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ENHANCING UNDERGRADUATE ARCHITECTURAL EDUCATION (SCALE 1 TO 1 DESIGN - BUILD METHOD)

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Keywords: Architectural education, practicum, Design-Build application

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Abstract

On 1997, the board of RIBA – Royal Institute of Britch Architects – highly recommended "experimental learning" or "learning by doing" methods in design studio teaching in architecture as a "practicum". (Wallis, 2005) Although practicum is the task of learning architecture as practice, most of practicum teaching applications in architectural education are either in postgraduate level or in extra curriculum activities. Based on international studies on Design-Build educations, teaching experience and observation of fresh graduates and junior architects, there is still a shortage between design and execution in undergraduate education level, students faces many problems during project implementation phase in reality due to the lack of experience. However, most of the construction sheets provided the needed execution data for installation phase; the 1 to 1 scale imagination was missing in those sheets. As for undergraduate level, in architecture career it is highly recommended to avoid this inability by encouraging the students to build big scale projects during the education process and increase their practical skills more in such projects in order to prepare students for practice. This paper focuses on evaluating the experiment of Design-Build education method in undergraduate level, which was done at faculty of Architecture-Design And Built Environment at Beirut Arab University- Tripoli campus. The method of "Design – Build" was applied in undergraduate core courses; Execution Design I (ARCH 333), Execution Design II (ARCH 334) and Digital Design & Fabrication Course (ARCH468). During the education of these courses, the students gained a construction experience in scale 1 to 1, which in turn gave them the ability of using manual and digital building skills practically. The evaluation of this experiment was based on instructors ' observations, analysis, final semester jury members, grading results and students' survey that lead to give guidelines and recommendations in order to develop this educational method for future applications.

Keywords

Architectural education, practicum, Design-Build application

1. INTRODUCTION

In education, design-build is an effective alternative solutions to traditional means of architectural education methods such as the theoretical, desk-based, and media-driven (drawings, models, digital models). With design-build, students engage design and construction projects that are vary in scale, size, and complexity. In addition, it is extending the students' design skills in material experimentation and construction filed (Canizaro, 2012: Wallis, 2007: 201-202).

As the nature of Architectural design education that undertaken in schools of Architecture, courses appear to preparing students for practice through models, which is not can be considered as professional practice (Nicol, D., 2000). Architecture is a multidisciplinary field of study that integrates among art, science and social. Regarding to the Royal Institute of Britch Architects Registration Board, it is committed for architectural schools to involve the following aspects five branches; architectural design, environmental design, constructional and architectural technologies, communication skills, and management in architecture curriculums. In addition, the board of RIBA focus on "experimental learning" or "learning by doing" describes design studio teaching in architecture as a "practicum" a setting design for the task of learning as practice. However, the architectural school curriculums through both their formal structure and their informal socialization process. They not fully preparing undergraduate students in the skills needed for participative practice. While virtual world of studios becomes a collective world as a mixture of materials, tools, languages and appreciation. This mixture of aspects embodies students – practically - seeing, thinking and doing to assert them with increasing authorities and self-confidence. In addition, it -Practically- treats the greatest weakness of architectural education, which is the preparation for practice (Cuff, D., 1992). By "Learning by practice"- or in new terminology "Design-Build" that have been mostly used by contemporary architectural schools - design build projects provide students with a tangible, hand on opportunities to merge and integrate with the physicality of architectural design and construction(Clouse, 2016). Students investigate the engagement values of time, resources, management, materiality, interdisciplinary collaboration and technology in order to achieve their project target and realize it in reality.

1.1 Research aim

The aim is to develop and enhance architectural education process which intern prepares students implementation skills in the undergraduate level by applying the method of Design-Build in real scale 1 to1. Thus, this paper assesses an evaluation of the application of scale 1 to 1 Design-Build that has be applied in architectural undergraduate courses in order to providing guidelines and recommendation for architectural schools for further applications.

1.2 Research Problem

Architectural educations - depend on theoretical courses - do not give opportunities for students to construct their projects in real scale. Even 3D model studies that are using in design courses do not give real construction sense. So that, in order to fully prepare undergraduate student for practice filed, Design-build application methods should be included as a part of mandatory core courses which interne increase students design, construction and implementation skills.

