Towards Sustainable Future: Green Courses Imbedded into Higher Education Institutions' Curriculums

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Abstract: This research accents the importance of higher education, which exists for creation and dissemination of knowledge, and its contribution to the societies' sustainable development, and the role the institutions play in this process by imbedding green courses into their plans of study. Via studying an example of a green course that was integrated into an institution's curriculum and analyzing the course's assessment methods and its learning outcomes, which were aligned to the institution graduate attributes, the paper acknowledges the efforts the higher education institutions make to graduate young people that are equipped with knowledge and practical skills in the corresponding field, and, thus, in formation of a new generation of citizens with a sustainable vision.

Key-Words: Higher education, Green curriculum, Graduate's attributes, Heritage conservation, Sustainable future.

1 Introduction

This research emphasis the role higher education (HE) plays in sustainable development process.

Nagoya Declaration [1] proclaims:

"With this declaration, we call upon world leaders to support the transformative role of higher education towards sustainable development, and commit to work together and further promote transformative learning and research by encouraging multi-stakeholder, multi-sector partnership, communicating examples of sustainable practices, promoting broad and strong leadership and public awareness of the values of sustainable development, and recognizing the essential role and responsibility of higher education institutions towards creating sustainable societies."

Hence, according to Cortese [2] HE institutions are responsible for increasing the awareness, knowledge, skills, and values of the present generation that will take the responsibility for the creation of the sustainable future for the generations to come. Shepard [3] also acknowledges the impact of the HE institutions on sustainable development and states that one of the means of contribution is via integrating specialized courses into the plan of study, or how he puts it - "greening the curriculum". Henceforth, to contribute to the sustainable development, the Department of Architectural Engineering at the College of Engineering in Dhofar University (Salalah, Sultanate of Oman) also started "greening the curriculum' of the Interior Architecture major by introducing a new green course Special Topics in Architecture (STIA) - Green Design. The course is an independent major elective and covers a specific topic suggested by a faculty member (course instructor). STIA – Green Design has been taken for study in this research, wherein its learning outcomes and especially the final project, where students suggested a green method of built cultural heritage conservation were analyzed.

The paper presents the results of the research and is composed of six parts starting with the introductory (1) and chapter 2, where the literature review explores the role of HE in sustainable development, educational approaches applied by the institutions e.g. integration of green courses into the plan of study, and explores the relationship between sustainable development and cultural heritage conservation. The following chapter 3 formulates the problem and explains the methodology of the research. Forth chapter describes the course STIA – Green Design taken for study, its objectives, learning outcomes assessment methods, and also describes the course final project and provides samples of students' works. Chapter five discusses

the evaluation of students' works and the assessment of the course final project's learning outcomes. Last chapter (6) concludes the results of the research, presents the findings and recognizes the extent of the course contribution to the sustainable development.

2 Higher Education for Sustainable Development

Quality Assurance Agency for Higher Education, UK [4] explains education for sustainable development as a procedure of students' training while providing them with the knowledge and understanding, skills and attributes in the field of sustainability. This procedure guides students to develop a new style of working and living that suggest environmental, social and economic present and future stability. And, in this training process HE institutions play the main role. They, as knowledge's providers, graduate students that are capable of critical thinking, problem solving, meeting the speedily changing demands of the society. Hence, HE institutions' graduates, as future alumni, employees, citizens, mentors of the generations to come, trained in the field of sustainability can take the responsibility of safeguarding the environment [4].

Education for sustainable development should become a propulsive force that will stimulate graduates to think not only about the emergent current satiations, but future ones too. To achieve this future vision, long-term efforts in transformation of the education system at all levels are required [2]. A persistent system of education, which integrates research and service to the local community (for making it economically secure and environmentally friendly, healthier and socially vibrant) into curriculum, guarantees graduates with sustainable development vision [2].

