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TOWARDS SUSTAINABILITY OF ARCHITECTURAL EDUCATION PROGRAMS IN PUBLICUNIVERSITIES IN EGYPT: CAIRO UNIVERSITY CASE STUDY

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Abstract

More than a decade ago; the concept of sustainability had a great concern from the whole world because of the global warming dilemma. Sustainability is a paradigm that contains environmental, economic and social factors. Many governments have adopted the sustainability paradigm especially in the MENA region as they are the most affected by global warming. In Egypt, within the government role in paving the way to sustainability; principles of sustainable development has been integrated into the country's policies and programs in reflection to sustainable development strategy of Egypt's vision 2030. However, the concept of sustainability is still considered as a facultative matter that has to be included in architectural education in public universities in Egypt. To test this hypothesis, it requires tracing the sustainability paradigm in architectural educational programs offered in Egypt with special mention to Cairo University. An investigation of the selected architectural programs will be conducted using the selected programs' official literature review and analyzing the development of courses' data, vision, mission, philosophy, objectives and outcomes aiming at evaluating the current situation of sustainability integration in architectural programs and providing a state of art of architectural education in Egypt.

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A. A. SALEH[1]

ABSTRACT

More than a decade ago; the concept of sustainability had a great concern from the whole world because of the global warming dilemma. Sustainability is a paradigm that contains environmental, economic and social factors. Many governments have adopted the sustainability paradigm especially in the MENA region as they are the most affected by global warming. In Egypt, within the government role in paving the way to sustainability; principles of sustainable development has been integrated into the country's policies and programs in reflection to sustainable development strategy of Egypt's vision 2030. However, the concept of sustainability is still considered as a facultative matter that has to be included in architectural education in public universities in Egypt. To test this hypothesis, it requires tracing the sustainability paradigm in architectural educational programs offered in Egypt with special mention to Cairo University. An investigation of the selected architectural programs will be conducted using the selected programs' official literature review and analyzing the development of courses' data, vision, mission, philosophy, objectives and outcomes aiming at evaluating the current situation of sustainability integration in architectural programs and providing a state of art of architectural education in Egypt.

KEYWORDS

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1. INTRODUCTION

1.1 Definition of Sustainability

It is known that Sustainability is crucial strategy for meeting the challenge of enhancing the built environment to overcome climate change, natural resources exhaustion, environmental damage and social disintegration. The sustainability paradigm, more than a decade ago, has emerged the practice of the built environment field for architects, urban planners and other actors in the field. Sustainability is defined as the state where all people can have a decent standard of living for now and in the future within the limits of natural resources without jeopardizing any (Benkari 2013).

According to the Rio declaration, sustainability was defined as preserving natural resources and enhancing the quality of living while offering the future generations at least the same quality of living of the actual generation is getting (UN, 1992). There is no doubt that sustainability could not be understood without the cultural, social and economic factors (Salama 1998, 2002). This was previously assured by the international congress of architects 1993 by recognizing that all humans are culturally, socially and economically independent.

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So sustainability is a development process that can satisfy the current generations' needs without compromising future generations to satisfy their needs (ECE 1996). From all mentioned, it can be identified that sustainability implies environmental, socio-cultural and economic aspects that are imposed on natural resources while providing a qualitative development for communities (Fig. 1). However, the sustainable city movement requires serious efforts, idiosyncrasies call for specific approaches to the program in order to create applicable solutions basically inspired from local wisdom, knowledge and expertise meanwhile taking climate, culture, resources and technology into consideration (Alvarez et al. 2

