Journal of University of Duhok, Vol. 20,No.1(Pure and Eng. Sciences), Pp 64-76, 2017
eISSN: 2521-4861 & pISSN: 1812-7568
https://doi.org/10.26682/sjuod.2017.20.1.6

TRACES OF SUSTAINABILITY PRINCIPLES IN ARCHITECTURE TEACHING PROGRAMS AT SALAHADDIN UNIVERSITY SURVEY AND ANALYSIS OF TEACHING COURSE BOOKS

Dr. MAHMOOD AHMED KHAYAT and CHRA HUNAR AHMED
Dept. of Architecture, University Salahaddin, Kurdistan Region-Iraq

ABSTRACT

The rising importance of the theory and principles of sustainability, and its high influence on architecture practice and education is very clear in a way that the term sustainable has been mentioned many times in the UIA\ UNESCO charter for architectural education (UIA, 2015), it is clearly stated (Architecture for a Sustainable Future) as one of its aims for architecture education.

Traces of this influence can be detected by examining teaching course books of any architecture teaching institution, many western teaching institutions has developed tools for detecting theses influences, the (STAUNCH tool) is used to trace the level of engaging sustainability principles in Salahaddin University teaching program.

The paper managed to elaborate an assessment of Salahaddin University architecture teaching program status in terms of availability of sustainability principles, and raised some notes and recommendation on how to develop teaching programs to go with UIA\UNESCO aim (architecture for a sustainable future)

KEY WORDS: Sustainability, Architecture, Education, UIA, UNESCO.

1. THEORETICAL PART

1.1 Introduction:

Sustainability as a general term promotes the human life and sustains the natural environment; it usually comes with development expression. The most common definition of sustainable development (SD) as stated in BrundtLand Report (1987): "Development that meets the needs of present without compromising the ability of the future generations to meet their own need". Furthermore International Union for Conservation of Nature (IUCN), United Nations Environment Programme (UNEP) and World Wildlife Fund (WWF) in (1991) defined sustainability as: "improving the quality of human life while living within the carrying capacity of supporting ecosystems" and its products **1)** sustainable economy: it maintains its natural resource bases and its continuity through, adaptation, organization, wisdom, technical efficiency, and improvement in knowledge. **2)** Sustainable society: it will be continued through these principles: to begin considering the social life with change in personal attitude for protecting their own environment, in the second place earth conservation in term of diversity and vitality, moreover minimizing the use of non-renewable resources, to conclude developing national and global framework for conservation and promotion.

Defra in (2002) defined some key objectives of SD, as an illustration for its definition and providing better life for now and the future: **1)** the effective protection of environment. **2)** Effective use of natural resources, **3)** the social progressing should meet need of everyone. **4)** The stable level of economy. Additionally, Jones P.et.al in (2011) have defined sustainability, they indicated that it may be conceived as "set of conditions where by human and natural systems can continue indefinitely in a state of mutual well-being securing and survival"

For explaining sustainability in architecture, National Architecture Accrediting Board (NAAB) in (2009) defined sustainability as the capacity to design projects that conserve and optimize built resources, besides reuse natural resources, again it provides healthful environment for occupants in buildings construction, moreover reduces its environmental impacts through means such as bioclimatic design, energy efficiency, and carbon neutral design which will operate the future generations. Further, Ray J. (2000) illustrated that sustainability is obtained through right manner of using energy for human and environment "thoughtful and well-considered use of the energy systems to make buildings more conducive and comfort to human use, and without generating

Journal of University of Duhok, Vol. 20,No.1(Pure and Eng. Sciences), Pp 64-76, 2017
eISSN: 2521-4861 & pISSN: 1812-7568
https://doi.org/10.26682/sjuod.2017.20.1.6

pollutants or borrowing the earth's resources for future generations".

At Environmental Indicator report, Allen Hammond et.al (1995) discussed on the dimensions of sustainability which are concerning the environment, economy, and social pillar, indeed sustainability should consist of minimum interaction between (Environment, Social, and Economy) also they stated that "Any progress toward sustainability thus requires directing policy attention to all three". According to these above definitions sustainability has the same presence in general and in architecture, it promotes the environment, economic and social life. Above all the three pillars of sustainability is the actual fact of the start of understanding sustainability, indeed they will be the pure identified directions for anyone who wants to study sustainability.

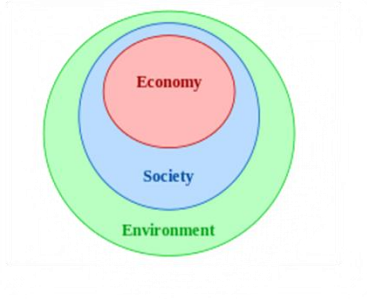

Fig. (1): pillars of sustainability. Source: Scott Cato. M. (2009).

learning and teaching sustainability all over the world which is Education for sustainable development (ESD). (UIA,2015)

So the common definition of ESD: "Education for Sustainable Development (ESD) is a learning process (or approach to teaching) based on the ideals and principles that underlie sustainability and is concerned with all levels and types of learning to provide quality education and foster sustainable human development – learning to know, learning to be, learning to live together, learning to do and learning to transform oneself and society." (UNESCO, 2016), also UNESCO in (2014) made a conference with Japan's government, they determined the decade of Education for Sustainable Development DESD and the conference has based on these objectives: **1)** making agenda for organizing ESD after 2014; **2)** making more activities for SD and decrease its challenges through ESD; **3)** using Education for increasing the quality of lifestyle; **4)** for the better lessons receipting the decade of action.