Cortese's [2] opinion is that HE institutions' programs of study should be designed to provide students with a clear understanding of the following doctrines: a) Humans are not the dominant species and are not separated from the nature, but an integral part of it; b) The resources of the Earth are free, but not unlimited; c) Planet's ecosystems can't easily recover themselves from the impact of the humans' activities; d) Not all of the humans' and society's problem can be solved via technological development; e) Not all humans' needs can be satisfied through material means; and f) The achievement of an one single person directly depends on the well-being of the community and Earth's life supporting ecosystems.

In education for sustainable development the teacher, who is an architect of the learning environment that motivates widespread social changes, plays a crucial role [3]. The learning environment created by the teacher should be authentic, enable students to link their knowledge/skills to the real-life problems locally and globally, and suitable for exploring and evaluating sustainability practice within the institution and community. As a part of learning experience, e.g. students can work for their community (and within the community), on real-world projects while solving real problems. On the other hand, the learning environment should provide an opportunity for the students to freely express their individual opinion about sustainable development and share it with others [4]. It is also essential that the teachers are high professional academics and researchers, who are well-equipped with knowledge, are dedicated to idea of sustainable development and keen on educational system transformation [5].

Johnston [6] in his report describes the Talloires Declaration, which is an international agreement signed by 350 university presidents in over 40 countries. The declaration calls to take actions for implementing sustainable practices into HE institutions and aims to: a) reverse the environmental damage; b) reorient research activities and c) enhance outreach in colleges and universities [6]. There are also other platforms such as International Sustainable Campus Network (ISCN) and the Global Higher Education Sustainability Partnership (GHESP) that provide the institutions with opportunities to exchange their practices in sustainability integration [6].

An E-learning approach for sustainable education proposed by Barth & Burandt [7] offers HE opportunities to design powerful constructivist learning environments, which includes teacher-learner centered pedagogies, is input-to-output oriented and focuses on problems solving [7].

Creating green campuses and curriculums, designing E-learning environments are definitely positive steps towards stainable development, but a systematic approach to embedding sustainability is required [6]. Transformation of the HE institutions education system and its orientation towards sustainable development is a continuous process that requires long-term efforts; nevertheless there are advantages of doing so. The institution will benefit by having: 1) graduates, who are prepared for citizenship and future career; 2) increased external

respect; 3) reduced economic, social and environmental costs; 4) augmented cooperation and satisfaction across the institution. In addition to that, the increased respect of the institution will result in attracting more students, professional teachers, funds and the most important – will fulfill the HE's moral and social responsibilities [2].

2.1 Heritage Conservation as a Constituent of Sustainability Concept

According to the Council of Europe [8] the concept of sustainable development is rather associated with natural resources protection than with built cultural heritage conservation.

Furthermore, there isn't any clear separation between 'nature' and 'culture' because humans live within the nature and constantly interact with it. Therefore, along with the natural heritage, the built cultural heritage, which is also a non-renewable recourse, must be handed on to the future generation. This will retain the continuity between past, present and future [8].

As stated by United Nations Istanbul Declaration on Human Settlements [9]:

"…conservation, rehabilitation and culturally sensitive adaptive reuse of urban, rural and architectural heritage are also in accordance with the sustainable use of natural and human-made resources".

ICOMOS specifies in its Concept Note for the United Nations Agenda 2030 and the Third United Nations Conference on Housing and Sustainable Urban Development [10] that, Built Cultural Heritage and Historic quarters of cities contribute to the sustainability of the cities: the buildable footprint in the historic areas is minimal, because they are dense, compact and design for people (walks) not for cars; adaptive reuse of existing buildings, quarters, fabrics is ecological and resources' saving; traditional construction methods, technologies and materials, if still available and relevant, are energy saving and the most suitable for the climate of the region. Traditional knowledge and accumulated wisdom used for ecosystems management, e.g. disaster risks lessening, have already contributed to the environmental sustainability of the locality and are motivating forces for future resilient cities attainment [10].