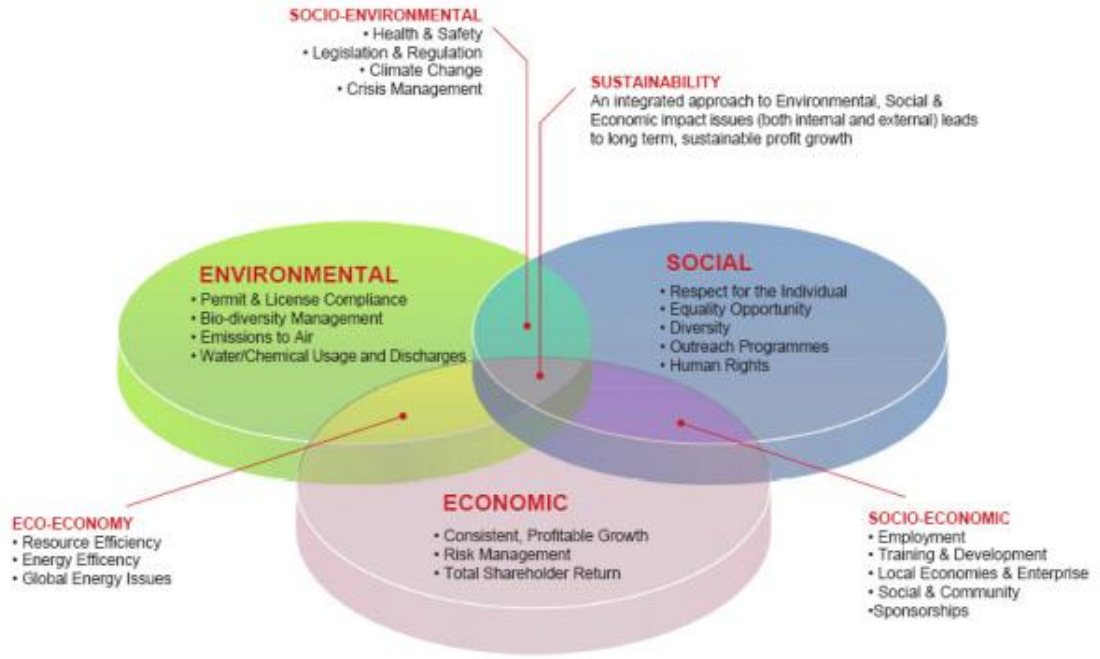

Fig.1The main aspects of Sustainability
Reference: www.computingforsustainability.com

2. LITERATURE REVIEW

2.1 The Need of Integrating Sustainability in Architectural Education

There is an instant need to implement consideration of sustainability is architectural education. No one can deny that higher/architectural education has a vital role in providing more sustainable future. It will enable future architects to propose architectural solutions that can face the previously mentioned challenges and to reconcile sustainability aspects as a part of the built environment. It is responsible for training professionals, students and even communities to be sustainably literate (Adegible 2012).

According to addenda 21, UN program of action, Rio de Janeiro; environmental education was considered as one of the catalysts for sustainable development (UN, 1992). It is also recognized that sustainable development processes can be implemented effectively when it is supported by well-informed and educated community (UNEP, 1999).

Starting from year 2005, there was a sparkle of awareness of the importance of implying sustainability in education. Since this year marks the commencement of on the United Nations Decade of Education for Sustainable Development that formed both an opportunity and a challenge for educators in all fields to reorient their teaching, research towards sustainability (Shari and Jaafar 2012).

2.2 The Previous Trials of Integrating Sustainability in Architectural Education

Despite the instant need to integrate sustainability consideration in the architectural education, we are far from finding a final perfect system. Most of the architecture schools have not reached a clear system to integrate these considerations into curricula. Most of them provide electives on energy efficiency and add information to an already overburdened studio pedagogy (Nguyen and Pudlowski 1999; Elliot 2004; Shari and Jaafar 2012; Ramirez 2006; Alvarez et al. 2015). However, the inclusion of sustainability aspects is basically depended on individual efforts of lecturers that are familiar and inclined towards sustainability (Shari and Jaafar 2012). Unfortunately, these efforts do not give students enough exposure perspective because they are only limited to isolated topics of sustainability (Adegible 2012). Accordingly, most of literate talked about the missing link between architectural education and professional practice (El Nachar 2010).

A former research was held to track sustainability across the curricula in the United Kingdom schools of architecture. The research concluded considering a holistic system of thinking to understand the interdependence of environmental, technological, social, cultural aspects in design studios, besides recognizing the architects' responsibilities through codes and legislations towards ensuring sustainable future and of course inculcating sustainability awareness at foundation level of architectural education (Fowles et al. 2003). The Royal Institute of British Architects RIBA has initiated "Criteria for Validation" aiming to develop sustainability awareness in part I curricula (RIBA 2002) and several schools are taking steps towards achieving it. The "Building Design Magazine" has published a report commended several architectural schools for their approach to sustainability (Stewart 2008).

Another research was conducted to assess the level of sustainability in architecture schools in Malaysia which concluded the individual efforts towards integrating sustainability in architectural education despite the major barriers holding it back such as lack of research and professional networks, lack of awareness, lack of motivational incentives and lack of well documented references that are relevant to local conditions. The research provided major recommendations accordingly such as increasing training programs related to sustainability for both educators and researchers, increasing the level of sustainability awareness for first degree qualifications by enhancing the current curricula of Malaysian universities and finally emphasizing funding by both research centers and universities to address sustainability issues (Shari and Jaafar 2012).

Moreover, another research was conducted to address the question of sustainability in architectural education in the UAE after releasing the two of the strongest incentives of sustainability. They are the project of "Masder City" and the establishment of "Estidama" rating system for sustainable buildings. The research concluded that there is gap between the government strategies and the accredited architectural education programs. Sustainability aspects are covered with variable levels yet there is a need for better effective involvement of academic community and programs concerning sustainability (Benkari 2013).

2.3 Sustainability of Architectural Education Programs

Sustainability of education was defined as "an emerging paradigm that transcends disciplinary boundaries, wielding a potentially profound, but also imprecisely understood, influence that requires a reflection on the way in which new generations of students and practitioners are trained within academic and professional institutions"(Altamonte 2012).

It is noticed from most of educators that it is quite difficult to encourage students to integrate sustainability principles in design projects. There are various pedagogical multi-layered challenges that face integrating sustainability in architectural education. Educators are supposed to try to understand the possibility/complexity of students' involvement and discuss its multiple dimensions. (Schwarzin et al., 2011).