1.3 Methodology

In order to investigate the ability of applying scale 1 to 1 Design-build methods in undergraduate level of Architectural education, the research traces a certain analytical and experimental methodology that has been evaluated at the end of the research in order to explore the impact of the design-build on students implementation skills in architectural education filed. The methodology steps are as following:

- Exploring and evaluating design – build past academic experiences and state of the arts by measuring its scales, educational level possibilities, relativities with students backgrounds and referable application courses.
- Defining Design-build principles and its application process in all its methods and phases through past schools experience, studies and researcher critics.
- Applying and experimenting the design – build method in our curriculum through 2 case studies as a part of both design and execution core courses.

- Evaluating the case studies outcomes to give conclusion and recommendations for architectural school when design-build methods are essential to be applied in undergraduate level.

2. LITERATURE REVIEW

Design-Build method started to be taken in consideration in Architectural education methods after old schools of architecture discovered that the absence of construction practice skills during education phases will not create professional graduates of architecture. In 1997, William J. Carpenter noticed the importance of practicing construction in architectural education and said “In the very beginning of formal architectural education, at the Ecole Des Beaux Atrs in Paris in the early 1800s, The designers was encouraged to formulate drawings to capture the intention of design. Students took classes in geometries, perspective stereometry, mechanics, and architectural orders. The tectonics of buildings only emerged in the detailed watercolor plans, elevations, and section. Construction was removed from the design process. In 1966 to 1967, university of Yale school of Architecture in United states applied design-build programs as an alternative to studio based method of learning (Folić,2016). A tow-dimensional analogue replaced the building itself. Even the three-dimensional model was removed as well from the design process. Both the practicing architects and students entering the profession lament the lack of understanding that architecture students today have to construction and built reality of their design.” (Willas, 2005).

He mentioned the lack of practicing experience given in education “Their lack of building know-how to comes, not from any deficiency on their part, but from two characters inherent in institution of architectural education. The first is the growing fracture between design and construction, which finds the architect drifting further and further from the contact with the craft of building. The second is growing imbalance between conceptual thinking and the idea.”

William gives an example of emerging construction method’s in education as “The Parkstadt workshop in one example 1:1 models at full scale on-site was used. In this case, the professors Hajo Neis and George Elvin encouraged the students of the Fachhochschule in Frankfort, Germany, to build arcades. This method weaves design and construction into a continuous unfiled building process_ one with several advantages over the traditional way of designing at the drafting board and handling of drawings over to a contractor for execution. A few schools have taken building seriously. Cranbrook Academy of Art in Michigan has already held that the theoretical development of a student should include tectonics. Similarity, Frank Lioyed Wright’s Taliesin in Wisconsin and Arizona includes on-site work, and at Yestermorrow, In Vermot, non-architects and architecture students learn the ideas and the skills of building side by side. Paolo Soleri’s Arconsanti Has existed for twenty five years as experimental Design/Build city in Cordes Janction, Arizona. All these schools emphasize the value of thinking and making in architecture instruction.”(Willas, 2005).

The idol example of design-build application is the Bauhaus school. Bauhaus school is a pioneer and leading school of applying the contemporary design-build concept. Design and craft education workshops started by the Bauhaus school helps students to improve their industrial design practice skills. During the workshops on campus houses, the students were involved in construction phase. Many architectural schools followed the contemporary trend of the Bauhaus school in hands-on architectural approach (Folie’, 2016). Later on, in 2016, an exploratory study done in USA to formulate and define the dimensions of design-build educational method in architectural schools. This study was based on intensive interviews with 15 directors of architecture schools and group of students in each school. Researchers discovered the importance of design-build method in increasing students’ construction dimensions and implementation skills. However, they mentioned that most of applications were in forms of workshops, postgraduate experiments and small extra tutorials. This important application is still need to be more involved for undergraduate levels as mentioned by schools directors and students (Canizaro, 2016). As a state of art conclusion, Most of design-build education projects were involved in extra curriculum such as workshops, seminars and extra - trainings. While – on the other hand – Mainor numbers of schools were applying design-build method as a main part of design and execution core courses which means that architecture schools not fully prepare students to construction filed which in turn graduated students’ needs extra training and internship to gain the execution skills in scale 1 to 1 construction projects.

