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VOLUME 13 ISSUE 4

The International Journal of

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## Achieving Sustainable Urbanism through Architectural Education

### A Move Back to a Learning-by-Doing Pedagogy

FAY AL KHALIFA

## THE INTERNATIONAL JOURNAL OF ARCHITECTONIC, SPATIAL, AND ENVIRONMENTAL DESIGN

<http://designprinciplesandpractices.com>

ISSN: 2325-1662 (Print)

ISSN: 2325-1670 (Online)

<https://doi.org/10.18848/2325-1662/CGP> (Journal)

First published by Common Ground Research Networks in 2019  
University of Illinois Research Park  
2001 South First Street, Suite 202  
Champaign, IL 61820 USA  
Ph: +1-217-328-0405  
<https://cgnetworks.org>

*The International Journal of Architectonic, Spatial, and Environmental Design* is a peer-reviewed, scholarly journal.

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# Achieving Sustainable Urbanism through Architectural Education: A Move Back to a Learning-by-Doing Pedagogy

Fay Al Khalifa,<sup>1</sup> University of Bahrain, Bahrain

*Abstract: Sustainable urbanism is strongly related to the ability of modern educational systems to train autonomous learners who can contribute positively to their built environment. This study investigates using a spatial installation project on the ability of fourth-year architecture students to understand and recall complex philosophical ideas related to architecture and urbanism. The study is based on two experiments of term projects assigned to students in the academic years 2017–18 and 2018–19. The first experiment was followed by a survey and the second was followed by interviews and focus groups. The results showed that the students' involvement in the hands-on project increased their curiosity and enhanced their ability to understand complex philosophical ideas related to architecture and urbanism. Having to work in groups to achieve the objectives of the course via designing and constructing a space helped also in developing the student's soft skills and their ability to cognise the technical requirements of the design. The findings suggest incorporating active learning pedagogies in the theoretical courses of architecture programs.*

*Keywords: Sustainable Urbanism, Architectural Education, Architectural Design, Learning-by-Doing, Design-Build Projects*

## Introduction

Architectural education has been separated from site operations and real-life struggles since the establishment of the architecture studio-training program at the School of Fine Arts (Ecole des Beaux-Arts) in France at the beginning of the nineteenth century (Drexler 1977). The informal transfer of knowledge from master to student that shaped architectural training in the eighteenth century was disrupted. Today, architecture students are taught in classrooms and are trained to take a consultation and supervision role upon graduation rather than being part of a team. Students are assessed individually, rather than for their ability to work in groups and deliver tasks with the help of others (Kattein 2015). The realization of architectural communication skills is now dependent on student's ability to graphically represent ideas rather than the ability to build, listen, and negotiate projects with various stakeholders (Kattein 2015).

Furthermore, architectural education is constantly challenged by the changes in the industry and the pressure to satisfy the technological needs of the evolving construction trade. Graduates need to meet the demands of the diverse career destinations for architecture graduates of the century (Nicol and Pilling 2000). Off-site technologically dependent teaching pedagogies continue to influence architectural education and practice, thus widening the gap between the architecture practice and its education.

Literature established a relationship between proper architectural education and sustainable urbanism, but very little empirical evidence shows how this can be practically achieved in architecture schools today. This research, thus, looks into the impact of using spatial installation<sup>2</sup> projects on the ability of fourth-year architecture students to understand and recall complex philosophical ideas related to architecture and urbanism.

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<sup>2</sup> A spatial installation is a structure that defines a space in the environment. The space defined by the installation is not necessarily habitable but should be utilizable. It overlays the boundaries between architecture and spatial art.

## Architectural Education from Practice to Consultation

The term “Architectus” during the time between the Roman civilization and the renaissance bore a different meaning to what we now understand the architect to be (Pevsner 1942). Architects worked as creators amongst other artisans until the fourteenth century. Historically, young men learnt the important skills of the trade by shadowing an experienced professional on real projects for real clients on real sites. As skills were attained, the responsibility of the apprentice would grow. Business relationships are founded and strengthened throughout the multiple years of training allowing the young professional to take up a senior position in their master’s business or establish their own (Forty 2012; Kattein 2015). During the Italian Renaissance, drawing abilities grew allowing architects to remove themselves from the site operations and take on a consultation and supervision role. The informal transfer of skills from master to student gradually diminished, and the site-dependent practice of teaching architecture was disturbed (Kattein 2015).

Formal architecture university education emerged in France during the beginning of the nineteenth century when the School of Fine Arts (Ecole des Beaux-Arts) in Paris established an architecture studio-training program (Drexler 1977). Later, and following a rising pressure from architecture professionals in the UK to formalise the training of architecture, the Architectural Association was established in 1890 and since then, the education of architecture has continued to move away from real projects and sites to institutions that focused on the theoretical knowledge and philosophical understandings of the subject (Kattein 2015).