2.3.1 Agenda of Sustainability of Architectural Education Programs

In January 2010, a symposium of Environmental Design in University Curricula and Architectural training in Europe (EDUCATE) that was held in Budapest. An agenda of sustainable architectural education was proposed. Unfortunately, those principles mainly focus on environmental sustainability meanwhile set aside the economic and socio-cultural aspects of sustainability. The agenda concluded the following ten principles;

- "Sustainable environmental design should be seen as a priority in the education of building practitioners from the beginning of their studies and through to continuing professional development"
- "Higher education and professional institutions, educators, students and practitioners should all be committed to this priority"
- "Teaching and learning should enthuse and inspire students to rigorously and creatively address design challenges"
- "Educators should promote a sustainable approach to design through appropriate pedagogical methods, tools and techniques"
- "The pedagogy should encourage critical awareness, responsibility and reflection of the interdependencies within the design process"
- "The curriculum should support investigative discourse between different disciplines, parties and professions"
- "Adequate time, human and financial resources should be devoted to this pedagogical process"
- "Educators, students and professionals should continually evolve the knowledge base of sustainable environmental design through exemplar and design practice"
- "The knowledge base of sustainable environmental design should be disseminated in a manner that is easily accessible to students, academics, practitioners and the general public"
- "A sustainable architectural education should have the full support of accreditation and regulatory bodies"

2.3.2 Stages of Integrating sustainability aspects in architectural education

A previous study was made by Altomonte 2012 that proposed a framework for integrating sustainability in architectural education programs. The framework consists of three subsequent stages; Sensitization, Validation and Reflection as shown in details in figure 2. These stages are considered to be applied in one single cycle of an educational program for either undergraduate or postgraduate. There is no perfect model of education program. Nevertheless, exploratory approach to propositive approach till critical approach are all mainly meant to define sustainability based skills and knowledge that should be gained gradually. The three stages are indicated as the following:

2.3.2.1 Sensitization Stage

This stage basically depends on introducing the key drivers and main challenges of contemporary architecture through concepts and principles of sustainability. It aims at creating sensitive attitude towards the built environment that may assist in reducing misconceptions, prejudices and misleading decision making towards sustainability. Academics are supposed to increase students' commitment towards sustainable design and provide them with basic knowledge and skills needed to generating creative ideas.

2.3.2.2 Validation Stage

This stage is based on developing autonomy in design and problem solving. It is meant to enhance students' abilities and gain knowhow/ needed skills of research and analysis with the appropriate techniques. Students are supposed to find the needed knowledge to validate the sustainability concepts provided in the previous/sensitization stage. They are also supposed to learn skills to propose innovative solutions for design.

2.3.2.3 Reflection Stage

This stage is based basically on specialization. Students are supposed to specialize in their preferable discipline while working as a team member of a multi-disciplinary teamwork. They are supposed to focus on the linkage between the professional advancement and the knowledge they gained through the two previous stages. It mainly assist in linking continuing professional development with lifelong learning. The main approach, objectives and the knowhow of application for each stage are indicated in fig. 2.

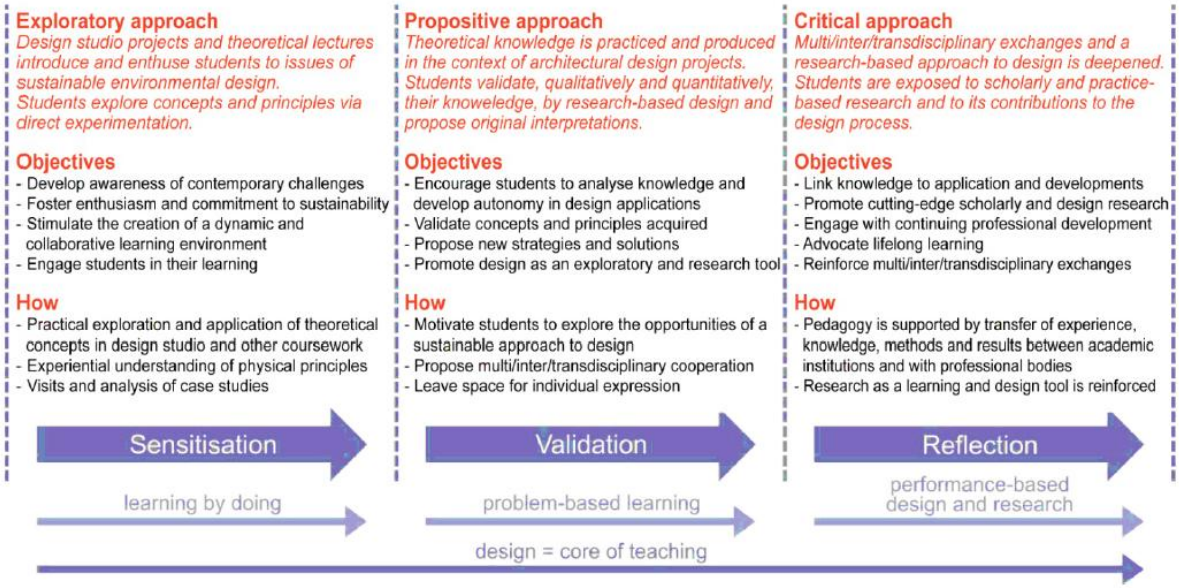

Fig.2 Stages of integrating sustainability in architectural education
Reference: Altomonte 2012