2.1 Design - Build principals

Design-build projects done by architecture schools usually located in places that have a certain theme related to political, social, economic, environmental and sometimes ethnic crisis. “Design-build projects are usually oriented towards better living conditions for community or solving the social issues of vulnerable groups. The type of integration of the design-build studio into curriculum is also an issue that varies from school to school.”(Folie’, 2016).

Any architectural project starts as a mental design idea that goes through many steps in order to be implemented into a real building on-site. Student should learn all these steps in order to be well prepared for professional career. Based on previous studies and experiments done through researchers and accepted research papers, design-build principles are deducted in the following process:

2.1.1 Design-built projects should have a preparation priory of a research which is usually done as a part of design studio work to define the project time period, size, implementation phase. Those researches depend on theoretical, practical, skilled experts and should meet the design – build course objectives and be relative to the theoretical bases knowledge that adequate to support the students for the practical phase.

2.1.2 After the research, students should be able to take design decisions that are depending on hands-on experiences and they should transform all design drawings into actual execution drawing that have all construction details used in implantation phase that contain a well knowledge of construction material selection. In order to do so, Material studies should be considered as a full scale of study that including, material specifications, properties, availability in local market and construction techniques.

2.1.3 Referring to providing material and equipment used in construction phase, the project should be financially supported by a sponsor, school and in effort with students. In order to make the project feasible to be constructed, its size should fit students’ economic budget one hand.

2.1.4 Referring to the construction phases, “A building can be made without skill, without ideas, and without inspiration, but it cannot be built without labors and materials”(William J. Carpenter, 1997). Any architectural project requires background design, and construction skills with cooperation and integration of many people working together for a certain goal. as a previse experience from project management, the separation between disciples causes lack of cooperation which have a negative impact on cost and delay the schedule of construction phases and also decrease the whale quality of the project. A well-formed, communicated and organized team from multidisciplinary backgrounds is resulting a better construction project. (George Elvin, 2007).

3. CASE STUDIES AND APPLICATION

Design/Build method has been experimented and evaluated in two case studies which have been taken at Faculty of Architecture-Design And Built Environment at Beirut Arab University-Tripoli campus. The method of “Design – Build” was applied in undergraduate core courses; Digital Design & Fabrication Course (ARCH468), Execution Design I (ARCH 333) and Execution Design II (ARCH 334). During the education of these courses, the students gained a construction experience in scale 1 to 1. They were able to merge and integrate between design and execution skills in order to achieve the project target. After the application, final product, course grading, instructors and student feedback were essential for evaluating this application which in turn formulates some considerations and guidelines for future further design- build application in undergraduate educational level.

3.1 Case Study 1

Course: Digital Modeling & Fabrication
Code: ARCH 468
Academic Year / Level 4: Year: 2016-2017 Term: Spring
Team: A group work of 5 students
Project Aim: The project dealt with investigation of design problems using computer graphics from the initial stage of design conceptualization to design development and process of generating complex shapes. It also concentrated on the idea of digital design which followed the new architectonic possibilities . The targets of the course project were to digitally design and build in

scale 1 to 1 an outdoor partition using parametric generative tools together with digital fabrication machines technology.
Materials: Plywood sheets 244 X 122 cm – wood fames – led light
Tools: Design: CAD Drawing – Rhino digital parametric design
Fabrication: ArtCam – CNC machine – manual tools

3.1.1 Implementation Steps:

a. Design the out-door partitions: The partitions were designed on parametric design inspirations and characteristics of the actual site. There were varieties in partition patterns and techniques. Most of the students added lighting features to the partitions.
b. Preparing digital fabrication drawings:
In order to transfer the design ideas to actual execution drawings, students used digital fabrication software (ARTCAM, CNC programing machine). They also designed a wooden frame section to maintain the wooden partition panels.
c. Exporting files to digital milling machines:
In order to form patterns on the panels, all fabrication drawings were transformed to a language that can be read by the milling machine, where all the panels had been fabricated. During this phase, most of students had to develop digital cutting files so as to avoid connection gaps between the panels.

