Sustainability as an Educational Concern: A Study on Industrial Design Curricula

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Abstract: *With the emergence of sustainability, it became an important concern for curricula of industrial design education as for many other educational structures. Currently, lots of higher education institutions offer courses focusing on sustainability for various objectives. This study deals with the current situation of industrial design education in the world by means of sustainability as an educational concern. It starts with the examination of a variety of sustainable development definitions and continues with the discussion on the development of sustainability education and its possible effects on the future. The study also presents an overview of the current structures/formations of teaching sustainability in industrial design programs of ICSID member universities by scrutinizing their informational materials and web sites.*

Keywords: Sustainability, industrial design, design education, industrial design curricula

1. INTRODUCTION

After the industrial revolution, inconsiderate pattern of industry not only affected environment but also affected both social and economic life of cultures. The balance of the world economy was based on the industrialization of civilizations. Overall energy use, carbon dioxide emissions, number of threatened species, and water pollution levels that the industry cause continue to increase; extreme weather events and other environmental disasters clearly indicate our increasing pressure on the planet [1]. Authorities had become aware of environmental impact of human being many years ago; however, ecology, society and economy should be thought in the same context. This brings a wider and new concept beside eco-design, green design or environmental friendly design; 'sustainability' has emerged with the need to change the existing situation going on. Last decade of this century, authorities agreed on that, the world requires such a "development that meets the needs of the present without compromising the ability of future generations to meet their own needs", that is, sustainable development [2]. Thus, sustainability is an evolving and widely accepted concept, but it is still ambiguous.

Although definitions show diversity, people seem to be agreed about sustainable development and the forthcoming question would be: "how it can be achieved?". Education can be accepted as the key element to achieve sustainable development and it would be the primary agent of transformation towards sustainability. Education can increase people's abilities to transform society and reality. Education not only provides scientific and technical skills, but it also provides the motivation, the justification, and social support for pursuing and applying them [3].

By considering the question of "how can sustainability be achieved?", designers may also play a significant role for the solution. Victor Papanek [4], in his book titled Design for the Real World, criticized industrial design as being one of the most harmful professions. Designers create problems and solutions; however we should consider the whole process from the beginning to the end with regarding environmental issues. This brings to mind that the importance of industrial design education for sustainability. As expected, educational authorities of those times, as well, were aware of this key role and trying to integrate sustainability in industrial design education. For instance, in 1996, when the question of "what are the subjects that should be included in curriculum content by considering the future developments in the field?" was asked to industrial design educators from different universities around the world, and the concept of "green design" and "sustainable design" were considerably given as the important subjects in industrial design education to tackle with the future developments [5].

This study explores the current situation of sustainability awareness in industrial design education to enlighten the further evaluation of related curricula in order to contribute sustainable development.

1.1 What is sustainable development?

Recent trends for economic development are not sustainable by means of their positions for social and environmental contexts; public awareness, education and training are keys to move society toward sustainability. One of the most accepted definitions of sustainability is stated by the World Commission on Environment and Development and it defines sustainable development in terms of the present and the future:

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs." [2]

Because of its ambiguousness, some others have added social and economical dimensions to the definition above. Accordingly, many different sustainability definitions have similar notions, such as ''living within the limits'', ''understanding the interconnections among environment, economy and society'' and ''equitable distribution of resources and opportunities'' [6], [7], [8]. Moore [9] has composed many views by dividing the sustainability definition into three:

"Sustainability is a concept, a goal, and a strategy. The concept speaks to the reconciliation of social justice, ecological integrity, and the well-being of all living systems on the planet. The goal is to create an ecologically and socially just world within the means of nature without compromising future generations. Sustainability also refers to the process or strategy of moving toward a sustainable future."

In spite of the variations of sustainability definitions and the different visions on how sustainable future will be, environment, society and economy are the common concerns of all. However, this situation was challenging because of the

economic and social considerations that were also the elements of sustainable development vary particularly in developed and developing countries and this made tricky to mention the same meaning in defining sustainability concept.