2.3.3 Paradigmatic models of architectural education program structure

There is no doubt that there are various techniques/methods of teaching in architectural education programs. However, all of them are supposed to provide the same needed skills and knowledge throughout the different stages of education. The EDUCATE framework for curriculum development has provided five models of architectural education program structure edited also by Altomonte as shown in fig. 3. Those models are the following;

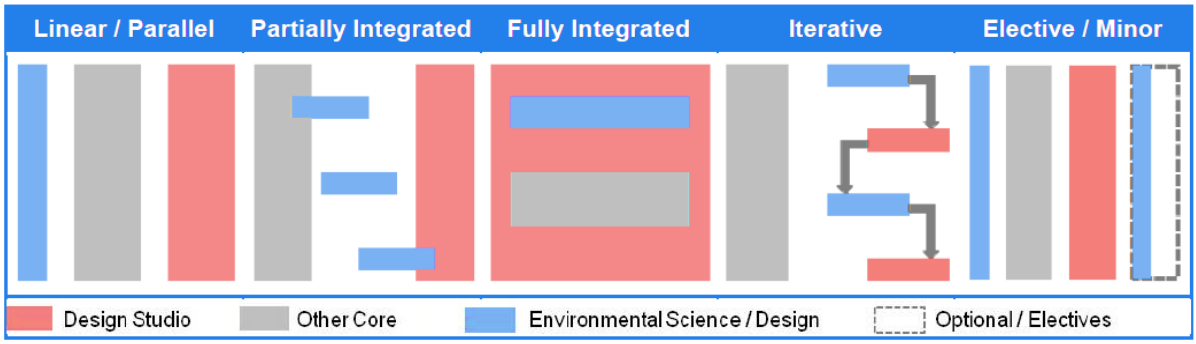

Fig.3 Paradigmatic models of architectural education program structure
Reference: Altomonte 2012

2.3.3.1 Linear/Parallel model

"Each disciplinary domain runs in parallel and knowledge is delivered autonomously with ex-cathedra lecture modules and studio being assessed independently. This satellite structure may allow a coherent education on issues of sustainability, although an unclear integration between studio and other coursework could make such principles and values be considered as divorced from design."

2.3.3.2 Partially integrated model

"Taught modules of environmental science or design can represent the link between studio and other core teachings. Although these modules can be taught as stand-alone units, they are generally, at least in part, integrated with other subjects on delivery or in assessment. This structure allows the introduction of principles of sustainability and their simultaneous design exploration."

2.3.3.3 Fully integrated model

"studio modules are conceived as working spaces, where contents of different domains converge around the central role of the design project. Theoretical knowledge is delivered in accordance with the requirements, timing and pace of studio to inform and support the design development. This structure requires adequate resources, careful management, cooperation and dialogue amongst staff."

2.3.3.4 Iterative model

"Rather than following a linear sequence of linear delivery, acquisition and application. This structure is based on series of interlinked phases, where the contents delivered at one stage inform the competence acquired in the following. At each stage, knowledge is deepened and complexity of elaboration grows through a series of cognitive loops. This model emphasizes critical reflection and is built on a clear dependency between environmental science, design studio and other core modules."

2.3.3.5 Elective/Minor model

"This structure is characterized by various electives, eventually from different degrees or departments that students can include in their study program. Delivery and assessment is similar to the linear/parallel structure. Such flexibility encourages interdisciplinarity and offers the possibility to investigate sustainability from many points of view."

Each model has its own pros and cons. However, it is vital to consider the convenient approaches that can facilitate the needed knowledge delivery and skills enhancement aiming at reaching the optimum curriculum for sustainable architectural education program.

2.4 Architectural Education in Egypt

Within the government role in paving the way to sustainability; principles of sustainable development has been integrated into the country's policies and programs in reflection to sustainable development strategy of Egypt's vision 2030. Not only in the government's policies but also in universities. The Supreme Council of Universities (SCU) that is responsible for supervision on all Egyptian universities has established the Sector of Environment Affairs and Community Service (SEACS) in all universities and faculties. This sectors aims at raising awareness concerning sustainability, environmental issues and serving community. The SCU has also established the National Authority for Quality Assurance and Accreditation of Education (NAQAAE) in November 2007. It mainly aims at increasing quality of education, assuring its continuous development and accrediting educational authorities through independent, justified and transparent procedures. The NAQAAE is adopting the National Accreditation Regulatory Standards (NARS) for all educational programs in Egypt. Accordingly, architectural education programs are applying those standards that include "knowledge and understanding", "intellectual skills", "general and transferable skills" and "practical and professional skills" for both Engineering discipline and Architecture discipline. While measuring the sustainability concept integration in those standards as shown in fig.4, the following was found:

2.4.1 For "knowledge and understanding"; in Engineering discipline it was found that 2 standards out of 12 (16%) are referring to sustainability issues and in Architecture discipline it was found that 3 standards out of 11(27%).

2.4.2 For "intellectual skills"; in Engineering discipline it was found that 2 standards out of 12 (17%) are referring to sustainability issues and in Architecture discipline it was found that 1 standard out of 9 (11%).

2.4.3 For "practical and professional skills"; in Engineering discipline it was found that 2 standards out of 12 (17%) are referring to sustainability issues and in Architecture discipline it was found that 4 standard out of 10 (40%).