Figure 1: Digital fabrication of panels
Source: by authors.

d. Fabrication phase: Students learnt how to fix the raw panels on the CNC machine and started monitoring the cutting and graving process (see Figure 1).
e. Assembly phase: After fabricating all needed panels to create the partitions, students started to install the panels into the wooden frame by using manual installation tools. They added wheels to the base of the wooden frame to easily move the partitions.
f. Adding light features and finishing: Considering using the partitions at night as decorative outdoor units, students added linear LED lights. Finally, they used a water resistant-varnish in order to cover the wooden partitions and protect them from the outdoor weather conditions.

3.1.2 Construction Challenges:

During implementation, although, students faced problems, they were able to solve most of them, they are listed as follow:

- Tolerance: there were some tolerance problems in connecting the panels with the wooden frames. Other students faced problems in the patterns size relatively to the main panel. To solve these problems, they added extra wood filling strips to the gaps and re-fabricated the panels on the CNC after developing the fabrication files (see Figure 2).
- Joints: other students found a problem in joints, especially in the frame base and in corner angles. They replaced the broken joints with new reinforced ones using metal L-shape sections.

Figure 2: Solving tolerance problems
Source: by authors.

- Final Finishing: two groups of students were not able to finish their partitions on the submission date. Others did not consider the panels' thickness in final finishing.

3.1.3 Design - build Gained Knowledge:

Students were able to design complex forms and shapes for the outdoor partitions using digital design software. Moreover, they were able to prepare all construction drawings, deal with CNC machine language, and prepare all the needed files to finalize the fabrication process and assembly phases. Although they encountered the construction problems during the assembly phase, they were capable to find solutions for problems like: tolerance, joints, fixation and final finishing.

3.1.4 Case study 1 Evaluation:

The evaluation done by project instructors was based on three criteria; time, performance and final project outcome as shown in the following table:

Table 1: Evaluation of 1st case study done by course instructors
Source: digital modeling & fabrication course instructors

Evaluation aspects	Values	Notes		Reason
Time	Design phases	**Planed** (2 weeks)	**Actual** (3 weeks)	Designing, preparing construction drawings and training on fabrication machines took more time than planned, which in turn did not give enough time to fabrication and assembly phases.
	preparing drawings	(2 weeks)	(2 weeks)	
	machine training	(2 weeks)	(4 weeks)	
	fabrication	(1 week)	(1 week)	
	assembly	(1 week)	2 days	
Performance:	Fabrication	Satisfied		- The time was not enough for the fabrication and assembly phases. - The lack of material experience
	Assembly	Satisfied, but not as designed		
Final product:	Function	Most of the final products were functional		- Material capabilities were needed more studies by students to achieve good stability - Selection of partition accessory were not appropriate in some cases - Frame base section dimensions affect the final product stability
	Stability	-All of the projects were satisfying except two projects only, because the dimension of frame base was not able to maintain the partition weight.		
	Handling	In one project, there were difficulty in handling the movement because of wrong selection of wheel type		

Final grades:

Final grades were based on an average of three external jury members. They were evaluating the final produce with criteria of evaluation that contain (functions - form - creativities - finishing - assembly). As shown in figure 3, the following chart shows that most of groups were successful to reach the project target.

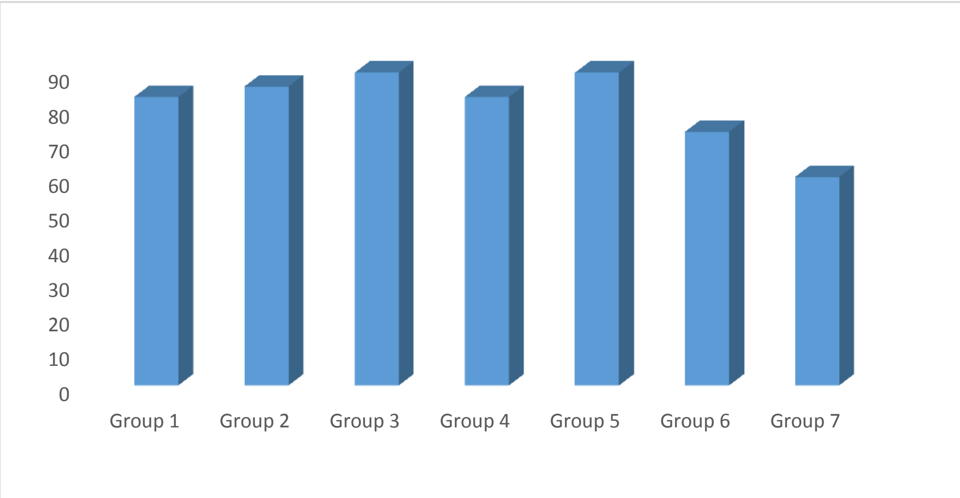


Figure 3: Final Grade of Case Study I evaluation
Source: digital modeling & fabrication course instructors