Murray [11] considers that sustainable development and built cultural heritage conservation are tightly interconnected with each other and that the most environmentally friendly building is the one that do not have to be built because already exists [12]. The conservation of the built cultural heritage is a vital part of societies' sustainable development [13], [14].

Due to certain conditions and challenges in the currently existing socio-economic, environmental and political framework, the association of cultural conservation with sustainable development became noticeable. The recognition of the emerging problems in urban conditions and speedily urbanization calls to change the concept of sustainable development to be more humanistic and ecologically oriented. In achieving this goal of concept reorientation heritage plays a crucial role as a creator of humanistic, ecological and sustainable city [10].

Hence, the integration of heritage conservation courses, which are a constituent of "greening the curriculum" process, into HE institutions' plan of study will create a new generation of graduates that have knowledge and practical skills in corresponding field and are capable to contribute to the formation of more humanistic, ecologically healthy and sustainable cities [15], [16].

3 Problem Statement and Research Methods Description

3.1 Problem Statement

Education for sustainable development is already present in various HE institutions' programs and educators who are willing to boost students' learning in this context usually find ways of doing it [4]. As previously mentioned, one of the ways the HE institutions can contribute to the sustainable development is 'greening the curriculum' or on the other words imbedding green courses into the plan of study. Henceforth, it is important also to find methods to assess the contribution of those green courses to sustainable development.

3.2 Research Methods Applied

This research is composed of two phases a) assessment of the course's STIA – Green Design final project's learning outcomes; and b) valuation of the course contribution to the sustainable development.

For this course, which has been first offered in spring semester 2014 – 2015, were registered four students (year three and four). The course is composed of theoretical modules and practical – final project, which is evaluated in this research. The final project comprises four stages. During the first stage (S1) of the project the students were working on site - taking measurements, photographs

and examining the given building. The second stage (S2) resulted with building's drawings, where the original layout and exterior view were reproduced. The third stage (S3) required building assessment against to criteria: physical conditions and green design. For the last stage (S4), a green building design for its renovation and conservation was required.

Table 1 STIA - Green Design course learning outcomes and assessment methods

LO**	Assessment methods*							
	S 1	S 2	S3	S4	PI	IPS	IF	Total
	10	10	10	15	15	20	20	100
Knowledge								
K1				3	2	1	1	7
K2			3			1	1	5
K3	2	2				1	1	6
K4	2	2				1	1	6
K5				2	3	1	1	7
Cognitive skills								
CS1				2	2	2	2	8
CS2			3			2	2	7
CS3	2	2				2	2	8
CS4	2	2				2	2	8
CS5				2	2	2	2	8
General competencies								
GC1				2	2	1	1	6
GC2			2	2	2	1	1	8
GC3	1	1				1	1	4
GC4	1	1				1	1	4
GC5			2	2	2	1	1	8
Total	10	10	10	15	15	20	20	100

*Abbreviations: LO – Learning outcome; S1 – stage 1; S2 stage 2; S3 – stage 3; PI – performance improvement; IPS – interventions on plan scheme; IS – intervention on facade

**Learning Outcomes

KNOWLEDGE

K1 – Collect knowledge in sustainable (green) design
K2 – Recognize green buildings assessment methods
K3 – Examine local traditional architecture
K4 - Distinguish conservation techniques
K5 – Present green building design solutions

COGNITIVE AND PRACTICAL SKILLS

CS1 – Apply green design concepts to solve practical problems
CS2 – Demonstrate the ability of green buildings assessment
CS3 – Contribute to the recognition of local traditional architecture by the community
CS4 – Contribute to the heritage conservation
CS5 – Effectively utilize life-long learning skills to promote sustainable design

GENERAL COMPETENCIES

GC1- Understand the importance of country sustainable development
GC2 - Motivate the community to build green buildings
GC3 - Stimulate traditional architecture employment
GC4 - Inspire conservation of built heritage
GC5 - Encourage community for green design

The total duration of the project was sixteen weeks (the whole semester) and by the end of the semester the students were asked to submit their proposed green conservation design composed of a set of drawings containing building's floor plans (scale 1:50), two sections (scale 1:50), elevations (scale 1:50), details (scale 1:5), exterior and interior 3Ds, living systems, as well as a project report and posters, which were presented to the jury.

