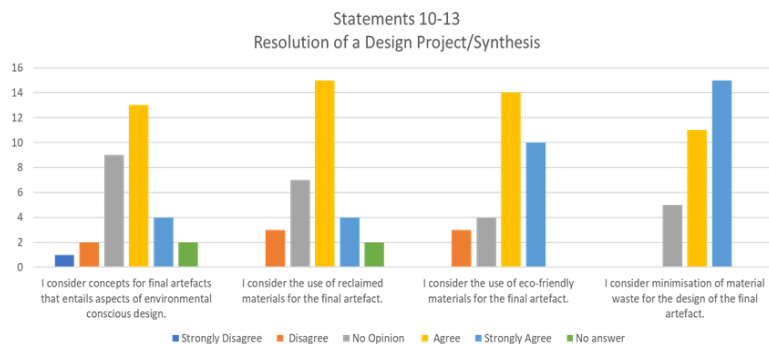

Figure 3: Part B3. Resolution of design project synthesis stage

The results of Part C present answers to open questions that are related to the current knowledge on sustainability and suggest a qualitative understanding of the focus of the

research. This part includes six questions. To open question 1, what does sustainability mean? Students note various explanations highlighting the maintenance of natural resources and friendliness to the environment. To open question 2, what are the three pillars of sustainability? Some students reply correctly referring to the environment, society, and economy, however other students do not answer or do not know, and some of the students indicate reduce, reuse, and recycle as the three pillars of sustainability. To open question 3, what materials are recycled in Cyprus? All the students that answer the question named all the materials that we recycle on the island including plastic, paper, glass, cloths, batteries, aluminum, and electronic devices. To open question 4, what sources does Cyprus get its energy from? Solar, wind, and petroleum, are the most popular answers. To open question 5, what are the most important environmental problems? Air pollution, water pollution, and global warming, are the most popular answers. To open question 6, how would you contribute to a more sustainable world? Recycle, reduce, and reuse; use renewable sources and avoid plastics; conscious traveling and saving energy, are among students' responses.

The results of part D present students' answers about sustainability in education in the form of yes/no or no opinion. This part includes 6 questions. For question 1, have you ever taken any courses related to sustainability? An equal number of students answer yes and no. The most positive results appear to be the most general question of this part, question 5, do you think the graphic and interior design profession can contribute to environmental sustainability? Moreover, question 4, do you think a course on sustainability develops life skills and personal growth? and question 2, do you believe that environmental education should be part of every school grade's curriculum? follow in positive answers. Question 6, are you interested in enrolling in a course on sustainability in your first year of studies? There are more yes answers but also no, and no opinion answers noted (Figure 4).
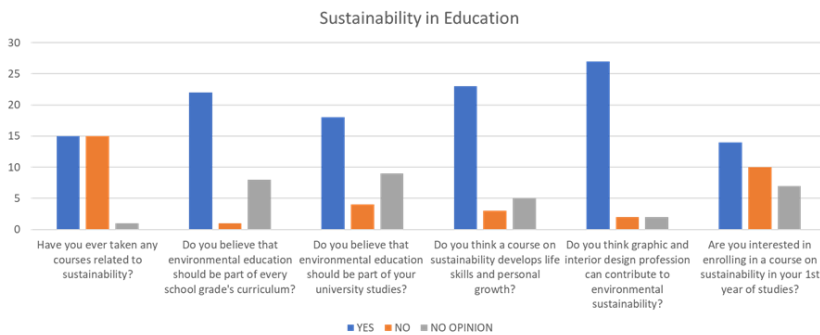

Figure 4: Part D. Sustainability in education

5. Discussion and conclusion

In this part of the study, a description of some unexpected findings, alongside a brief interpretation of why they appeared and followed by a possible significance concerning the overall study, will be discussed. The results of Part B present answers related to the students' consideration of environmental issues in the approach and

resolution of a design project. Beginning with the results of part B1 that reflect the participants' approach to the design project, it is clear that students understand and consider the importance of reducing, reusing, and recycling (3Rs) in design. It is substantial as the 3Rs are related with resource consumption as an environmental issue. However, there are some answers with no opinion for all statements that should be addressed and also some answers with disagreements that are not at all expected. Additionally, the overall positive answers are also reflected in the open questions. This is possible as this issue is well promoted for some years now in Cyprus through governmental, but also private organizations' campaigns. In any case, Cooper and Gutowski's (2015) opinion is acknowledged when they write that "as policy makers look to incentivize greater reuse in the future, it is essential that the environmental impacts of reuse be better understood".