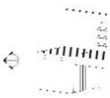
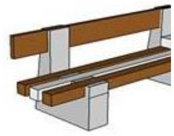
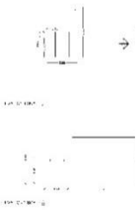
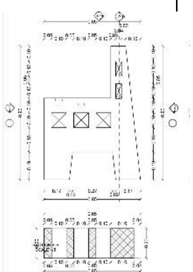
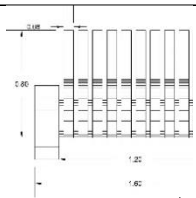
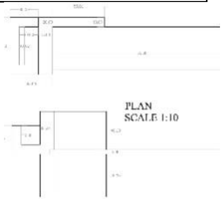
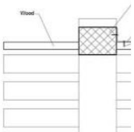
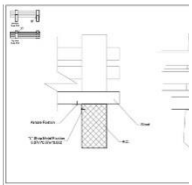
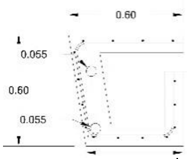
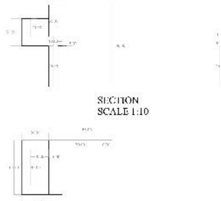
3.2 Case Study 2

Concrete Benches
Course: Execution Design II
Code: ARCH 334
Academic Year / Level 3: Year: 2016-2017 Term: Spring
Team: 10 groups each group work consists of 4 students
Schedule: 5 weeks divided to specific tasks for each week (design phase, preparing drawings, molding and assembly)
Course aim: This Course deals with investigation of design problems in project execution phase from the initial stages of design conceptualization to design development and construction. The course concentrates on the idea of executing designs that is giving rise to architectonic construction practice.
Project Aim: The final project is to design and build it in scale 1 to 1 outdoor concrete bench for architecture students in the space between E and F building at BAU-Tripoli campus
Materials: Plywood sheets 244 X 122 cm catted as reinforced concrete molding drawing dimensions – oak wood sections – varies technical materials.
Tools: Design: CAD Drawing – 3D studio max
Fabrication: concrete lab – concrete mixture machine -Manual fabrication tools

3.2.1 Implementation Steps

The following table demonstrates a sample of project implementation steps that have been done by students and supervised by course instructors

Table 2: Project Implementation Steps
Source: Execution II instructors

Design bench form and shapes according to the students' needs some students liked to add renewable energy installations to supply for laptops or mobile phones			
			
Preparing workshop drawings			
			
Preparing section details scale			
			

Implementation phase: Each group of students has to prepare a modelling form by cutting plywood sheets according to concrete form dimensions taking into consideration the clear concrete dimension and adding the plywood sheet thickness in total dimension. Next, they Prepared the steel bars according to the needed reinforcement as discussed with civil students. Then, they had to calculate and prepare the quantities, rations and test the concrete mixture. In some cases, students added foam varies sections to concrete molding forms to create gaps inside the concrete forms according to their design. This would intern helps them to add steel and wood parts later on and to make concrete casting.
Installing wood and steel part In some projects, according to students design, they were using steel and wood sections.
Adding technical installations In some projects, students added some technical installation such as PV solar panel and using bicycle to generate electricity
Finishing materials, cracks treatments and finial painting.

3.2.2 Construction Challenges

Molding concrete form dimensions: In some groups during execution 2D drawing, students face some challenges in customizing wood sheets to concrete form dimensions. Unfolded wood sheets caused some errors in form dimensions because wood material thickness was missed in the form calculation.

- Steel bars Joints:
  It was noticed in some students, there was lack of experience in load analysis (bending moments, sheering… etc.) and steel bar distributions in concrete sections.
- Concrete form cover:
  In order to keep the effective cover distant between steel bars and wooden form, students face some problems related to the concrete cover, shown in figure 4.
- Concrete mixture ratios:
  The lake of the knowledge about mixture concrete raw material ratios and its relation to final concrete strength caused some problems in concrete crash capacity for concrete cubic test which caused some small cracks in final concrete surface and some weakness in small concrete sections
- Concrete and wood connections:
  The clear distance to refill of wooden or steel sections wasn't clear enough to install it in concrete sections after discharge foam, shown in figure 5.

