

Developing Architectural Education For Adapting Climate Change

Mervat Nasr¹

Assistant Professor, Department of Architecture & Urban Planning, Faculty of Engineering, Suez Canal University,
Ismailia, Egypt¹

ABSTRACT: Climate change is one of the pressing global issues that affect the human and the natural environment. Sustainable development is the only way to secure the present and ensure future. The main objective of this paper is to describe and demonstrate the development stages of the architectural courses at the Faculty of Engineering - Suez Canal University- Egypt and the implementation mechanisms of the CLIMASP project. As well as, emphasize the role of architect in designing and producing of architectural projects able to adapt to climate change and mitigate its effects through the study and application of the principles of sustainable architecture. The paper follows two methodologies: the first is descriptive approach through the theoretical study concerns with the architectural education and the definition and objectives of CLIMASP project. The second is the analytical approach which deals with architectural courses development stage through the implementation process of the CLIMASP project.

KEYWORDS: Architectural Education, Climate Change, Sustainability Policy, Sustainable development.

I. INTRODUCTION

Climate change is one of the pressing global issues that affect the human and the natural environment because of its negative effects on environmental, social, economic as well as cultural aspects. This problem poses an even bigger threat to developing countries due to the lack of focus on climate change in economic and development policies, since these countries have more urgent matters to attend to such as: food security, poverty, energyect. [1]. The issue is not just the reduction of carbon dioxide emissions, but more importantly how to prepare hard to mitigate the effects of climate change, where it is considered the biggest challenge in the long term, which is facing human development.

The World Commission on Environment and Development has put the definition of sustainable development is: "*Development that meets the needs of the present without compromising the ability of future generations to meet their own needs*" [2]. Sustainable development with its various dimensions; environmental, cultural and economic is the only way to secure the present and ensure future. Generally, education plays a critical role in climate change response. UNESCO responds to climate change through education within the framework of the Global Action Programme on Education for Sustainable Development. The programme aims to help people understand the impact of global warming today and increase "climate literacy" among young people. [3]

Architectural Education plays an essential role in the preparation of architect, planner, developer, landscaper and the decision maker in order to achieve a sustainable built environment. Therefore, it is urgent to change and shift the teaching and learning methodologies and tools in order to help the students in architectural departments to produce architecture projects adapt and mitigate climate change by using and applying the sustainable architecture principles [4].

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 1, January 2017

A. PROBLEM OF THE STUDY

Sustainable development in education means more than integrating sustainability topics into curricula, but refers to understanding sustainability problems and how to achieve the solutions. Nowadays, the traditional teaching methods and learning approaches are not suitable for sustainability in architectural education [5]. New curriculum design, teaching methodology, and teacher training programs need to be updated to raise the extent of the sustainable thinking and knowledge.

B. OBJECTIVE OF THE STUDY

The main objective of this paper is to describe and demonstrate the development stages of the architectural courses at the Faculty of Engineering - Suez Canal University- Egypt and the implementation mechanisms of the CLIMASP project. As well as discuss the importance and the role of this project in the development process of architectural education and emphasize the role of the architect in designing and producing of architectural projects able to adapt to climate change and mitigate its effects through the study and application of the principles of sustainable architecture.

C. METHODOLOGY

In order to achieve the above mentioned objective, the paper follows two methodologies approaches: the first is descriptive approach through the theoretical study concerns with the architectural education (the focus of the study) and the definition and objectives of CLIMASP project. The second approach is the analytical study which deals with the developing process of number of architectural courses in Suez Canal University as partner in CLIMASP project and monitoring the outcomes of these courses after the implementation process. Moreover, the role of the CLIMASP project in this development process.