2.4.4 For "general and transferable skills"; there is no clear significance for sustainability issues that means it may need further modifications for sustainability integration.

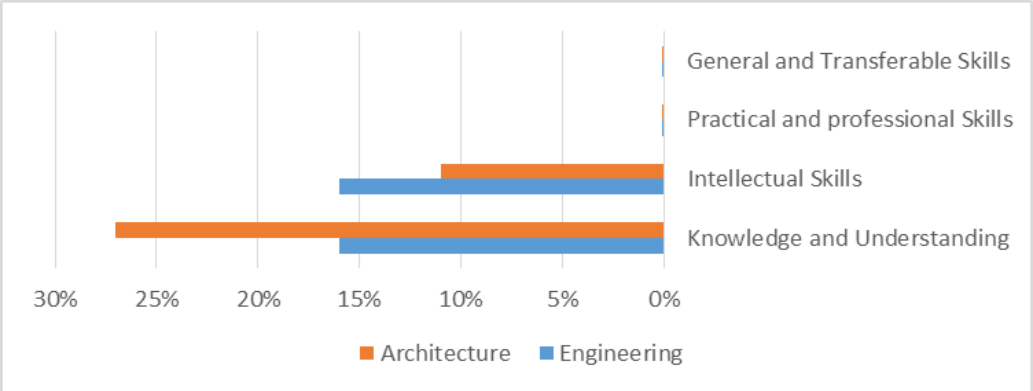

Fig.4 Level of sustainability integration in NARS of architectural education
Reference: author

2.4.5 Architectural education program at Cairo University: case study

The department of Architectural Engineering at Cairo University was established 1908, is considered as the first leading university in Egypt. Development of academic programs and research, and cooperation with the community, has been the main and continuing components of the mission of the department throughout its history that extends now over 190 years. A strategy has been established for accreditation, within a national plan to introduce total quality in university education, in order to cope with the ever pressing needs of technical and economic development enforced by globalization. It has been the first and the only UIA accredited department in Egypt. It has been awarded the UIA unconditioned accreditation in October 2014. Besides, the department is adopting the NARS and has applied for accreditation by NAQAAE this year and still waiting for results.

It is vital to indicate that the department lies under the umbrella of faculty of engineering, there are five academic years of the Bachelor. The first year is a general preparatory year and students begin to specialize in a specific department in the second year and they complete their study in the selected department in four years. As mentioned before, the department of architectural engineering is adopting NARS for both engineering and architecture. These standards cover 58 courses distributed amongst the four years of studying architecture. Accordingly, it is vital to measure the sustainability integration in those standards and to know the level of embedding its concepts in the curricula taught in the department.

3. METHODOLOGY

The current practice of applying sustainability aspects in architectural education in Egypt is being investigated. It was decided to focus only on the undergraduate Bachelor degree. An investigation was conducted using the selected programs' official literature review and analyzing the development of courses' data, vision, mission, philosophy, objectives and outcomes in order to assess the level of awareness and sustainability integration in design studios and other courses. Besides, a separate study was conducted to NARS and how it was applied in the department curricula. It followed Intended Learning Outcomes ILOs, methods of achieving it, level of achievement and requirements of development. And finally identifying barriers to promoting sustainability in architectural education to suggest solutions to overcome those obstacles based on discussions with professors of Architecture specialized in sustainability and environmental design.

4. RESULTS

The department of architectural engineering belongs to the faculty of engineering and keeps the conventional approach of architectural engineering as technology and design are not separated. The undergraduate program is four years long. All semesters are dedicated to general education including various except the last semester of the fourth year that is dedicated to graduation project.

4.1 Sustainability Embedment Level in Architectural Education program at Cairo University

The program is a combination of the partially integrated model and elective/minor model of architectural education program structure. Sustainability is integrated/embedded in all main core courses with various level and timing of integration as shown in table 1.

Table 1 Sustainability issues integration in main core courses amongst the four years of study (XXXXXX refers to sustainability issues integration)
Reference: author

Education Stage	*SENSITIZATION*				*VALIDATION*		*REFLECTION*	
	Year 1		Year 2		Year 3		Year 4	
Courses	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Architectural Design				XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	
Building & Working						XXXXXXX	XXXXXXX	
Urban Planning					XXXXXXX		XXXXXXX	
Urban Design & Housing						XXXXXXX		
Environmetal Control			XXXXXXX	XXXXXXX				
Theories of Architecture			XXXXXXX				XXXXXXX	
Elective Courses (Sustainability)					XXXXXXX	XXXXXXX		XXXXXXX
Graduation Project								XXXXXXX

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ntroduced since the sensitization stage but the sustainability awareness of students is still considered quite low. But the situation improves throughout the following years. Environmental control and environmental sustainability aspects are studied also in the sensitization stage with special concern to the applied strategies of sustainability in Islamic architecture in old Cairo. Lighting, acoustics, thermal comfort and other related topics are also considered.

More specialized topics are introduced as electives in the third and fourth year concerning energy efficiency in buildings, sustainable development, renewables, environmental building simulation, community development, building management and economics. It is noticed that all aspects of sustainability are quite introduced in electives but with different levels. Environmental sustainability is highly introduced in various electives through the last two years of education. On the other hand social and economic sustainability is two limited courses in the fourth year. Educators tend to integrate sustainability in their design studios and core subjects based on their own initiatives without clear spelling in the curriculum.