As an industrial designer, how does one contribute to sustainable development? The need to employ sustainable design strategies in product development and design is no longer a question because of the existing environmental problems. Implementing sustainability in the early stages of product design procedure is more valuable for sustainable development of the countries. Thorpe [10] defined sustainable development as "the development that cultivates environmental and social conditions that will support human well-being indefinitely"; consequently, sustainable design will be theories and practices that foster ecological, economic and cultural well-being.

How and in which extent would sustainability be integrated into undergraduate curricula in order to educate industrial designers of the future respecting to the ecological, economic and social considerations? In order to find the best integration methods, most of the developed nations have some forms of active research on design for sustainability, covering issues like implementation of legislations, eco-innovation, corporate social responsibility, product service systems, eco-redesign, impacts of user behavior, design for disassembly and reverse manufacturing [11].

1.2 Progress of the Subject of Sustainability in Higher Education

"Education including formal education, public awareness and training should be recognized as a process by which human beings and societies can reach their fullest potential. Education is critical for promoting sustainable development and improving the capacity of the people to address environment and development issues." [12]

The importance of sustainability was first endorsed in 1975; the United Nations Education, Scientific, and Cultural Organization (UNESCO) recognized the importance of environmental education in the Belgrade Charter. In 1977 the world's first intergovernmental conference on environmental education was organized by UNESCO in cooperation with the United Nations Environment Programme (UNEP) and was convened in Tbilisi, Georgia. Tbilisi Declaration mainly discusses the role, objectives, and characteristics of environmental education. However, these movements were not for the same objective. Education for sustainable development was clarified when world leaders agreed that the concept of sustainable development should be understood as a global goal. UN General Assembly endorsed sustainable development in 1987 from the time on the importance of education for sustainable development was explored.

From 1987 to 1992, the concept of sustainable development was matured and communities came together to discuss and negotiate then wrote the 40 chapters of Agenda 21 which is a "comprehensive plan of action to be taken globally, nationally and locally by organizations of the United Nations System, Governments, and Major Groups in every area in which human impacts on the environment" [12]. In 1992, United Nations declared Agenda 21 in Rio de Janeiro. Chapter 36 of Agenda 21 mainly mentions sustainability education and discusses it in three points such as reorienting education towards sustainable development, increasing public awareness and promoting training. In which extend the education effects the people's awareness about sustainability is as important as the education itself. After the declaration of Agenda 21, series of UN conferences were held to develop sustainable development.

Twenty years after Tbilisi, in 1997 the Intergovernmental Conference on Environmental Education, held in Thessaloniki, in the light of Belgrade and Tbilisi Conferences, general objectives for environmental education were declared:

- to raise awareness and sensitivity on environmental problems;
- to gain knowledge and basic understanding of the environment and associated problems;
- to change attitudes, values and motivation to actively participate in environmental protection and improvement;
- acquisition and development of skills to identify and solve environmental problems;
- participation of all social groups and business players.

It is widely agreed that education is the most effective mean that society possess for confronting the future challenges. However, as it is stated in the discussion paper for Thessaloniki Conference, education is not the whole answer to every problem. But with its broadest sense, it must be a vital part of all efforts to imagine and create new relations among people and to foster greater respect for the needs of the environment [13].

In 2002, the World Summit on Sustainable Development held in Johannesburg reaffirmed the importance of sustainable development as a base for overcoming poverty and improving the quality of life worldwide, and especially in the developing world. Just after the Johannesburg Summit, the United Nations General Assembly adopted the resolution ''United Nations Decade of Education for Sustainable Development (DESD)'', which emphasizes that education for sustainable development must provide specific skills such as learning to know, learning to live together, learning to do and learning to be [13]. UNESCO and the Global Higher Education for Sustainability Partnership (GHESP) are the pioneers of UN DESD preparations, which include a series of international collaborations and the development of a "toolkit" to guide the incorporation of sustainability into university practices.