Indeed, curriculum is the basic element for the architecture education, through assessing the content of curriculum, the true level of sustainable development will be obtained, Zalina Shari1 and Mohd Fakri Zaky (2006) in *Towards a more Sustainable Architectural Education in Malaysia*, study found that reviewing curricula is

"Education is the most powerful weapon you can use to change the world." Nelson Mandela. Education has the great role in humans life, there are many different points between developed and developing countries: developed countries always enjoy the condition of health, education, and employment, more than developing countries, there are 1.1 billion people with lack access to clean water, and 2.4 billion have no quite sanitation all these are the effect of inequality between developed and developing countries. (World watch Institute, 2003)

For understanding and obtaining sustainability in our live, education is a way that preferred by common education agency: United Nations Educational Scientific and Cultural Organization (UNESCO): "Moving towards the goal of sustainability requires fundamental changes in human attitudes and behaviour. Progress in this direction is thus critically dependent on education and public awareness", (UNESCO & Educating for a Sustainable Future, 1997). Union Internationale des architectes (UIA) has developed the contents of architecture education internationally, besides one of its aims is" promote multi-disciplinary exchange; aid in the sustainable development of the built environment". United Nations countries believe that education is the main foundation for improving and achieving sustainability, so they introduced a process of

Journal of University of Duhok, Vol. 20,No.1(Pure and Eng. Sciences), Pp 64-76, 2017
eISSN: 2521-4861 & pISSN: 1812-7568
https://doi.org/10.26682/sjuod.2017.20.1.6

Social:
- Social progression.
- Health.
- Education.

For assessing sustainable development there are many tools that determine the area of contributions on education, such as: RESFIA + D tool, AISHE 2012, SD curriculum scan and STAUNCH tool. Each of these tools have their aspects and criteria that they depend on during the process of assessment, for selecting the proper tool, the research will prepare a comparison table of similarity between the main aspects of the assessment tools and the main aspects of the observed criteria of SD. The table consists of the name of the assessing tools regarding SD with their aspects of criteria, their methods of assessment and the name of developers. the best method for embedding sustainability into architecture education.

Thus promoting sustainability in education will be a way of understanding and obtaining sustainability according to the UNESCO and UIA, further the other definitions of sustainability will be summarized into some points of the observed criteria of sustainable development:

Environment:
- Protect natural environment
- Sustain natural resource.
- Support ecosystem.
- Conservation of earth.
- Minimize non-renewable resource.
- Energy efficiency.
- Less pollution.

Economy:
- Economic growth
- Conserve and optimize the build resource.

Table (1): The main aspects, method and the editor of the tools (reference: gathered by the researcher).

Name of the tool	Main aspects	method	editor
RESEFIA+D	Responsibility, emotional intelligence, system orientation, future orientation, personal involvement, action skills, plus disciplinary competence.	Consists of six competences each of them was divided into three sub-competences, during the application of this tool a group of education management, teaching staff, the students, and professional's field are gathered, for obtaining the consensus result of the assessment.	Roorda 2012 (2012)
AISHE 2012	Objective, people and resources, education, result	The tool was divided into four categories, they have based on self-evaluation of consensus answer of these three questions: 1- objective: what does the study program want to achieve? 2-people resource + education: how does the study program aim to achieve its objectives? 3- result: Does the study program achieve its objective?	Dutch (CDHO) committee on sustainable higher education. (2013) Roorda 2012 (2013).♯
SD curriculum scan	Basics, people, plant, profit.	Including a prepared check list for assessing curriculum, through self-evaluation, the assessor will be enabled to draw a map of curriculum, in which SD topics and its aspects will be realized.	Niko Roorda 2012 (2013)♯
STAUNCH	Economic, environment, social, and cross-cutting themes.	The process of assessment consists of three steps: criteria selection, data collection, analysis of degree.	Rodrigo Lozano 2010 (2013)♯

Table (2): Comparison table of the main aspects of the observed criteria of SD with the main aspects of the tools

The main aspects of the observed criteria of SD	RESEFIA+D	AISHE 2012	SD curriculum scan	STAUNCH
Environment	-	-	-	√
Economy	-	-	-	√
Social	-	-	-	√

Journal of University of Duhok, Vol. 20,No.1(Pure and Eng. Sciences), Pp 64-76, 2017
eISSN: 2521-4861 & pISSN: 1812-7568
https://doi.org/10.26682/sjuod.2017.20.1.6

STAUNCH tool includes all three aspects of the observed criteria of SD; it is used for assessing the curriculum only with the additional dimension (cross-cutting themes). And it will be the method of this research that includes the sustainable development criteria more than the other tools, the tool depends on the course description and course outlines which will be explained in brief in the next part, the practical part of this assessment starts with stating quite information on the tool.

Lozano, R. & Peattie, K. (2007), in Audit of Contributions of Cardiff University Curricula to Sustainable Development they cited number approaches and methods for integrating sustainability in curriculum:

1. Some coverage of some environmental issues and material in an existing module or course.
2. A specific SD course.
3. SD intertwined as a concept in regular disciplinary courses, tailored to the nature of each specific course.
4. SD as a possibility for specialization within the framework of each faculty.