4.2 The NARS Sustainability Embedment in Architectural Education Program at Cairo University

4.2.1 Knowledge and Understanding; referring to *part 2.4.1*

As indicated in table 2, ILOs that refer to sustainability issues in both disciplines are achieved as 41% in Engineering and 36% in architecture which is acceptable but still need more concentration to be covered effectively. Also fig.5 indicates the percentage of achievement for each ILO in each year.

Table 2 percentage of achievement of NARS ILOs of knowledge and understanding concerning sustainability issues
Reference: author

Discipline		year 1	year 2	year 3	year 4	bachelor
Engineering	ILO 6	50%	57%	28%	36%	
	ILO 11	25%	50%	39%	50%	41%
Architecture	ILO 5	17%	36%	28%	36%	
	ILO 6	0.01%	28.50%	44%	50%	
	ILO 11	42%	71%	39%	36%	36%

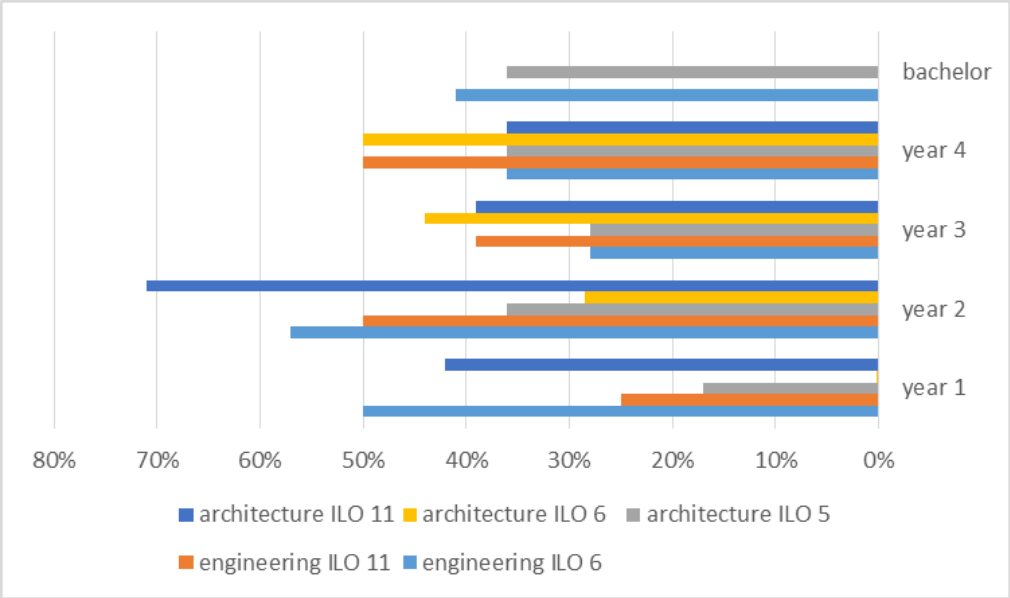

Fig.5 percentage of achievement of NARS ILOs of knowledge and understanding concerning sustainability issues
Reference: author

4.2.2 Intellectual Skills; referring to *part 2.4.2*

As indicated in table 3, ILOs that refer to sustainability issues in both disciplines are achieved as 46% in Engineering and 48% in architecture which is acceptable. Also fig.6 indicates the percentage of achievement for each ILO in each year.

Table 3 percentage of achievement of NARS ILOs of intellectual skills concerning sustainability issues (Reference: author)

Discipline		year 1	year 2	year 3	year 4	bachelor
Engineering	ILO 9	42%	64%	33%	50%	46%
	ILO 10	17%	50%	33%	78%	
Architecture	ILO 7	25%	57%	61%	43%	48%

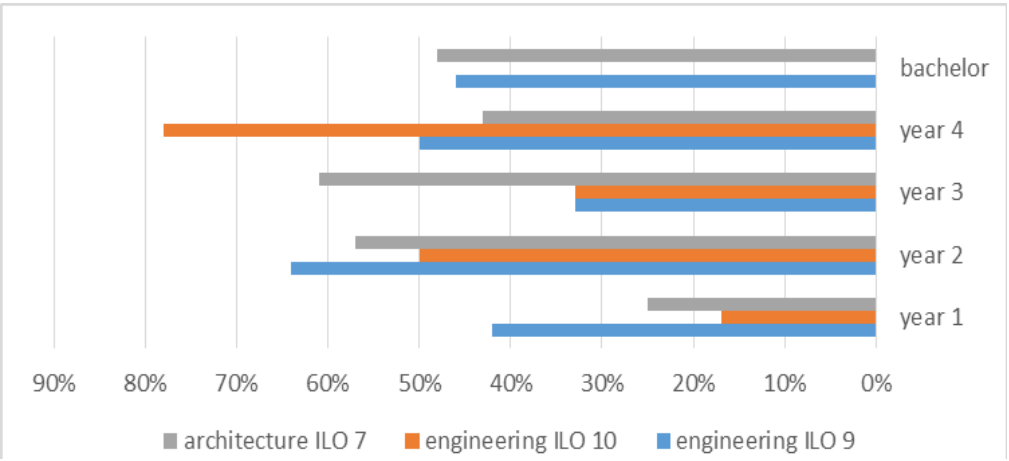

Fig.6 percentage of achievement of NARS ILOs of intellectual skills concerning sustainability issues
Reference: author

4.2.3 Practical and Professional Skills; referring to *part 2.4.3*

As indicated in table 4, ILOs that refer to sustainability issues in both disciplines are achieved as 19% in Engineering which is quite low and may need to be modified and revised and 35% in architecture which is quite acceptable. Also fig.7 indicates the percentage of achievement for each ILO in each year.