Figure 4: Concrete form preparations
Source: by authors.

Figure 5: Concrete & wood connection problems
Source: by authors.

3.2.3 Construction Solutions

Molding concrete form dimension solution: by getting directions of the feedback and revising with instructors, the students developed another drawing version taking into considerations the wood sheet thickness and unfolding details.

- Steel bars Joints solutions:
  After discussion among students and instructors, students acquired information about steel tension, compression sides and the method to put steel bars in concrete section to maintain the accurate strength of concrete section.
- Concrete form cover solutions:
  Students added concrete screed pieces to solve the concrete cover problem.

- Concrete mixture ratio solutions:
  The instructors gave intensive lectures about concrete raw material rations, mixture methods and hardening time, preparing concrete form for casting, acquiring the needed knowledge about all the previous mentioned problems , students were able to solve the previous problem.
- Concrete and wood connections solutions:
  Students develop new 2D drawings that contain enough clearance to be easily installed in wood or steel sections when they discharge foam from the concrete section after casting phase.

However, instructors have provided those previous instructions, but some students didn't commit them perfectly, which make some projects insufficient especially in the finishing phase.

3.2.4 Design – build Gained Knowledge

Students were able to design a complex forms and shapes with different materials, for the first time, to handling concrete raw material and preparing a concrete mixture. They were able to preparing all construction and workshop drawings. They were able to preparing all files needed to finalize the assembly phases. They discovered construction problems while assembly phase and were able to find solutions of joints, casting, wood and steel connections, fixation and finishing material problems.

3.2.5 Case study 2 evaluation

The evaluation done by project instructors was based on three criteria; time, performance and final project outcome as shown in the following table:

Table 3: Evaluation of 2nd case study done by course instructors
Source: Execution II instructors

Evaluation aspects		**Values**	**Notes**		**Reason**
Time		Design phases	**Planed** (one week)	**Actual** (one week)	In the assembly phase, Students took more time because the experience weakness
		Preparing drawings	(Two weeks)	(Two weeks)	
		Molding	(one week)	(one week)	
		Assembly	(one week)	(Two weeks)	
Performance:		Concrete stress	Satisfactory but not as designed		Tension and compression of concrete sections were not considerable by some students
		Assembly	Satisfactory		
Final product:	Function	Most of the final products were functional except 2 projects	- Human dimensions and students' needs were well considered - Due to lateness of submission, one project doesn't maintain loads and was broken in the installation phase		
	Finishing quality	All of the projects were satisfied except one project only			
	Options	Two of the projects have extra options such as, electricity generators and solar panels			

Final grades:

Final grades were based on an average of seven staff members. They were evaluating the final produce with criteria of evaluation that contain (functions - form – stability – durability – finishing – sustainability). As shown in figure 6, the following chart shows that most of groups were successful to reach the project target except one group.