The learning outcomes of the final project, which are aligned to the course learning outcomes (which are subsequently aligned to the university graduate attributes), are divided into three categories: 1) Knowledge; 2) Cognitive Skills; and 3) General Competencies. They are listed and explained in table 1, which is given bellow.

The assessment methods applied to evaluate the learning outcomes are: Stage 1 (S1); Stage 2 (S2); Stage 3 (S3); Stage 4 (S4); Intervention to the original plan scheme (IPS); Intervention to the original façade (IF) and level of performance improvement (PI).

4 Selected for Study Green Course Description

As mentioned above STIA - Green Design is three credit hours course.

The course introduces Green building design as an indispensable mechanism for efficient resources consumption. The terms such as sustainability and ecology are studied. Building green rating systems as well as green buildings evaluation methods are studied. The course also educates students in built cultural heritage conservation with the emphasis on green methods application. The students study local traditional construction techniques, materials and legislation on heritage conservation.

The course combines theoretical and practical modules, wherein the learning outcomes of the theoretical module are assessed through quizzes and a midterm exam. The final project of the course, where the studied theory is practically applied, assesses both modules – theoretical and practical.

4.1 Course's Final Project Description

The aim of the final project given to the students for the course STIA – Green Design was to apply the gathered theoretical knowledge in green design and built heritage conservation methods on a real-world project. The students were requested to suggest a green conservation method for an old traditional residence. The dwelling (Figure 1), which was selected for the project is situated in Al Haffah district, which is an old area of Salalah city of Dhofar region in Sultanate of Oman. Al Haffah runs

along the coast of the Arabian Sea and consists of old residences and a traditional souk (Figure 1).

The project was divided into four stages: 1) Building's study (S1 - group work); 2) Building's drawings production (S2 - group work); 3) Building's assessment (S3 - group work); and 4) Building green conservation (S4 - individual work).

Fig. 1 Al Haffah district showing abandoned traditional residences (photos by the author).

For the first stage (Building study) - literature and site survey was executed: the architecture of the Dhofar region and Al Mahrah style (a region of Yemen), local climate and local traditional construction materials and techniques, conservation methods and legislations were studied, the building was measured, and its examination executed (physical conditions, construction materials and techniques and architectural features). The results of the site survey were documented.

The second stage of the project resulted with building's drawings - original plans, elevations, sections (scale 1:50), 3Ds, façade attributes (scale 1:10) and construction details (scale 1:5).

During the third stage the dwelling was assessed according to the following criteria: a) site; b) energy efficiency – passive techniques (thermal mass, solar orientation, surface to volume ration, insulation, and ventilation); c) water efficiency; d) indoor air quality; e) materials (quality and effective use).

At the forth (final) stage of the project each student suggested a method of green conservation – dwelling re-use via restoration and its systems design for comfort improvement and water, energy and materials efficiency.

By the end of the project students were asked to present their design and green conservation solution along the list of interventions to the plan scheme and façade and new systems for building performance improvement.

4.2 Students works presentation

Students' works are presented following the stages of the project.