Table 4 percentage of achievement of NARS ILOs of practical and professional skills concerning sustainability issues
Reference: author

Discipline		year 1	year 2	year 3	year 4	bachelor
Engineering	ILO 8	0%	0%	11%	14%	19%
	ILO 10	42%	57%	11%	26%	
Architecture	ILO 7	42%	0%	17%	21%	35%
	ILO 8	67%	14%	22%	36%	
	ILO 9	42%	36%	33%	57%	
	ILO 10	58%	28%	39%	64%	

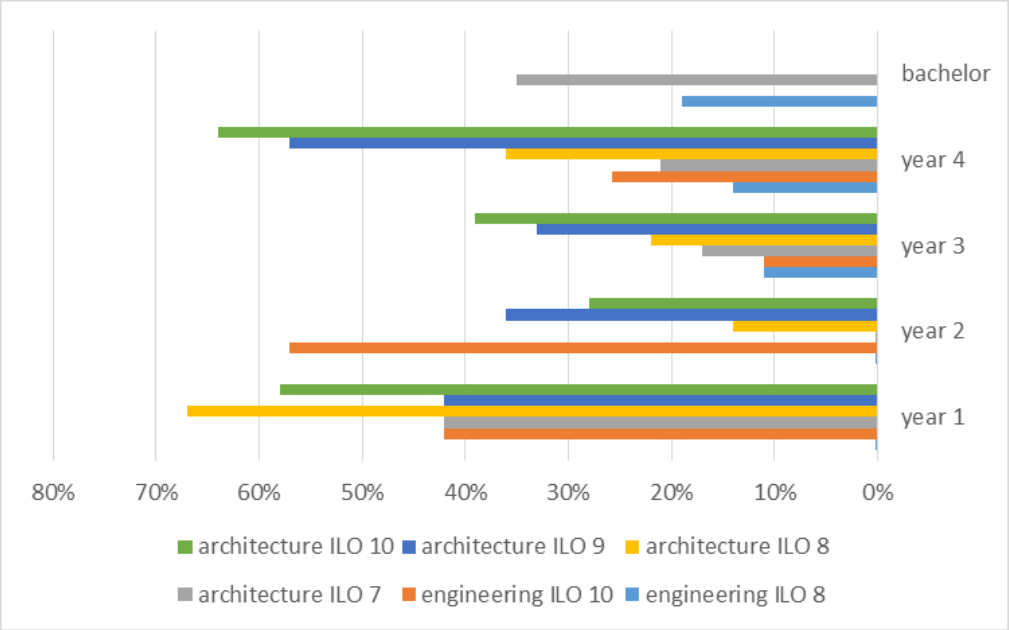

Fig.7 percentage of achievement of NARS ILOs of intellectual skills concerning sustainability issues Reference: author

4.2.4 General and Transferrable Skills; ; referring to *part 2.4.4*

As mentioned previously, there is no clear significance for sustainability issues that means it may need further modifications and revision for sustainability integration. A detailed matrix of NARS ILOs and courses for the year 2014-2015 is attached in the appendix.

4.3 Obstacles of Sustainability integration in the Curricula

Based on discussions with professors of Architecture specialized in sustainability and environmental design; the following obstacles was concluded to promote sustainability in architectural education;

- Lack of exposure or training courses in sustainability and lack of interest and motivation, besides the limited expertise, besides the inadequate number of educators of the sustainability field
- Shortage of local data sources, sustainable building literature and contemporary sustainable buildings or projects.
- Lack of commitment of governmental actions, regulations and enforcement to prioritize to sustainability issues in the curricula
- Disability to embed sustainability in such an existing complicated content.
- The wide complex field of sustainability that is beyond students understanding that lead to less interest and enthusiasm
- The wide gap between the abstract sustainability informative knowledge and the applicable projects
- Lack of funding facilities for research, besides the high cost of pioneering approaches

The case of Cairo University is distinguished with its intensive approach. The positive side is the balance between theoretical and practical courses. Besides the emphasis on sustainability environmental aspects. The negative side is that the other aspects of sustainability are not well covered. Besides the unclear spelling of sustainability in the curriculum.

However, more efforts and research are needed to be done aiming to promote the current system applied in architectural education in Egypt. It is needed to reach a more efficient and realistic system while keeping the Egyptian universities' culture and identity.