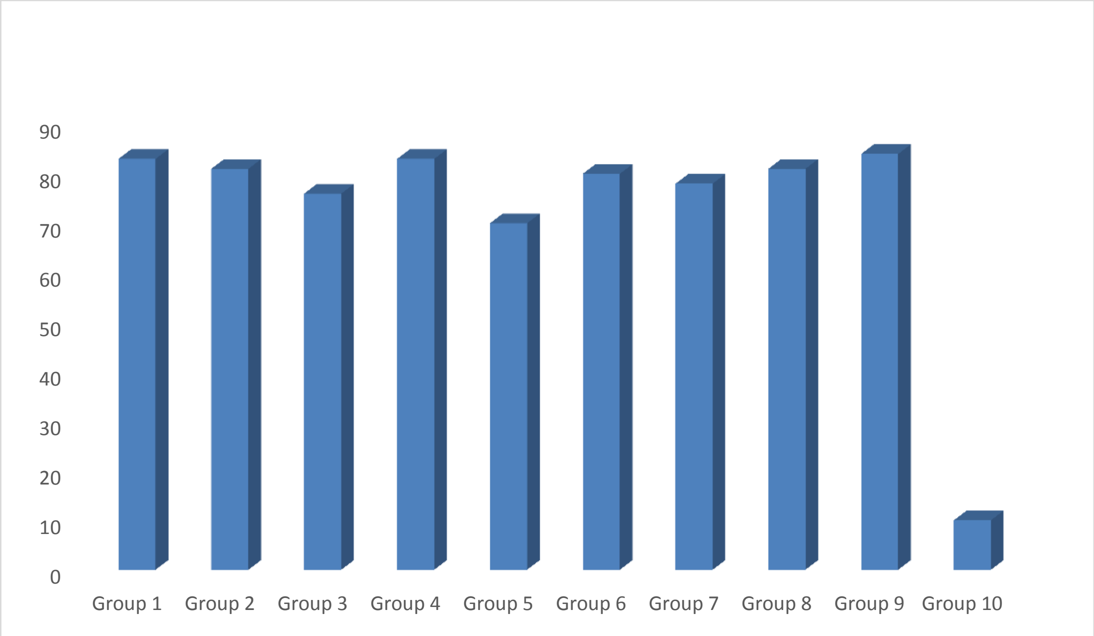


Figure 6: Final Grades of Case Study 2 evaluation
Source: Execution II instructors

4. DESIGN-BUILD STUDENTS EVALUATION

In addition to instructors' evaluations, the students gave evaluation by their side. The purpose of this evaluation is to allow students to give ideas to the instructor about how Design-Build method might be improved to enhance architectural education and academic scientific research. Students have been encouraged to add their comments and suggestions. (See the following form)

The students supported the experience of design-build projects by adding positive comments. They mentioned that they have exposed to a good practical experience on building a real 1: 1 scale where knowledge about materials, building tools and digital machines is essential. In addition, the project increased their communication, time management and teamwork skills. However, some of students mentioned that project time was short and the budget was expensive, students recommend the repetition of the Design-Build projects to enhance the architectural education and prepare them to the professional flied.

STUDENT SURVEY FORM OF Design/Build educational method
Concrete benches - outdoor partitions

The purpose of this form is to allow students to give ideas to the instructor about how this method might be improved to enhance architectural education and academic scientific research. You are encouraged to add your comments and suggestions on the back of this survey.

Concrete benches
Project Data: Design and Build Concrete Outdoor Benches
Course code: Arch 334 _ Execution Design II Spring 2016 – 17

Outdoor partitions
Project Data: Design and Build an outdoor partition
Course code: Arch 468 _ Digital modeling Spring 2016 – 17

Faculty: Architecture, Design & Built Environment - Beirut Arab University – Tripoli Campus

N	**Question**	**5**	**4**	**3**	**2**	**1**
a	Did you have any previous experience in Design and Build?					
b	How much have you gained new knowledge after this experience?					
c	How much do you find this project enhancing your architectural education?					
d	Was the time enough to finish the project in good quality?					
e	Did you need any external assistant in order to finalize your project?					
f	Do you find group-work method and organization affective enough?					
g	Were instructors and assistants helpful enough for finalize your project?					
h	Were Facilities and faculty labs enough helpful to finalize your project?					

Evaluation unites:

5; Strongly agree **4**; Agree **3**; average **2**; disagree **1**: Strongly Disagree

- What are advantages and disadvantages from this project experience?

- Do you have any further comments or suggestions?