Stage 1 – Building study. Local traditional houses general description: The old residential buildings of Haffah area are nearly one century old and follow Al Mahrah architectural style. They are one or two-storied (rarely three), and usually built around the inner courtyard. Each floor of the residence is named differently according to its function e.g. the ground level is called Bakhkhar, the first – Ghafat, the second – Gasr, and the last, which is a roof terrace, - Rawshan [17]. The selected dwelling is composed of two levels – Bakhkhar and Rawshan. The Bakhkhar, which is higher that the upper ones, is the ground level of the dwelling and houses public spaces such majlees (male reception room) and workshops and private spaces such as multipurpose rooms (utilized as family bedrooms), sallah (living room), kitchen and storage rooms. The first level (roof terrace), which is named Rawshan, is an expansion of house living area and houses three multipurpose rooms (bed rooms), an unroofed toilet and an open terrace used by inhabitants for lounging in the afternoons and evenings (Figure 2).

Fig. 2 Dwelling's exterior view showing the façade facing the main street (photo by the author).

The attributes of the selected dwelling (See figures 2 & 3 exterior and interior views) were identified as the following:

- Geographical location - 17° 1' 3" North, 54° 4' 58" East;
- Architectural style - Al Mahrah;

- Construction period – 1st half of 20th century;
- Number of floors – 2;
- Courtyard – inner;
- Occupancy – abandoned;
- Decorative elements: pointed arched windows, wooden carved doors; wooden carved windows and shatters, stepped roof parapet (crenellation);
- Construction materials – lime stone walls, compacted earth floor, multilayered ceiling and roof (wooden beams, palm fronts, coconut fiber, sand and plaster), exterior and interior plaster (local traditional plaster – nurah), wooden beams at openings, wooden locally carved windows and doors.
- Physical condition – bad (partially ruined) (Figure 3).

Fig. 3 Dwelling's interior spaces (photos by the author).

Stage 2 – Building's drawings: The building original layout, which was produced by students as a group work (after the site measurements) is shown by figure 4.

Stage 3 - Building's assessment: The performance of the building was assessed according to the following criteria: a) site; b) energy efficiency (passive design techniques applied – b1; and active design techniques applied – b2); c) water efficiency; d) indoor air quality and e) materials. Each of the criteria and its attributes was evaluated using the scale – Positive (P), Average (A); and Negative (N). The criteria or attribute that was given a positive score was considered to have a very good original design, which satisfies green requirements. The criteria or attribute that received an average score was measured as good, but not filly satisfying green design requirements. The criteria or attribute that received a negative score was measured as bad and unsatisfactory. Those criteria and attributes that received an average or negative score needed improvement, therefore suggestions were given for further consideration during the green design stage. In table 2, which is given below, the summary of the building's performance assessment is demonstrated.

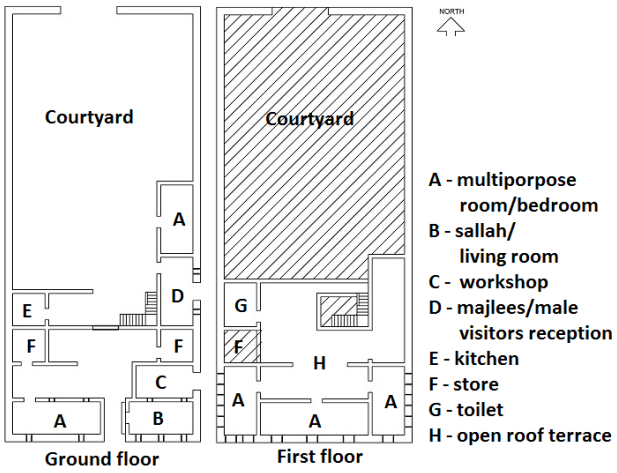

Fig. 4 Dwelling's ground and first floor original plans reproduced by students.

Table 2 Building's performance green assessment.

	№	Evaluation		Suggestions
Criteria	a	Sun path	P	
		Wind direction	P	Front courtyard or tall trees
		Spaces location – day/night activities	P	
	b(1)	Thermal mass	P	
		Absorber	P	
		Control	A	Overhangs
		Aperture	P	
		Distribution	A	Improve air circulation
		Surface to volume ratio	P	
	b(2)	Active techniques	N	Mechanical ventilation Alternative source of energy
	c	Water well	N	Hot and cold water supply Grey water reuse Rain water harvesting Water saving appliances and fixtures Solar water heater
	d	Indoor air quality	N	Improve ventilation Dust control
	e	Materials	P	

*Abbreviations: P – positive; A – average; N - negative

Stage 4 – Dwelling green conservation: During this stage the students proposed their green design solutions for the criteria and building attributes that received average of negative score considering also the built heritage conservation legislations.