2. PRACTICAL PART:

2.1 STAUNCH tool:

This tool was developed in 2007 by Rodrigo Lozano; it has the system that quantitatively examines the curriculum, it calculates the percentage, level and course contribution to sustainable development, and reports the result by graph and diagram. (International Society of Sustainability Professionals, 2016)

2.1.1 History of the tool: STAUNCH tool is (sustainability Tool for Auditing for University Curricula in Higher Education). It was developed by Rodrigo Lozano, he works at the ESRC funded BRASS Research Centre at Cardiff University, it was invented for systematically auditing the Curricula of Cardiff university, after that spreading from other institutions systems, the tool was used by these institutions:

- In (2011) the United Kingdom Cardiff University under took the assessment of SD contributions in their curricula of study, to all teaching program, by using STAUNCH tool Rodrigo Lozano and Ken Peattie stated that the assessment has been done for 19 curricula in 28 schools for 5,400 course descriptions, the tool; revealed that there are some area that weren't improved for better integration with sustainable development. (Lozano R. &Ken Peattie, 2011)
- In Georgia Institute of Technology (Georgia Tech) for embedding sustainability in Civil and Environmental Engineering (CEE) curricula, they selected the STAUNCH tool for determining the level of efforts, the tool revealed that CEE have medium contribution to SD by analysing 44 course descriptions (Lozano R. & Mary K. W., 2013).
- For overcoming the problem of curricula connection with SD, Francisco J. Lozano & Rodrigo Lozano (2013) in developing new bachelor's for engineering SD selected STAUNCH tool, at Technologic de Monterrey, Mexico. The tool revealed that the curriculum is well balanced with SD dimension with a little bias toward environment dimension.
- Faculty of business and environment at university of Leed, selected STAUNCH tool for auditing curricula for both bachelor and master degrees.

From business faculty 698 course description and 2,063 courses from faculty of environment were analyzed, the tool revealed that the faculty of environment has better contribution than business faculty.

So STAUNCH tool has been used for more curricula of sustainable schools as successful method for assessing SD contribution in to curricula by mapping the issues and principle of sustainability, it was also used by 11 Welsh and Worcester University (Lozano R. Jordi L. & Gary T., 2013).

2.1.2 The Objective of STAUNCH tool:

It has two objectives:

First: if the extent of university curricula modules contributed with education for sustainable development (ESD), the tool systematically assess that.

Second: the assessment use for large quantity of courses.

2.1.3 The Methodology of STAUNCH tool: The methodology consists of number of steps:

2.1.3.1 Criteria selection: has four dimensions (environment, social, economic and crosscutting themes) the tool has 36 criteria for assessing the course description for determining the SD contributions (STAUNCH calculation, available from all the published papers of Rodrigo Lozano of assessing curriculum through using STAUNCH tool). For grading these criteria in any course description, the Tool has Grading system for evaluation:

- **[Blank]:** if the criteria has not been mentioned.
- **Low grade: [1]** if the criteria is mentioned
- **Medium grade [2]** if it contains a brief description of the criteria
- **High grade [3]** if it contains comprehensive description of the criteria.

Table (3): sustainable development contribution and qualitative level, (reference:R.Lozano and Mary. K. W.,2013)

Contribution	Level
0.00	None
0.01- 0.67	Very low

Journal of University of Duhok, Vol. 20,No.1(Pure and Eng. Sciences), Pp 64-76, 2017
eISSN: 2521-4861 & pISSN: 1812-7568
https://doi.org/10.26682/sjuod.2017.20.1.6

0.67- 1.29	Low
1.30- 1.99	medium
2.00- 3.50	High
>3.50	Very high

The calculation of the criteria's in (table 4) in curricula contribution to SD consists of two balances in calculating: **First:** cross cutting calculation among the three dimensions of sustainability environment, social, and economic), its breadth calculation. **Second:** balance between each dimension of these criteria it means (environment, social, economic, and crosscutting themes), its depth calculation.

2.1.3.2 Data collection: depends on course aim, outline, published course, but course documentation doesn't capture.

2.1.3.3 Data input and grading: for selected criteria.

2.1.3.4 Analyzing of degrees.

In analysing step, two kinds of reports will be prepared:

A-summary Report and

B-Detailed Report: (STAUNCH calculation, available from all the published papers of Rodrigo Lozano of assessing curriculum through using STAUNCH tool)

Table (4): Criteria selected to assess curricula contributions to Sustainable Development (Reference:STAUNCH calculation).

Economic	Environment	Social	Cross-cutting themes
1-GNP, Productivity	7-Policy/Administration	17-Demography, Population	28-People as part of nature/Limits to growth
2-Resource use, exhaustion (materials, energy, water)	8-Products and services (Inc. transport)	18-Employment, Unemployment	29-Systems thinking/ application
3-Finances and SD	9-Pollution/Accumulation of toxic waste/Effluents	19-Poverty	30-Responsibility
4-Production, consumption patterns	10-Biodiversity	20-Bribery, corruption	31-Governance
5-Developmental economics	11-Resource efficiency and eco-efficiency	21-Equity, Justice	32-Holistic thinking
6-**Technology improvement**	12-Global warming, Emissions, Acid rain, Climate change, Ozone depletion	22-Health	33-Long term thinking
	13-Resources (depletion, conservation)(materials, energy, water)	23-Social cohesion	34-Communication/ Reporting
	14-Desertification, deforestation ,land use	24-Education	35-SD statement
	15-Ozone depletion	25-Diversity	36-Disciplinarity
	16-Alternatives	26-Cultural diversity (own and others)	37-Ethics/Philosophy
		27-Labour, Human rights	

What is more, the curriculum evaluation depends on the selected criteria of one STAUNCH tool, indeed all selected criteria of the tool were reviewed and the **technology improvement** was added to the economic pillar, **besides the instructor and students evaluations**, after the curriculum evaluation a percentage of SD will be determined within curriculum, further finding the percentage of students that know about this determined SD within the evaluated curriculum, moreover finding the percentage of instructors responsible for this determined SD within the evaluated curriculum. The instructor and students assessment depend on two questionnaires survey. Furthermore, the questionnaires try to evaluate them quantitatively which were derived from the selected criteria of STAUNCH tool and the general questions on sustainability.