II. THE THEORETICAL STUDY

A. ARCHITECTURAL EDUCATION

Architectural education is considered one of the important and essential fields that affect the built environment through the architectural products of architects. Therefore architectural institutions are responsible to improve the education and curriculum to prepare and enable their students to become future architects to meet the rapid global changes in order to design and build sustainable societies. [6]

According to the National Academic Reference Standards (NARS), the discipline of architecture draws on knowledge and skills from the human and physical sciences, the humanities, and the fine and applied arts. It addresses the accommodation of all human activity in all places under all conditions, understanding our place within differing physical, historical, cultural, social, political and virtual environments. Architecture proposes, forms, and transforms our built environment, and does so through an engagement with the spaces, buildings, cities and landscapes in which we live. While architectural education must be concerned with the constraints of the physical world and historical and cultural dimensions, it must also constantly adapt to a changing social, economic and environmental context nationally, regionally and internationally. [7]

The Architecture curriculum is structured to expose students to the comprehensive theoretical, historical, technological, professional and social issues that play a role in the design of the built environment. Architectural education is therefore rich, varied and by definition interdisciplinary. *“Architects, concerned for the future qualitative development of the built environment in a fast changing world, believe that architecture involves everything that influences the way in which the built environment is planned, designed, made, used, furnished, landscaped and maintained”*. [8]

Since its World Congress in 1993, the International Union of Architects and its Sections underlined in their “Declaration of Interdependence” the key role of architects in the fight against global warming. This message was reiterated by the “Imperative 2050” that was unanimously approved at the 2014 Durban general meeting of the 130

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 1, January 2017

UIA member organizations and its partners. Supported by the various institutions that represent the architectural profession, this call is widely adopted by architects from around the world in their daily practice. From the city to the building, at all scales of the built environment, architects have indeed the responsibility to propose solutions adapted to the culture and the local context that focus on the well-being of users. [8]

B. CLIMASP PROJECT : DEFINITION AND OBJECTIVES

The Climate Change and Sustainability Policy minor (CLIMASP) is an interdisciplinary program funded by the European Commission Tempus under the coordination of the UNESCO Chair ICT in Education for Sustainable Development, University of Crete, Greece. The grant agreement duration was from December 2013 – November 2016. The CLIMASP Consortium consists of 16 partners: 3 institutions from EU, 10 universities from Egypt, Jordan and Lebanon and 3 NGOs from Egypt and Jordan. [9].

The CLIMASP project aims at developing a minor in Climate Change and Sustainability Policy at partner universities in Egypt, Jordan and Lebanon. The main idea of the project depends on the provision of the necessary knowledge, skills and attributes for the students, to make them able to play an active role in order to face the challenges of climate change locally and globally. The interdisciplinary CLIMASP courses will consist of core courses, elective courses, and the required capstone course in the three concentration areas: Climate Change, Environment and Society- Climate Change, Economics and Public Policy - Climate Change, Science and Technology.

The number of courses to be taken by undergraduate students, including the capstone course to qualify for the CLIMASP minor are weighted 60 ECTS. Students will be provided a formal credential through transcript documentation (Euro-Arabpass) adapting the Europass diploma to certify that they have developed leadership in the field of climate change and sustainability policy [10], [11].



Fig.1 The CLIMASP Curriculum Development Process [12]

Source: <http://www.ictinesd.org/unescocoair/climasp/methodology/>

According to The CLIMASP framework, the curriculum development process for the interdisciplinary CLIMASP programme integrates six stages: [12]

1. Design: stakeholders participate in the process (organisations, local trade unions, civic initiatives and societies)
2. Develop: Each partner university will proceed to the development of 24-30 course syllabi and course modules in the CLIMASP three concentration areas.
3. Pilot: A small number of CLIMASP courses start in this stage to observe processes, methods and practices by faculty, students and evaluators.
4. Implement: Based on the pilot assessment, proper interventions to enhance content and methods will be applied to all CLIMASP course modules across the 10 partner universities.
5. Evaluate: Evaluation is being integrated into the CLIMASP program before, during and after implementation in the following way: Evaluation before project implementation includes the activities performed in the design

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 1, January 2017

and development stages of capturing stakeholders' expectations, competences needed as well as validating/accrediting the course modules.

6. Review: Internal and external assessment can provide data that demonstrates how the CLIMASP interdisciplinary courses can foster the objectives set.

III. THE CURRICULUM DEVELOPMENT PROCESS

Suez Canal University is one of the Egyptian universities partners in the CLIMASP project, where seven faculties involved in the project with a total 41 courses. Faculty of Engineering participated in the CLIMASP project by the Department of Architecture and Urban Planning five architectural courses from a total of 41 course participants from the different faculties of the Suez Canal University by 12.2%, in addition to the preparation of the capstone course description "Sustainable Communities". These courses have been developed and add topics of climate change and sustainability policy within the existing main content of the curriculum.