International Council of Monument and Sites (ICOMOS) Venice charter Article 5 [18] states that the conservation of built heritage is facilitated with the purpose of using it social purposes. Such use is, therefore, acceptable if doesn't add changes to the original layout or façade's attributes and decoration. No new construction, demolition or modification, which would alter the relationships of mass and color, must be allowed as states ICOMOS Article 6 [18]. The ICOMOS Charter on the Built Vernacular Heritage [19] requires that in case of vernacular structure adaptation (reuse) its integrity, character and form is kept as the original one. On the other hand, the structure should be brought to the condition to be compatible with acceptable contemporary standards of living. As required by ICOMOS Article 5 [18], students selected adaptation (compatible use) as a conservation method for the old traditional residence, wherein the function remains the same.

Figures 5, 6, 7 and 8, which are given bellow, show green conservation design solutions produced by the students.

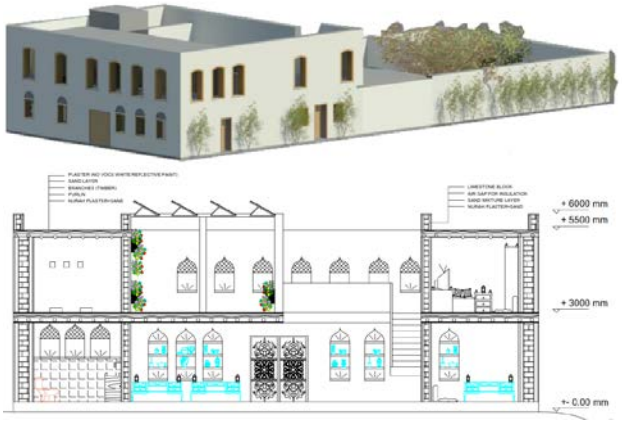

Fig.5 Green conservation solution №1 - 3D and section, design by Nusrath Mozumber (project 1).

Students' design solutions consider the requirements of ICOMOS Article 6 [18] and suggest for reconstruction to apply identical to the original once materials and construction techniques. The improvements to the building's systems and indoor comfort suggested by the students make it compatible with contemporary living standards as comply with ICOMOS Charter on the Built Vernacular Heritage [19].

Fig.6 Green conservation solution №2 - 3D and section, design by Sharifa Al Shanfari (project 2).

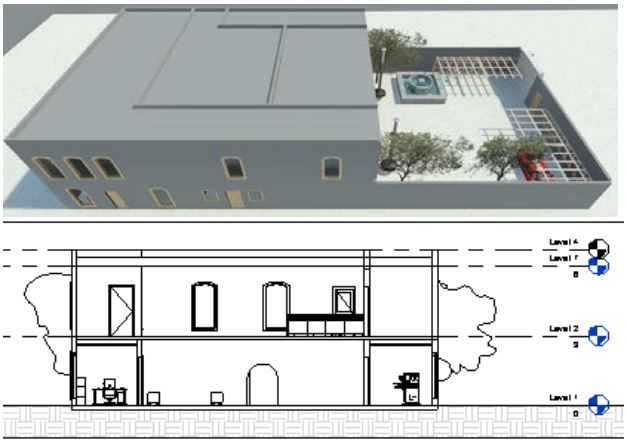

Fig.7 Green conservation solution №3 - 3D and section, design by Alia Fadhil (project 3).

Fig.8 Green conservation solution №4 - 3D and section, design by Abir Bakhit (project 4).