Journal of University of Duhok, Vol. 20,No.1(Pure and Eng. Sciences), Pp 64-76, 2017
eISSN: 2521-4861 & pISSN: 1812-7568
https://doi.org/10.26682/sjuod.2017.20.1.6

2.2 The process of assessment: Salahaddin University- Erbil (SU-E) architecture department /engineering college will be the case study of this research, so thirty three course books were gathered as the main data for this assessment, but only twenty four course books contributed to SD, according to the STAUNCH tool the others will be ignored.

Table (5): the names of the contributed courses to the assessment (reference: architecture department).

First Stage	Second stage	Third stage	Fourth stage	Fifth stage
1-architecture design	5-architecture design-A	10-architecture design	13-architecture design	21-architecturedesign
2-graphic	6-Architecture design-B		14-history of architecture	
	7-history of architecture	11-housing and city planning	15-urban design	22-estimation and specification
3-art and architecture		12-history of architecture	16-theory of architecture	23-building physics
			17-Air condition	24-vernacular architecture
	8-building construction		18-architectural environment	
4-academic debate & critical thinking	9-planning principles		19-landscape design	
			20-interior design	

Architectural environment course book, a subject of fourth stage, has been illustrated in this paper in detail as an example of its assessment method. According to the methodology of STAUNCH tool for each course book the place, dimension, and level of strength of the selected criteria will be determined. So for indicating a clear picture of any criteria of the tool on ***architectural environment course book*** the research designed a code in which the criteria's dimension and level of strength will be illustrated. For indicating the criteria's dimension on the course books: the code takes the first two letters of the dimensions with the number of its criteria, for example (GNP, Productivity) first criteria of economic dimension, Ec1 will be its code, so the other criteria were determined on the below table:

Table6: reformed selected Criteria for evaluating architecture curricula regarding to SD.

Economic	Environment	Social	Cross-cutting themes
EC1-GNP, Productivity	En1-Policy/Administration	So1-Demography, Population	Cr.Cu1-People as part of nature/Limits to growth
EC2-Resource use, exhaustion (materials, energy, water)	En2-Products and services (Inc. transport)	So2-Employment, Unemployment	Cr.Cu2-Systems thinking/ application
EC3-Finances and SD	En3-Pollution/Accumulation of toxic waste/Effluents	So3-Poverty	Cr.Cu3-Responsibility
EC4-Production, consumption patterns	En4-Biodiversity	So4-Bribery, corruption	Cr.Cu4-Governance
EC5-Developmental economics	En5-Resource efficiency and eco-efficiency	So5-Equity, Justice	Cr.Cu5-Holistic thinking
EC6-technology improvement	En6-Global warming, Emissions, Acid rain, Climate change, Ozone depletion	So6-Health	Cr.Cu6-Long term thinking
	En7-Resources (depletion, conservation)(materials, energy, water)	So7-Social cohesion	Cr.Cu7-Communication/Reporting
	En8-Desertification, deforestation ,land use	So8-Education	Cr.Cu8-SD statement

Journal of University of Duhok, Vol. 20,No.1(Pure and Eng. Sciences), Pp 64-76, 2017
eISSN: 2521-4861 & pISSN: 1812-7568
https://doi.org/10.26682/sjuod.2017.20.1.6

En9-Ozone depletion	So9-Diversity	Cr.Cu9-Disciplinarity
En10-Alternatives	So10-Cultural diversity (own and others)	Cr.Cu10-Ethics/Philosophy
	So11-Labour, Human rights	

The level of strength of any criteria various colors will be used for each of them, the levels of strength are:

- **[Blank]:** ignored, indicating that a particular issue is not mentioned.
- **Low grade**: [1] Mentioned, the issue is mentioned, but no explanation is given on how it is addressed.
- **Medium grade**: [2] Described, the issue is mentioned and there is a brief description on how it is addressed.
- **High grade**: [3] Discussed, there is a comprehensive and extensive explanation on how the issue is addressed.

According to the SD qualitative level in (table3), the very low and very high levels will be ignored, because they don't have the descriptions of strength, the other four levels will be determined on the course book by these color indications:

None: no color
Low: yellow color
Medium: green color
High: red color

So for determining each criteria on this course book, the code and the underlined color will be determined, the assessment of ***Architectural course book*** will be:

1. Course overview:

Due to global warming crisis, it is wise for architects and architectural professionals to design buildings responding to the sever climatic changes depending upon advancement in technological issues in building materials properties. It is important for students to understand about the effect of climatic elements on buildings; then to design their buildings to save energy in one hand and maintain human comfort in another hand.

- Climatic elements, thermal properties of building material, concepts of thermal energy reduction through application of different natural phenomena; all these to be applied in building designs to maintain an take benefit of renewable energies and working within sustainable design through application of most of sustainability or green building rating system.
- Students must be aware how to implement all above facts and phenomena in there futuristic design to preserve the natural non-renewable energy resources for other generations and economize all projects with an optimum expenditure of energy consumption and maintaining human comfort climatically at the same time.