As seen from the fruition of sustainability concept in education, the overall considerations are similar however the realizations may differ among each other. If each conference mentioned above had succeeded to achieve sustainability in education, same agendas would not have needed to be repeated for the following conferences. More successful way for realizations might be to create the best strategies by comprehending what is most suitable for the aim and the context.

Since this paper mainly deals with the current situation of industrial design education in the world by means of sustainability as an educational concern, a research study was held in order to acquire the answers of main question which is explained in the next section.

2. METHODOLOGY

"The International Council of Societies of Industrial Design (ICSID) is a global not-for-profit organization that promotes better design around the world. ICSID counts over 150 members in more than 50 countries, representing an estimated 150 000 designers" [14].

The main vision of ICSID is as stated on its website that "striving to create a world where design enhances our social, cultural, economic and environmental quality of life." "Design seeks to discover and assess structural, organizational, functional, expressive and economic relationships", "enhancing global sustainability and environmental protection" counted as one of the tasks described as the 'global ethic' of industrial design [14].

In order to explore the current structures/formations of teaching sustainability in industrial design education of ICSID member educational institutions, which are offering undergraduate programs in industrial design, curricula of programs was investigated via online instruments such as e-mailing and search engines.

Undergraduate curricula of industrial design programs of different educational institutions were primarily searched from their websites. Programs whose detailed information about the sustainability related courses (or the courses covering the subjects related with sustainability) could not be reached from their websites, were contacted via e-mailing, in order to explore the current situation of the subject of sustainability as a curriculum component in industrial design education. By e-mail, they were asked to provide detailed information about the sustainability related courses (or the courses covering the subjects related with sustainability) that are offered by their program. Required information on 25 over 46 ICSID member educational institutions were gathered via Internet search or responses to e-mail query and by printed documents provided by academic publications.

Information about the programs or courses offered by the industrial design educational institutions in four ICSID member countries could not be reached (Table 1). It might be because of the language limitations on the website or of the respondents.

3. RESULTS AND DISCUSSION

With respect to the information gathered from educational institutions offering industrial design degrees, some of them do not offer sustainability as a subject in their curriculum, some offers specific courses which are directly concerning sustainability by considering their course outline whereas some others offer courses which are indirectly concerning sustainability, generally as a subject of entire outline. On the other hand, some institutions have unique programs on sustainability, which are conducted by the staff or by learning networks. The results of the scrutiny of the programs with the aim to explore in which extent they are concerned with sustainability are presented in the Table 2.

Twenty per cent of educational institutions do not offer any courses or programs about sustainability while 56% are offering courses directly related with sustainability among 80%.

It is noteworthy that 5% of educational institutions explored in this study have been attended online network program called as Learning Network on Sustainability which is contributing to human resources and curriculum development, in a reciprocal understanding of cultures, by promoting - through the role of Higher Education Institutions (HEIs) in world regions - a new generation of designers (and design educators) capable to effectively contribute to a transition towards a sustainable society. In this network system participant institutions are trying to design an integrated system of products and services, to promote new socio-economic stakeholders' partnerships and to orientate the above processes towards socially equitable (socio-efficient) solutions. New projects, which are designed by the educational institution participation, is uploaded to the network and feed backed by the member actors in an interactive way.

Considering the information gathered from course outlines, it seems that the courses directly related with sustainability touch on more theoretical subjects than courses covering sustainability in some sense in their contents. Ten courses offered by EI1, EI3, EI14, EI16, EI17 and EI23 which are related with manufacturing processes and material technologies include sustainability in their contents by referring how design and production can be achieved in a more environmental way. In those courses, the environmental effects and causes of the use of materials and manufacturing processes in product design are mentioned by taking into account product life cycle and environmental design considerations. Moreover, the information gathered from descriptions of studio courses related with sustainability shows that most of them use the term 'inter-disciplinary' and 'cross-disciplinary' in course descriptions. Inter-disciplinary and cross-disciplinary educational methods are commonly implemented in sustainability education [15]. As Agenda 21 declared, educational authorities should promote proven educational methods and the development of innovative teaching methods for educational settings. They should also recognize appropriate traditional education systems in local communities.