The results of Table 2 have shown that the areas the building needed improvement are – site, energy efficiency, water efficiency, indoor air quality and general comfort. These were considered by the students during the design stage. The green design solutions presented by the students suggest site upgrading – water well as fountain and surrounding pool, landscaping and outdoor sitting area, shading devises, and parking. For energy efficiency improvement was employed bot active and passive techniques – passive: triple glassed windows with reflective coating, white paint of the roof, shading devices, greenery; active: solar water heater, PV panels for energy generation, LED lights, energy efficient home appliances. For water efficiency enhancement – a water supply and distribution system (which was not available) was designed, rain water harvesting system, grey water domestic treatment system (the treated water to be used for gardening purposes), water saving plumbing features and home appliances were suggested. Indoor air quality has been also improved – exhaust fans for better air circulation and ventilation; free of volatile organic compounds (VOCs) finishes and furnishings materials. The materials, which were used for restoration, are to be kept as the original ones.

Consequently, four solutions for dwelling green conservation were presented for the jury by the end of the semester.

5 Discussions

According to the Quality Assurance Agency for Higher Education, UK [4] the methods of assessment of the course learning outcomes should be aligned to the HE institution's graduates' attributes and be appropriate to reflect the outcomes students are expected to achieve.

The learning outcomes of the final project of the course STIA – Green Design, as mentioned in sub-chapter 3.2, were aligned to the course's learning outcomes, which were consequently aligned to the university graduates' attributes. As seen from table 1 the course final project's leaning outcomes were assessed for each stage independently, therefore each stage was considered as a method of assessment. Besides, the four stages of the project three additional assessments were added, which were required to evaluate the building performance improvement and the quality of green conservation (the level of interventions). The assessment methods of the project are listed in table 1 as - 1) Building's study (S1); 2) Building's drawings production (S2); 3) Building's green assessment (S3); 4) Building's green conservation (S4); 5) Performance improvement (PI); 6) Intervention on plan scheme (IPS); and 7) Intervention on façade (IS). Each of the listed in table 1 assessment methods were evaluated against the three criteria: a) knowledge; b) cognitive and practical skills; and c) general competencies.

The results of the course final project assessment, which are given in table 1, show that in the category of knowledge students have attained acquaintance in green/sustainable design (K1), green building assessment methods (K2), and green building design (K5). In the category of cognitive and practical skills students practiced in: green design concepts application for practical problems solving (CS1), green building assessment (CS2); effective utilization of life-long learning skills for sustainable design promotion (CS5). As general competencies, the students were trained to: understand the importance of county sustainable development (GC1), motivate the community for shifting to green buildings design and adaptation (GC2).

Table 3 Students' projects assessment according to the level of interventions.

	Interventions	**Level of interventions** Students projects			
		1	2	3	4
Interventions to the original plan	Original plan conservation	VL	VL	M	VL
	Original structure conservation	VL	VL	VL	VL
	Original construction materials conservation	NI	NI	VL	NI
	Modern addition to the structure	NI	VL	VL	NI
	Application of modern materials	NI	VL	VL	NI
Interventions to the original facade	Original façade features conservation	VL	VL	M	VL
	Original floors and façade heights conservation	VL	VL	VL	VL
	Original façade materials conservation	NI	VL	VL	VL
	Modern addition to the structure resulting in original façade view change	VL	VL	VL	VL
	Application of the modern materials	VL	VL	VL	VL

Abbreviation
NI – no interventions
VL – almost no interventions
L – low level of intervention
M – medium level of interventions
H – high level of interventions
VH – very high level of interventions

The course and its final project also provided students with an opportunity to gain a) knowledge in built cultural heritage and local traditional architecture (K1), built cultural heritage green conservation (K4, K5); b) cognitive and practical skills in contribution to the recognition by the community of local traditional architecture (CS3), built cultural heritage conservation (CS4) and utilization of life-long learning skills to promote sustainable design (CS5); and general competencies in community stimulation to employ traditional architecture, local construction materials and methods (GC3), and community inspiration for green built cultural heritage conservation (GC4, GC5).