2. Course objective:

- Students must be familiar with all climatic elements.
- To understand the relation between climatic elements with building envelop design.
- To get information about renewable energies.
- To learn and understand technological advancement in building technologies to be capable for maintaining climatic human comfort within nil energy consumption or minimal use of energy.
- Different application on usage of passive solar energy system methods on examples of building designs to initiate a variety of building designs and advanced concepts with innovative solutions.
- To manipulate building designs to all climatic elements as thermal transmission, wind benefits for natural ventilation, openings configuration design due to sun light needs functionally, avoidance of rain water and dampness on buildings.

3. Student learning outcome:

- Knowledge about all climatic elements.
- Learning about principles of heat transmission through building envelopes.
- Learning about passive solar energy consumption methods.
- Learning about natural lighting design principles.
- Learning about natural air movement and natural ventilation in building design.
- Implementation of stack effect phenomenon on building design.
- Design climatic principles application on buildings.
- Preparation of students for practical life projects applications concerning climatic principles and concepts.

Journal of University of Duhok, Vol. 20,No.1(Pure and Eng. Sciences), Pp 64-76, 2017
eISSN: 2521-4861 & pISSN: 1812-7568
https://doi.org/10.26682/sjuod.2017.20.1.6

• Learning about sustainability and green building principles and rating systems applied on building to minimize energy consumption or reduce it as much as possible.

4. Theoretical topic:

Week 1: Introduction, course outline.
Week 2: Sustainability, definition, requirements and applications.
Week 3: Green Architecture, definition, requirements and applications.
Week 4: Main climatic elements: Radiation, air temperature, air movement, humidity.
Week 5: Climatic design: cold zone climatic design, hot zone climatic design, building materials ´heat capacity, natural ventilation, cooling by evaporation.
Week 6: heat balance: heat regulation (heat exchange by radiation\heat exchange by convection\heat loss by evaporation.
Week7: Heat comfort: heat comfort zone, equation of heat comfort zone.
Week8-9-10: Thermal properties of building materials: heat conduction, radiation, heat convection, heat capacity.
Week11-12: Heat insulation: insulation materials properties, location of insulation materials, total heat transmission, calculation of heat transmission coefficient.
Week13: Mid-Semester exam.
Week 14: Air movement configuration in spaces: Air movement:

1. Air movements within buildings; because of (heat force).
2. Air movements within buildings due to outer wind force.
Week 15: natural ventilation; Hygienic benefit, Natural ventilation for human comfort.
Week 16-17: Architectural elements as aids to control natural ventilation:
- Orientation, cross ventilation, initiated cross ventilation, vertical location of window, way of opening window, inner partition design, wire mesh on window, general location of building on sit
Week 18: Air movement examples.
Week 19, 20: Wind catchers: Concept, Types (Iraqi, Iran, Egypt, Afghanistan, India, Emirates).
Week 21: Day lighting & properties: (intensity/ reflection/ glare types)
Week 22-23: shading devise: (horizontal /vertical /compound)
Week 24-25: Passive solar energy (concepts +types)
Week 26: Active solar energy: (concepts +types)
Week 27: Midterm exam.
Week 28-29-30: students final report presentations and discussion.

5. Practical topics:
In this section, the lecturer shall write titles of all practical topics he/she is going to give during the term. This also includes a brief description of the objectives of each topic, data and time of the lecture

Table (7): the evaluation template (reference: from the STAUNCH tool and SU-E Arch. Dep. Gathered by researcher).

Course code	Name of criteria of the course book	Selected criteria of STAUNCH tool	Grading system			
			None	**Low**	**medium**	**High**
		Economic				
AE404 Fourth stage	Energy, materials, water.	**Ec**2-Resource use, exhaustion (materials, energy, water)		**1**		
	technological advancement	**Ec**6-Technology improvement		**1**		
		Environment				
	Global warming, climate change.	En6-Global warming, Emissions, Acid rain, Climate change, Ozone depletion		**1**		
	Materials, energy.	En7-Resources (depletion, conservation) (materials, energy, water).				**3**
		Social				
		Cross-cutting themes				
	Sustainability,	Cr.Cu8-SD statement				**3**

Journal of University of Duhok, Vol. 20,No.1(Pure and Eng. Sciences), Pp 64-76, 2017
eISSN: 2521-4861 & pISSN: 1812-7568
https://doi.org/10.26682/sjuod.2017.20.1.6

sustainable design.

So this process of assessment will be applied on the contributed course books of the case study and the total result of the assessment will be:

2.3 The curriculum results:

Through the prepared assessment code and color each course book was assessed and the final results of all of them were summarized for each selected criteria of the tool as well as for the pillars which including: environment, economic, social and cross cutting themes.

Table (8): The number of the course contributions. (Reference: the researcher).

No. of course contribution	total taken course	Contributed courses (%)
24course	33 course	73%

Table(9): The frequency percentage of SD pillars. (Reference: the researcher).

course contributions	economic frequency	environment frequency	social frequency	cross-cutting themes frequency
0.2	16%	40%	18%	26%

Table (10): The frequency of SD pillars within the module of description. (Reference: the researcher).

economic	environment	social	cross-cutting themes
24.7	60.5	27.4	38.5

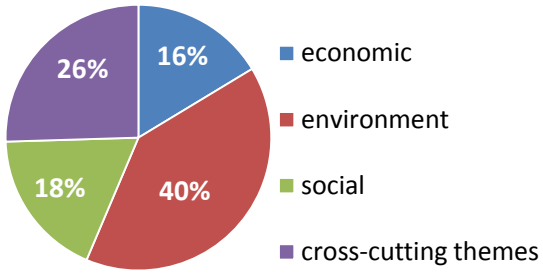

Fig.(3): the frequency of SD pillars within the module of description, (reference: the researcher).