Figure 7: Student evaluation form
Source: Prepared by authors

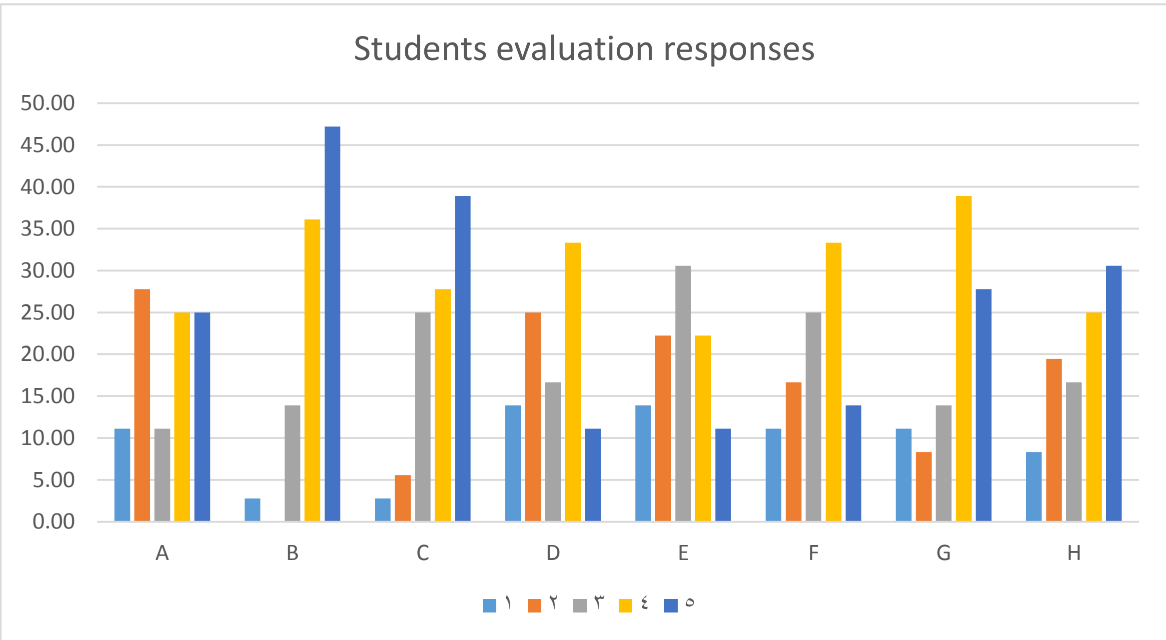


Figure 8: Students' evaluation responses
Source: Execution II and digital modeling instructors

Pervious chart shows the responses of students that have been participated in the Design-Build projects, the following are the analytical responses for each survey question listed below according to question letter:

a- Although the continues advices from instructors to have a summer training, some of students had previous experience in constructions but also some of students - specially females - were not able to have the same experience before joined to the Design – Build project.
b- Most of students agreed strongly that they have gained new knowledge after having Design – Build experience.
c- About 66 % of students samples (strangely agreed and agreed) that this projects enhancing their architectural educations.
d- More than 50 % of the students had seen the time of project was not enough to finish it in good quality.
e- Refers to point A, Some of students needed extra external assistances in order to finish their projects.
f- The majority of students found the organization of the team work was effective enough and there were good commitments from all team members, while a few of students mentions the disorganization of the team members in time and tasks that causes the late submission in one project.
g- Most of students agreed that all instructors and assistants were helpful in the project.
h- Some students found the facilities and laboratory helpful while some of them mentioned the opposite.

5. CONCLUSION

- Recent Design-Build applications illustrate a new turn in the education of architecture approaches where design and execution courses became more efficient than before as multi-dimensional aspects emerged together to formulate the final educational target as practice.
- For undergraduate level, Design-Build is one of main design activities that enrich the students' design-making and taking decisions through direct implementation and grounded practice. It can be considered as well preparation for students for professional flied after graduation.
- The value of Design-Build learning method is the key of motivation for students to join the course collaborate and interact together to understand how things integrate together and the way of build their projects in real scale.
- The Design/Build method - which has been applied, experimented and evaluated by both instructors and students at Beirut Arab University – Tripoli Campus –, highly supports the idea of including Design-Build architectural educations with practicum meaning in undergraduate core courses. It adds values of practice for young educators in architecture fields. After evaluation of this method, some of guidelines and recommendations came up to be taken into considerations for making design/build method more efficient and viable to students in architectural education as follow:
- Learning by doing method should be involved in most of architecture core and mandatory courses in order to teach students how to realize their ideas in realities and it increases practicum hand-on experiences
- Design/Build assignments and projects should meet the undergraduate intended learning outcomes of the educational course. This will increase the learning value and will not destruct the course focal learning target.
- This method needs an effective time management in order not to be overloaded experience among other architectural courses
- Collaboration with other professionals and labors will enhance this method. It will teach students how to deal with other fields, how to collect all needed data to reach their project target, and how to cooperate in teams that contain non-architectural background.
- Though the importance to involve Design/Build in undergraduate architectural course, the construction cost should be well studied to fit students' budget. It is highly recommended to fund the project by the school or finding relative sponsor that can cover the project cost.

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