Further, the results of part B2 which reflect the analysis stage of the resolution of the design project, it is clear that students agree and accept the use of recycled and reclaimed materials for mock-ups during the design process. On the contrary, most of the participants have no opinion in regard to the consideration of using water-based adhesives when working on their projects. It is possible that they lack this particular information. Additionally, in this band of statements disagreeing answers exist to all statements with most of these disagreements being relevant to printing issues. Yet again, this shows that students might not be able to connect printing issues with environmental sustainability. Therefore, letting students know of specific fundamentals to utilize during the analysis stage of the resolution of the design problem is significant.

The results of part B3 reflect the synthesis stage of the resolution of the design problem. In this part, it is important to note that even though students mainly answer with agree and strongly agree in all four statements, the no opinion answers occur in all statements. Most of them appear in relation to consideration of aspects of environmentally conscious design.

These findings can lead to the understanding of the need to provide students with specific guidelines on how to calculate the impact of their final artefacts' ecological footprint. This issue, avails ground for further research, in addition to the no opinion answers, is understood as a limit of the study that may involve other stakeholders like lecturers and design professionals.

Section C of the questionnaire explores the current knowledge of design students on sustainability. The findings reveal that students lack knowledge of sustainability. As a result, they do not implement a particular design process for the realization of an artefact that complies with the principles of economic, social, or ecological sustainability. Students were well informed about local issues on recycling materials, although, regarding where the island gets its energy from, they indicate the wind, which is not the case. Furthermore, in the answers to the question of how they would contribute to a more sustainable world, students' responses are positive and creative, with the most popular one on reducing, reusing, and recycling and the second about conscious traveling.

Section D of the questionnaire explores the current knowledge of design students have regarding sustainability in education. At this point, it is worth noting that the highest number of positive answers are to the question if the graphic and interior profession can contribute to environmental sustainability. It is also evident that students believe that environmental education should be part of every school grade's curriculum and that a

course on sustainability develops life skills and personal growth. On the contrary, half of the population wishes to enroll in a course on sustainability during the first year of their studies. Nevertheless, we have a clear message as far as our current first year students' understanding of environmental sustainability implications in the interior and graphic design profession. Moreover, the results support our attempt to propose the design and implementation of an introductory course in the two programs' curricula. The research results give an insight into the design approach of the new course. The structure of the course is based on two main parts. The first part is about the introduction of students to the concept of environmental sustainability as an approach to design. The second part concentrates on the two core stages of the design process, synthesis and analysis. Considering this understanding of the structure of the new course, Kosannovic, and Folic (2014) write: "The main objective of introducing sustainability in the educational curriculum is the development of additional but at the same time essential category of quality of students' work".

However, explaining how designers must be aware of the consequences of the things they design and propose specific actions under the context of sustainability should be the main focus of the introductory course. In agreement with this, Fleming (2013) notes that "societal conceptions of consumerism, design, and technology are radically shifting to address the superficial but useful demands of "greening," and are leading to finding deeper and more impactful processes to meet the much higher bar of sustainability". Therefore, this study and the proposed course are actions that design educators need to anticipate to an advanced degree to expand the potential of spreading environmental sustainability among young designers.

Finally, this research on the integration of environmental sustainability issues in design education curriculum, in our programs generated interest in proposing as future research the inclusion of a higher number of participants coming from all programs under the Design and Multimedia, and Architecture Departments.

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