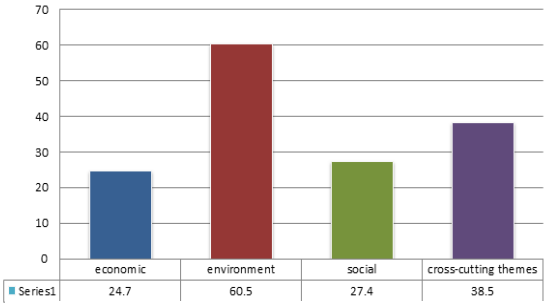

Fig. (4): the frequency of SD pillars within the module of description, (reference: the researcher).

Table (11): the statistical calculations of the assessed courses contributions..

No.	Year	Course code	Subject name	Economic	Environment	Social	Cross-cutting	Total	Course contribution	Level
1	First stage	AE101	Architecture Design	1	2.5	0	0	3.5	0.09	very low
2		AE102	Graphics	0	0	0	1.2	1.2	0.03	very low
3		AE103	Descriptive Geometry	0	0	0	0	0	0	Non
4		AE104	Freehand	0	0	0	0	0	0	Non
5		AE106	Art and Architecture	0	0	0	1	1	0.03	very low
6		AE108	Computer & Programming	0	0	0	0	0	0	Non
7		No code	Academic Debate	1	0	1	6.4	8.4	0.2	very low

		Total		**2**	**2.5**	**1**	**8.6**	**14.1**	**0.35**	**Very low**
8	Second	AE201b	Architectural design	0	0	1	0	1	0.03	very low
9	stage	AE201a	Architecture design	0	2	1	1	4	0.1	very low
10		AE202	Geometric perspective	0	0	0	0	0	0	Non
11		AE203	History of architecture	0	2	1.2	0	3.2	0.09	very low
12		AE204	Mechanic and structure	0	0	0	0	0	0	Non
13		AE205	Freehand drawing	0	0	0	0	0	0	Non
14		AE206	Building construction	1	3.5	0	0	4.5	0.1	very low
15		AE207	Planning principles	0.5	5.5	4	5	15	0.4	very low
16		AE208	Computer application	0	0	0	0	0	0	Non
		Total		**1.5**	**13**	**7.2**	**6**	**1.5**	**0.72**	**Very low**
17	Third	AE301	Architecture design	0	1	0	2	3	0.08	very low
18	stage	AE302	Concrete design	0	0	0	0	0	0	Non
19		AE303	Housing and city planning	1.2	6	1	2.2	10.4	0.2	very low
20		AE306	History of architecture	0	0	1	0	1	0.03	very low
		Total		**1.2**	**7**	**2**	**4.2**	**14.4**	**0.31**	**Very low**
21	Fourth	AE401	Architecture design	0	2	0	0	2	0.05	very low
22	stage	AE402	History of architecture	1	2	1.2	1.2	5.4	0.14	very low
23		AE403	Urban design	2	7	4.5	5	18.5	0.5	very low
24		AE404	Architectural environment	3	11.5	2.5	4	21	0.6	very low
25		AE405	Air condition	0	2.5	0	0	2.5	0.07	very low
26		AE406	Theory of architecture	0	0	1	0	1	0.03	very low
27		AE407	Landscape design	1	0	0	0.5	1.5	0.04	very low
28		AE407	Interior design	1.5	0	0	4	5.5	0.1	very low
		Total		**8.5**	**25**	**9.2**	**14.7**	**57.4**	**1.53**	**Very low**
29	Fifth	AE501	Architectural design	6.5	6	2.5	3	18	0.5	very low
30	stage	AE502	Thesis	0	0	0	0	0	0	Non
31		AE503	Estimation &specification	1.5	0	0	0	1.5	0.04	very low
32		AE504	Electives	0	5	2.5	2	9.5	0.3	very low
33		AE506	Vernacular architecture	3.5	2	3	0	8.5	0.2	very low
		Total		**11.5**	**13**	**8**	**5**	**37.5**	**1.04**	**Very low**
		Total		**24.7**	**60.5**	**27.4**	**38.5**	**131.6**	**3.95**	**very low**

For assessing the instructors and students of SU-E architecture department two questionnaire tools were prepared that are assessed quantitatively, the questionnaire were taken from the general definitions of SD and its pillars, also some questions were taken from the selected criteria of STAUNCH tool, after gathering the response, all the assessment are represented with each other.

2.4 The instructor response:

For assessing the instructor knowledge on SD, a questionnaire survey was made for all of them but only twenty two responses were returned, actually the questions are**:**

Journal of University of Duhok, Vol. 20,No.1(Pure and Eng. Sciences), Pp 64-76, 2017
eISSN: 2521-4861 & pISSN: 1812-7568
https://doi.org/10.26682/sjuod.2017.20.1.6

Question 1: **Please indicate if you are interested in sustainability?**

All of them indicated yes, just two instructors indicated partially.

Question 2: **Have you obtained an academic background related to sustainability?**

64% have it, 36% didn't have it.

Question 3: **Would you like your subject courses to be contributed with**

sustainability?

All, yes.

Question 4: **Do you believe that sustainability is related to your subject courses?**

68% yes, 9% no, 23% maybe.

Question five: **Have you participated in any training, conference, academic qualification that was related to sustainability?**

50% participated, 50% didn't participate.

Question six**: Do you believe that sustainability is integrated with curriculum of architecture department from- SUE?** 23% yes, 14% no, 63% partially.

Question seven: **Have you read any document on sustainability that was related to your subject area?**

64% yes, 27% No, 9% don't know.