Green built cultural heritage conservation projects presented by students were assessed against the level of interventions to the original layout and original façade features as required by the legislations, and the results of the assessment are shown in table 3. The results of these assessments demonstrate that the interventions to the original building's plan scheme, façade, structure, materials, and features are moderate, very low or there are no any interventions. A very low level (or no any interventions) are seen to the construction materials, thus the materials used for reconstruction are identical to the original, and very little of modern materials were added. Furthermore, the building's layout (plan), façade height, visual appearance and façade's features were kept as the original once (very low level of interventions or no any).

Table 4 Students' projects assessment according to the building performance improvement.

Improvements	**Level of improvements**			
	Students projects			
	1	2	3	4
Energy efficiency – passive techniques	M	H	M	L
Energy efficiency – active techniques	H	H	H	H
Water efficiency	H	H	M	M
Indoor air quality	H	H	H	H
Comfort	H	H	H	H

Abbreviation
NI – no any improvement
L – low level of improvement
M – medium level of improvement
H – high level of improvement

Students green conservation projects' assessment according to building's performance improvement shows that the areas that were enhanced are: energy efficiency; water efficiency; indoor air quality; and general comfort conditions. The results of the building performance improvements are demonstrated by table 4 and show high level of improvements to energy efficiency through the active techniques, to the water efficiency, indoor air quality and house comfort. Medium/low level of improvements is observed for energy efficiency via passive techniques.

6 Conclusion

The course STIA – green design, which was integrated into the plan of study, offered students as a part of learning experience, to work on a real-word project, solve existing, real problems and at the same time to serve their community. Conversely, this new learning experience provided an opportunity for the students to freely express their individual opinion via green conservation design, share it with others and, thus, spread the concept of sustainable development.

The results of this study also showed that through the course of STIA – Green Design the students were trained in the field of sustainability, green methods of built heritage conservation and learned how to respect their country's cultural heritage. Furthermore, they understood that built cultural heritage conservation is an integral part of country's sustainable development.

The assessment of the course's learning outcomes demonstrated that the course has contributed to the students' knowledge, cognitive skills and general competencies improvement in the domains of 1) global citizenship - students were trained to think globally, and to consider individuals/communities' decisions and actions' consequences on communities'/world's societies, economy and environment; 2) environmental stewardship – students learned to understand and manage the physical environment and consider the social and environmental impact of their managing and planning actions; 3) social justice, ethics and wellbeing – students became competent and learned to consider the individual as a part of the whole local and global communities; and 4) future-thinking - students developed a future vision and were trained to consider the individuals/communities' consequences of social, economic and environmental decisions and actions on the present and also future societies.

Additionally, by the end of the semester students have developed the following skills: a) capability to formulate problems and develop critical thinking for problems solving; b) ability to apply knowledge and skills in the domain of sustainable development and green built heritage conservation to real-world

problems; c) understanding of the relationship between their major and sustainable development; d) aptitude of life-learning that encourage future achievements in the areas of values, attributes and behaviors for sustainable development.

The results also showed that integration of sustainable development domain into the plan of study or 'greening the curriculum' enable HE Institutions to graduates young people that are equipped with knowledge and practical skills in corresponding field, trained for life learning and are capable of continuous self-improvement. Consequently, graduates with such potentials can recognize their responsibilities as leaders and creators of the future sustainable societies. This new generation with future oriented vision will change the demographics and boost the process of sustainable development.

The integrations of green courses into the plan of study is gradually changing the orientation of the HE institutions' education system towards sustainability, nevertheless is a long-term process [20]. Though, the integration of sustainability doctrines into each course of the curriculum will speed up this process. The changes in HE institutions' orientation towards sustainable development will generate changes in communities and transform them into socially, economically and environmentally sustainable.

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