5. CONCLUSIONS

A literature review was conducted to understand the sustainability aspects and attitudes in architecture. The research focused on integrating sustainability in architectural education curricula. An investigation was conducted to identify the current practice of applying sustainability aspects in architectural education in Egypt and in order to assess the level of awareness and sustainability integration in design studios and related courses. Architectural education is still quite late to respond to the previously mentioned challenges concerning climate change. With their low proportion in the whole program content, the courses related to the different aspects of sustainability are mainly focused on environmental issues while the other aspects (cultural and economic) are limitedly addressed. Furthermore, contemporary principles and practices and rarely refer to the local context except in environmental aspects in traditional architecture in old Cairo. Developing a sustainable design curriculum should be part of the focus and a long term goal of architectural sustainable thinking in education environmentally responsive designs, creating connections between people and aspects of place aiming to create a built environment that would fit a triplet sustainability aspects cultural, economic and environmental attributes.

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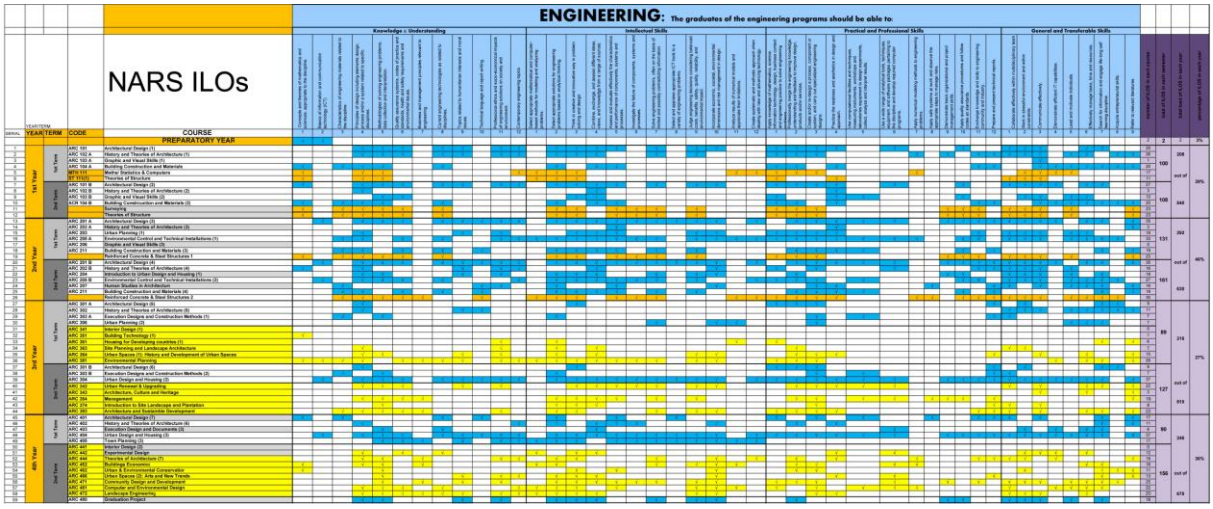
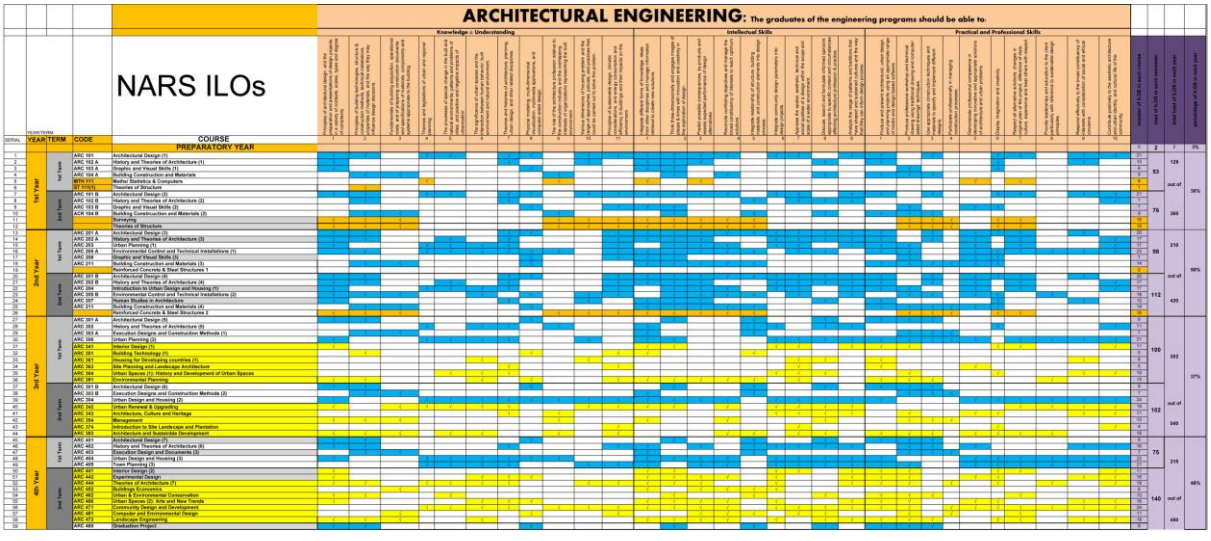
APPENDIX



Matrix of NARS ILOs for engineering discipline for the academic year 2014-2015



Matrix of NARS ILOs for architecture discipline for the academic year 2014-2015