Question eight: **Do you think that these items are related to your subject areas?**

69% relevant, 20% irrelevant, 11% don't know.

Developmental economics, Resources (depletion, conservation) (materials, energy, water), Social cohesion, Equity/ Justice, Ozone depletion, Disciplinarily, Holistic thinking, Ethics/Philosophy, Diversity, Poverty, Demography/Population, Biodiversity, Global warming/Emissions/Acid rain/ Climate change/Ozone depletion

Question nine**: if the instructors have this power to prepare sustainable student mentally and practically?**
54% yes, 23% No, 23% don't know.

The answer of these questions should be, the instructors were interested in sustainability, they had an academic background on sustainability, they would try to contribute their subject course to SD, for question four they should select yes, it is better to participate in training course or workshops on sustainability, for question six they should select partially, if they select yes for question seven is better than other choices, besides all the items of question eight are relevant, finally for question nine yes is better than the others. The right responses of the instructors are all summarized and divided by the number of questions in order to find their average knowledge of quantitatively.

2.5 The student's response:

For assessing the students' knowledge on SD and calculating the percentage of learners among them a questionnaire was designed for this purpose allocated on all the students of the five stages of the department, who are more than 200 students, but only 151 responses were retuned.

Question 1: **Have you heard about sustainability?**
85% yes, 15% no.

Question 2: **What is sustainability?**
42% know, 58% don't know.

Question 3: **What are the pillars of sustainability?**
17% know, 83% don't know.

Question 4: **Have you read any references on sustainability?**
36% yes, 64% no.

Question 5**: Have you heard these terms in your academic studying courses? If yes, could you write the subject area?**

The terms are: Water efficiency, Ozone depletion, Holistic thinking, Social cohesion, Demography/ population, Deforestation, Accumulation of toxic waste, Limits to growth, Sustainable development statement, Consumption pattern, and Gross national productivity.

41% yes, 59 no.

Journal of University of Duhok, Vol. 20,No.1(Pure and Eng. Sciences), Pp 64-76, 2017
eISSN: 2521-4861 & pISSN: 1812-7568
https://doi.org/10.26682/sjuod.2017.20.1.6

The student's response should be they heard about sustainability, indeed they should have this ability to define sustainability, moreover the pillars of sustainability, also they should have read the references, finally know this given terms of SD from question five which all should be yes. Their responses were calculated by summarizing their choices and divided by the number of questions and number of student from each stage in order to obtain the average percentage of their knowledge.

2.6 The results:

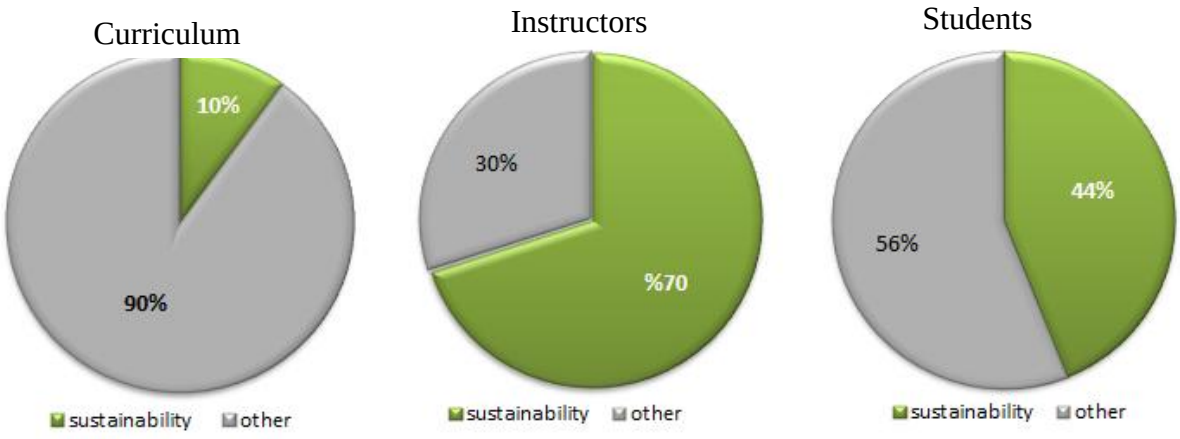

Fig (5): SU-E architecture curriculum, student and instructors quantitative contribution to sustainable development. (Reference: the researcher).

The result of this research is that 10% of SU-E architecture curriculum is contributed to SD, as follows 44% of the student of this department knew about this determined contribution of the curriculum regarding to SD, accordingly 70% of the instructors of the department are responsible for teaching this determined contribution of the curriculum to SD besides the determined percentage of students knowledge on SD.in other word 10% of the curriculum is sustainable, as well as 44% of student are at the very low level of understanding of sustainability, in particular 70% of instructors try to teach student by very low level of SD while 44% of them have learned this level of SD now.

3. CONCLUSION

Sustainable development has this importance to be embedded into the architecture education, for improving this integration assessing the architecture curriculum was preferred. Indeed STAUNCH tool as a certified assessment tool for SD within the curriculum was used for assessing SU-E architecture curriculum quantitatively and qualitatively, the tool was partially changed by adding one criteria beside increasing the student and the instructor evaluation.

Through the result of the assessment, the architecture curriculum of SU-E has very low effect of SD which is only 10% of the curriculum, which including (16%) economic, (18%) social, (40%) environment and (26%) of cross-cutting themes. This determined level is the average of all five stage of the department while each stage could determine specifically through it, besides the percentage of SD contribution in each course books also will be deducted, as well as this assessment can develop some area of curriculum which haven't contributed to SD, as an illustration the names of the SD criteria which have penetrated to the curriculum were available with these criteria that haven't been mentioned within the curriculum.