Participating in CLIMASP Project was one of the Architecture Department strategies towards the development of architectural education to achieve sustainability in architecture and urban planning through the graduation of architects are fully aware of the issue of climate change and how to mitigate and to adapt with its effects by following sustainability policy. Table 1, shows the selected Architectural courses covers the three concentrations of CLIMASP.

Architectural Courses in CLIMASP	CLIMASP Three Concentration Area			Faculty
	Climate Change, Environment & Society	Climate Change, Economics & Public Policy	Climate Change, Science & Technology	
Environmental Studies			✓	All students
Environmental Control in Architecture	✓		✓	Engineering /Architecture
Urban Renewal of Residential Areas		✓	✓	All students
Urban Studies & Humanities	✓	✓		All students
Architectural Design Studio 6	✓	✓	✓	Engineering /Architecture
Building Codes and Legislation	✓			Engineering /Architecture

Table 1.The Selected Architectural Courses in CLIMASP

Source: The Researcher

1. Environmental Studies / Environmental Control in Architecture - ARCH 306

The course covers the study and definition of the natural environment and the built environment and its characteristics and the impact on each other and the human relationship with them. The course includes the geographical division of the climatic regions in the world and considerations for human thermal comfort and studying climate Change & climatic factors affecting the design and examples and analysis of the heritage architectural elements in terms of sustainability.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 1, January 2017

2. Urban Renewal of Residential Areas – UPL 403

The course covers the study and definition of urban renewal in general and especially the problems facing the residential areas. The overpopulation is considered one of the great problems facing cities and the consequences of severe problems such as lack of housing, the spread of deteriorating neighborhoods, the informal extensions, slums and pollution as well. The course discusses the impact of climate change on the cities and how to apply the sustainable policy. This course was applied 2015 during the CLIMASP project period.

3. Urban Studies & Humanities - ARCH 207

The course aims to study the effect of the human behavior of the society on the architecture and urban production. As well as the course includes a study of the correlation between architectural design and human behavioral and psychological dimensions of society and the effect of socio- cultural, economic and humanitarian considerations, which in turn reflected on the design process. The course discusses the climate change and sustainable policy in the field of urban design and its impact on the urban communities and how to apply the sustainable policy. Fig.2. Shows sample of students' final project "Studying the human activities in an urban space in Ismailia City" in the course of Urban Studies & Humanities.



Fig.2. Sample of students' final project in Urban Studies & Humanities

Source: The teaching course by Researcher- 2nd Semester 2016

4. Architectural Design Studio 6 – ARCH 304

The course aims to develop the student's ability and training on the architectural design projects with complex problems through the application of the foundations and principles of sustainable and green architecture and how to use the appropriate technology in the development of architectural ideas to solve design problems of design public projects (hospitals, hotels, office building, etc.). With a focus on the interrelationships between the environment and the urban surrounding as well as emphasis on the study of the environmental, social, economic and technological aspects and its effect on the architectural idea of the project. This course was applied two times during the CLIMASP project period after developed. Fig.3 Shows sample of students' research in Climate Change & Sustainability in Architectural Design Studio 6.

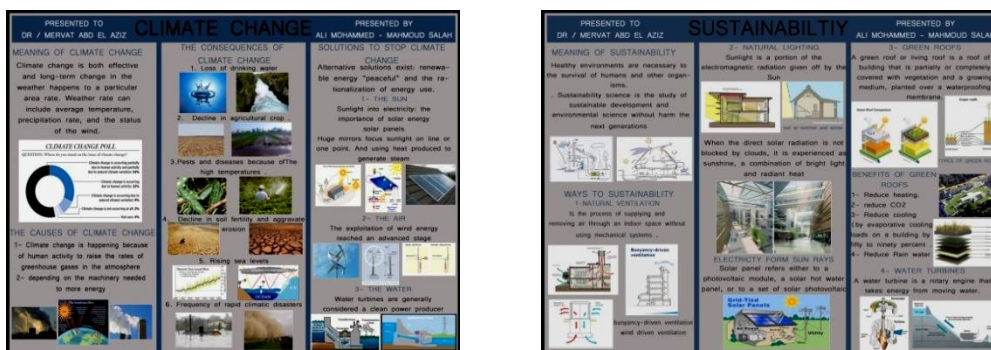


Fig.3 Sample of students' research in Climate Change & Sustainability in Architectural Design Studio 6

Source: The teaching course by Researcher- 2nd Semester 2015

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 1, January 2017

5. Building Codes and Legislation – ARCH 405

The course covers the study of building and environmental codes and its role in reducing the environmental impacts of buildings on physical resources and climate change. The course discusses the impacts of buildings on natural and economic resources, the role of Building and Environmental Codes in providing sustainable and green buildings and the current trends in environmental building certification schemes (national and international).