As the results of this study shows, among studied ones, not more than three educational institutions, have considerable attempt to sustainability education in undergraduate design curriculum. These institutions are both offers courses related directly and indirectly about sustainability and additional programs dealing with the sustainability concept.

4. CONCLUSION

Attempts of industrial design programs on sustainability education show similarities in some senses. It is seen that, inter-disciplinary and cross-disciplinary instructional methods are experienced in many courses. Sources about what are the best ways to integrate sustainability in curricula are very limited. Ashford [16], states that sustainability teaching in design and engineering should become trans-disciplinary teaching rather than multi-disciplinary teaching; and explains the reason: "Where broad system changes are desirable, trans-disciplinary approaches are essential. Trans-disciplinary approaches really 'open up the problem space of the engineer' ". On the other hand, Peet et al. [17] reported on both successful and unsuccessful ways to integrate sustainability into regular engineering courses such as design

courses, materials courses or processing technology courses. Engineering is just an example of this trans-disciplinary teaching; however, industrial design, business, engineering and environmental studies should be the parts of this trans-disciplinary teaching. All of those fields can work together in a cooperative way to achieve sustainable society. Designer's role in this work is bridging the consumer's cultural sphere and the world of production and to use the potential to be important actors in the product development process [18].

Infusing sustainability in all decision levels, promoting and practicing collaboration and trans-disciplinarity, focusing on personal and social sustainability, integration of planning, decision-making and evaluation, integration of research, service and teaching, creating space for pedagogical transformation are recommendations for creating sustainability education at the level of higher education [19]. On the other hand, it is obvious that a theoretical course is not sufficient by itself; it should be supported by practical courses, which enable students to transfer their knowledge and critical thinking about sustainability into their practices in design processes.

Inferences of current formations of teaching sustainability in industrial design education can be an important guide for educators or curriculum developers to integrate it into industrial design education in Turkey. However, it is more important that the Turkish educational authorities should recognize the importance of sustainability in education and try to find appropriate traditional educational systems in local communities by giving importance to research. To maintain cross and inter-disciplinary education, government and business as well as educational institutions should be involved in that research action. Industrial designers who have the power to decrease the environmental effects of products and shape consumption customs in more sustainable way can achieve increasing demand on more sustainable solutions by using learnt methods and knowledge during academic period.

TABLES

Table 1 Distribution of educational institutions according to the countries

	Number of institutions whose information was gathered	**Number of ICSID member university**
Australia	3	3
Botswana	-	1
Canada	3	4
Chile	-	2
People's Republic of China	1	3
Colombia	-	3
Finland	1	1
France	1	2
Hungary	-	1
India	3	5
Italy	2	2
Ireland	-	1
Mexico	1	1
Netherlands (the)	1	3
New Zealand	1	1
Norway	1	3
Singapore	1	2
Taiwan	1	1
Turkey	3	3
United Kingdom	1	2
United States of America	1	2
Total	**25**	**46**

Table 2 EIs' tendency in taking sustainability as an educational concern

Educational Institutions (EIs)	**Directly related with**	**Contains term in content**	**Additional programs related with**	**No course related with**
EI1 (Australia)		***		
EI2 (Australia)	*	*		
EI3 (Australia)	***	*	*	
EI4 (Canada)				*
EI5 (Canada)	**	**	*	
EI6 (Canada)	*	*		
EI7 (China)	*	*	*	
EI8 (Finland)	**			
EI9 (France)	*			
EI10 (India)			*	*
EI11 (India)		*		
EI12 (India)			*	
EI13 (Italy)				*
EI14 (Italy)	**	*	**	
EI15 (Mexico)	*			
EI16 (Netherlands)	**	*	*	
EI17 (New Zealand)		**		
EI18 (Norway)	**			
EI19 (Singapore)				*
EI20 (Taiwan)		*		
EI21 (Turkey)	*		*	
EI22 (Turkey)	*			
EI23 (Turkey)		*		
EI24 (UK)	*			
EI25 (USA)				*

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