Accordingly 44% of student of this department knew sustainability by very low level according to this assessment, the knowledge of student from each stage could be determined through this research within comparison table, with determining the shortcoming of their knowledge,

but in this paper only the average knowledge which is very low level of them was denoted.

As a sequence 70% of the instructors teach sustainability while their catchment level were 44% of students, further their teaching curriculum was at low level of contribution to SD and it was only 10% of the curriculum. To sum up, the instructors of this department should improve their curriculum of education regarding to SD, and selecting the proper strategies of integrating sustainability in to the main courses of the curriculum such as: theory/history, studio, technology, and professional practice, then organizing the academic seminars as well as workshops on sustainability for not only the instructors but also the students of the department.

REFERENCE

- DEFRA (2003) Achieving a better quality of life: Review of Progress towards Sustainable Development, Government Annual Report 2002. London: Department for the Environment, Food and Rural Affairs.
- Dutch committee & Niko R. (2013). Assessing sustainability and social responsibility in Higher Education Assessment Frameworks Explained. In: Piternel B., ed. Sustainability assessment tools in higher education institutions, Springer , New York, P:(121-139)
- Francisco J. Lozano & Rodrigo Lozano (2013), Developing the curriculum for a new Bachelor's degree in Engineering for Sustainable Development. Published in: journal of cleaner production. February 2014.
- Hammond A.et.al, (1995), Environmental Indicators, world resource institute. Library of Congress Catalog Card No. 95-060903.
- International Society of Sustainability Professionals (2016), STAUNCH© (Sustainability Tool for Auditing for University Curricula in Higher-Education), in: http://www.sustainabilityprofessionals.org/resources/staunch%C2%A9-sustainability-tool-auditing-university-curricula-higher-education accessed in 27/04/2016
- IUCN/UNEP/WWF, Caring for the Earth: A Strategy for Sustainable Living, Gland, Switzerland (1991), p10. http://www.uow.edu.au/~sharonb/STS300/sustain/meaning/defarticle2.html Access (2016/04/12).
- Jones, P, Selly, D., Sterling, S. (2010).More than the sum of their Parts? Interdisciplinary and Sustainability. In: jones, P, Selly, D., Sterling, S. (eds).sustainability Education: Perspective and Practice across Higher Education. London: Earthscan.
- Lozano, R. & Peattie, K. (2007). Audit of Contributions of Cardiff University Curricula to Sustainable Development. Maribor, Slovenia: International Advanced Research Workshop on HESD.
- Lozano R. &Ken Peattie (2011), Assessing Cardiff University's Curricula Contribution to Sustainable Development Using the STAUNCH(RTM) System, published in: SAGE, Vol 5(1): 115–128.
- Lozano R. (2013), Diffusion of sustainable development in universities' curricula: an empirical example from Cardiff University, Journal of Cleaner Production, 18(7), 637-644, 2010. doi: http://dx.doi.org/10.1016/j.jclepro.2009.07.005
- Lozano R. & Mary. K. W., (2013), Assessing sustainability in University curricula: case studies from the University of Leeds and the Georgia Institute of Technology, S. Caeiro et al. (Eds.). Switzerland: Springer international publishing.
- Lozano R. Jordi L. & Gary T. (2013), developing a university sustainability report: experiences from the University of Leed, In: Lozano, R. Jordi L. & Gary T., ed. Sustainability assessment tools in higher education institutions, Springer, New York, P:(189-205)
- NAAB, National Architecture Accrediting Board, (2009). NAAB conditions for Accreditation. New York: AIA.
- Roorda N. (2012).Fundamental of sustainable development. London: Routledge.
- Roorda N. (2013b), a strategy and a toolkit to realize system integration of sustainable development (SISD). In: Niko Roorda, ed. Sustainability assessment tools in higher education institutions. Springer, New York, P: (101-121).
- Ray-Jones, A. (Ed.). (2000) Sustainable Architecture in Japan: The Green Buildings of Nikken Sekkei. GB: Wiley-Academy.
- Shari Z. & mohd fakri, (2006), towards a more sustainable architectural Education in Malaysia. Paper, published from: ALAM CIPTA, Intl. j. on sustainable tropical research & practice, vol.1, 2006.
- United Nations Educational, Scientific and Cultural Organization UNESCO & Educating for a Sustainable Future (1997), EPD-97/CONF.401/CLD.1.
- UNESCO, (2014). World Conference on Education for Sustainable Development - Learning Today for a Sustainable Future. Access in 2016/ 04/ 17, from: https://sustainabledevelopment.un.org/index.php?page=view&type=13&nr=466&menu=1561.
- Union of International Associations UIA, (2015), Aims. Open Yearbook. Access in 2017/02/13, from: http://uia.org/s/or/en/1100066265.
- UNESCO, Education for Sustainable Development Unit (ESD), (2016), access in 2016/04/17, from:http://www.unescobkk.org/education/esd-unit/definition-of-esd.
- Worldwatch Institute (2003) Vital Signs 2003, New York: W.W. Norton and Co.
- World Commission on Environment and Development Report: Our Common Future (1987), UN Documents, http://www.un-documents.net/wced-ocf.htm.

Journal of University of Duhok, Vol. 20,No.1(Pure and Eng. Sciences), Pp 64-76, 2017
eISSN: 2521-4861 & pISSN: 1812-7568
https://doi.org/10.26682/sjuod.2017.20.1.6