IV. ANALYTICAL STUDY AND RESULTS

Table 2 shows the CLIMASP Architectural Courses that participated in the project from department of Architecture and Urban Planning - Faculty of Engineering – Suez Canal University. The table shows: the number of students that registered in the course, the credit hours and the main assignment or project that the students were presented in the final of the course.

CLIMASP Architectural Courses Faculty of Engineering - Suez Canal University – Egypt					
	Course Name	No. of Student	Credit Hr.	Short Description	Main Assignment/ Project
1	Environmental Studies / Environmental Control in Architecture 2016	17	3	Studying the natural environment and the built environment characteristics and the impact on each other and the human relationship with them	Studying of the architectural elements of an heritage building in a climatic region
2	Urban Renewal of Residential Areas 2015	14	3	The impact of climate change on the cities and how to apply the sustainable policy	Studying a residential area in Ismailia facing urban problems and applying of sustainable principles of the proposed urban renewal projects
3	Urban Studies & Humanities 2016	13	3	The architecture as a framework for Human Sciences and the effect of the climate change on the human behaviour of the society that reflected on the architecture and urban production.	Studying the human activities in an urban space in Ismailia and the effect of climate change in both urban space and human activities
4	Architectural Design Studio 6 2015 & 2016	17+9 =26	4	Develop the student's ability and training on the architectural design projects with complex problems through the application of the foundations and principles of sustainable and green architecture to achieve "Sustainable Architecture".	Design Project: 1- Sustainable Hospital - 2015 2- Sustainable Rural Village - 2016
5	Building Codes and Legislation 2016	17	3	The role of building and environmental codes in reducing the environmental impacts of buildings on physical resources and climate change	Preparing an action plan for sustainable management of a sustainable urban development project.

Table 2. CLIMASP Architectural Courses Faculty of Engineering –
Suez Canal University – Egypt
Source: The Researcher

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 1, January 2017

Table 3 Shows the CLIMASP Architectural Courses Learning Outcomes. Generally, after the completion of these courses students will be able to recognize and define the climate change and its effects and how to adapt and mitigate its effects in the built environment.

Architectural Courses in CLIMASP	Course Content Learning Outcomes Upon successful completion of this course, students will be able to:
Environmental Studies	Recognize the different types of environments and various environmental treatments. Students could analyse the climatic and environmental factors affecting the architectural design in different climatic regions especially the hot region and apply principles of sustainability on the architectural design
Urban Renewal of Residential Areas	Describe the different types of the residential areas and clarify the interrelationship between housing and social, economic factors and the impact of climate change. They could select appropriate urban renewal program of residential areas and apply principles of sustainability on the urban renewal projects.
Urban Studies & Humanities	Recognize the different types of societies and its human needs, and clarifying the interrelationship between Man, built environment and the impact of climate change on the human behaviours and the social relations. They were able to apply principles of sustainability on the urban design.
Architectural Design Studio 6	Collect, analyse data, formulate architectural design solutions and produce a sustainable architectural projects by using and applying of sustainability policy.
Building Codes and Legislation	Identifying of the different types of Codes (Building Codes – Environmental Codes). Proficiency analysis of environmental impacts of buildings. Recognize the possibility of greening building codes in Egypt and Find out guides for the design of green buildings. Use sustainable building materials and renewable energies in his design of sustainable development projects. Knowledge of current trends in international environmental building certifications. Mastering the skill of developing action plans for sustainable management of buildings

Table 3. CLIMASP Architectural Courses Outcomes
Faculty of Engineering – Suez Canal University – Egypt
Source: The Researcher

V. CONCLUSION

The study presented as part of the implementation of curriculum development process within the framework of CLIMASP project. After analysing the participating experience in CLIMASP Project and the case study of developing the selected architectural courses at Faculty of Engineering – Suez Canal University, the study concluded that:

1. The role of CLIMASP Project in the development process of the Architectural courses was essential and significant by using its framework and the evaluation stage. Therefore, it is important to participate in projects like CLIMASP Project.
2. The traditional teaching methods and learning approaches are not suitable for sustainability in architectural education. Therefore, it is important to adopt new curriculum design, teaching methodology, and teacher training programs to raise the extent of the sustainable thinking and knowledge.
3. Architectural institutions are responsible to improve the education and curriculum to prepare and enable their students to become future architects.
4. After the implementation of new curriculum, students understand the issues of climate change and could able to produce sustainable architecture projects.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 1, January 2017

5. Applying sustainable architectural education is an urgent process to improve the students' abilities and skills to produce sustainable built environment in the future.

The study recommends adopting and using the experience of CLIMASP project and its framework to apply it and helping in the Architecture Program developing process for Sustainable Education in Architecture and Urban Planning department – Faculty of Engineering – Suez Canal University.

VI. ACKNOWLEDGEMENT

This work has been developed within the framework of the CLIMASP (Development of an interdisciplinary programme on climate change and sustainability policy) project that has been funded from the European Commission (543879-TEMPUS-1-2013-GR-TEMPUS-JPCR). The content of the paper reflects the views of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

REFERENCES

- [1] Markandya, A. & Halsnaes, K., "Climate Change and Sustainable Development : An Overview", in Climate Change and Sustainable Development: Prospects for Developing Countries, Book edited by Anil Markandya, Kirsten Halsnaes, pp. 1-14, 2002.
- [2] World Commission on Environment and Development, "Our Common Future – The Brundtland Report", UN Document, pp.41, 1987
- [3] UNESCO, "The UNESCO Climate Change Initiative - Climate Change Education for Sustainable Development", pp. 4, 2010.
- [4] Santiago Porras Álvarez, Kyungsun Lee, Jiyoung Park, and Sun-Young Rieh, "A Comparative Study on Sustainability in Architectural Education in Asia—With a Focus on Professional Degree Curricula", Sustainability- Open Access, pp. 2, 2016
- [5] Bozkurt, Eray, "Integration of theory courses and design studio in architectural education using sustainable development", SHS Web of Conferences, pp. 2, 2016.
- [6] The International Union of Architects, UIA, "UIA and Architectural Education – Reflections and Recommendations", UNESCO, pp.5-8, Revised Edition 2014
- [7] National Authority for Quality Assurance and Accreditation of Education, "NARS for Engineering - NARS Characterization of Architectural Engineering", 2nd Edition, Egypt, pp. 12-14, 2009.
- [8] The International Union of Architects, UIA, "CHARTER, UNESCO /UIA for Architectural Education", pp. 3, Revised Edition 2011
- [9] Makrakis, V. & Kostoulas-Makrakis, N. , "A Strategic Framework for Developing Interdisciplinary Minor on Climate Change and Sustainability Policy: The CLIMASP- Tempus Example", in Integrating Sustainability Thinking in Science and Engineering Curricula, Springer, Switzerland, pp. 103- 115, 2015
- [10] Makrakis, V. & Kostoulas-Makrakis, N. , " Piloting the CLIMASP -Tempus Interdisciplinary Minor in Climate Change and Sustainability Policy: Outcomes Achieved", The European Conference on Sustainability, Energy & the Environment Official Conference Proceedings, The International Academic Forum, pp. 4, 2015
- [11] Makrakis, V. & Kostoulas-Makrakis, N. , "Interdisciplinary Problem-Based Sustainability Education: The Case of the CLIMASP-Tempus Minor", in Challenges in Higher Education for Sustainability, pp. 15-33, 2016
<http://www.ictinesd.org/unescochair/climasp/methodology/>

BIOGRAPHY



Mervat Nasr: is an Associate Professor of Architecture and Urban Design, Faculty of Engineering, Suez Canal University. I received the MS degree in Architecture Engineering from Cairo University in 1992 and PhD in Architectural Engineering from Cairo University Co-supervision with University of California, Berkeley in 2000. I am member of supervision of several post graduate researches in the field of Architecture and urban design. I am Member of CLIMASP project, "Development of an Interdisciplinary Program on Climate Change and Sustainability Policy", TEMPUS, European Union 2014 - 2017.