The most evident consequence of the migration of architectural education from the site to academic institutions was the introduction of the individual grading system (Nicol and Pilling 2000), which rewards intellectual monologue in a profession that has teamwork and group dialogue at its core. Success in the architecture profession is measured by the ability of the architect to work within a team, and the completion of a project is largely a result of cohesive teamwork (Chan, Ho, and Tam 2001; Chan, Scott, and Lam 2002). On the contrary, at university, educational excellence is rewarded individually (Kattein 2015). Furthermore, higher education institutions are nowadays changing shape to adopt organisational structures similar to other service providing businesses and/or governmental entities. Governments today stress that students should become customers and staff become service providers (Lomas 2007).

Architecture graduates are today empowered with the intellectual capabilities to excel in digital representation and critical thinking but lack the important practical skills needed to prosper as a real-world architect. In most cases, graduates need further training to learn the practical skills that are essential for the management and delivery of a project on site. Orthodox teaching approaches are still being used despite the need for practical based teaching pedagogies to compete in today’s markets (Álvarez et al. 2016).

The term “communication skills” in architectural education refer to the students’ ability to express the design in drawings graphically. The process of architectural design was described by Daemei and Hossein (2018) as the practice of drawing ideas from one’s unconsciousness. Education focuses on the ability of students to present their ideas as opposed to their ability to build, listen and negotiate them (Kattein 2015). The design team meetings of the pre-nineteenth century apprentice system that served as a means to examine design proposals are now called “crits,” “juries,” and “reviews.” Drawings and images became a means of academic speculation and research, as well as being a method of communication between architects and their clients and contractors (Kattein 2015).

Architectural education continues to be under tremendous pressure to satisfy the needs of the evolving construction industry and to meet the demands of the increasingly diverse career destinations of graduates (Nicol and Pilling 2000). Drawings evolved to be the most notable means of communication between the instructor and the student in any modern architectural education environment. They are today an integral part of the architectural process to the point

that they can sometimes be mistaken for architecture itself. Drawings, however, are only tools to create and control architecture (Chamel 2016). The dependency on drawings in architecture caused a separation between the design process and the building of things, a methodology that opposes that of the apprentice system in the pre-renaissance era. The method of designing using scaled drawings separates the trial and error from the production of architecture by using drawings instead of the product as an arena for experimentation (Jones 1992).

The above literature brings forward an important research question: can architectural education today revert to a practice-based pedagogy? And what impact would that have on the sustainability of the built environment?

## **The Making of Architecture: Hands-on Experiences in Live Projects**

Design and Build as an alternative teaching method emphasises an instinctual approach based on the interaction of the student with the material world and the creative impacts of manual labour. This methodology meets the needs of students who respond well to active learning pedagogy and re-engages a generation of students who are dependent on drawings as a tool for communicating their design ideas with the materiality of things (Chamel 2016). Students in the Design and Build approach learn by “making things,” and the assessment of the resulted projects necessitates that assessors re-examine their definition of excellence in architectural education (Kattein 2015).

Although unusual, the idea of 1:1 scale built projects as part of the architectural curriculum is not new (Kattein 2015). A few empirical studies have been conducted on the topic to assess the viability of the Design/Build teaching methodology versus conventional architecture teaching methods. Chamel (2016) experimented with design/build exercises of furniture and small building prototypes to teach subjects from various courses, such as material sourcing, structures, and construction detailing, using a hands-on approach with limited reliance on drawings. The author argued that energy could be infused throughout the curricula using such an approach no matter the topic.

In a larger, yet similar experiment, Kattein (2015) tested engaging students with a real project and client to design a series of structures in central London. The author stressed that collaboration and teamwork are essential skills for architects and were also of the utmost importance for the realization of projects in the experiment. Such experimentations should, nevertheless, be designed carefully as too many practical steps could submerge the project into technological shortcomings and craftsmanship challenges that might hinder the students’ ability to reflect on their designed objects philosophically (Duzenli, Yilmaz, and Alpak 2017). If designed carefully, hands-on design experiences could help shape the students’ future attitude towards construction and structures to help develop an interest in construction activities in architecture (Chamel 2016).

The benefits of the hands-on experience is not exclusive to architectural education but is also featured in many other design disciplines, like landscape architecture (Duzenli, Yilmaz, and Alpak 2017), interior design (Makki, Farooq, and Alaskar 2018), product design (Oberhofer and Maier 2018), and fashion design (Zhang et al. 2018). Building something requires a critical sense of time management to take into consideration material procurement, assembly, possible failures and errors along the way, as well as unexpected incidents (Chamel 2016). Additionally, live projects challenge the introvert nature of university teaching to involve the students in real-world challenges (Kattein 2015).

Creativity is one of the fundamental factors in the creation of architectural spaces (Dorst and Cross 2001). Daemei and Hossein (2018) examined six factors that may influence the creativity of students in architecture, including experience, sketching, computer-aided design (CAD), images, visual reference learning environment, and physical modelling. The results showed that “experience” significantly increases the creativity of architectural students in the design process compared to the five other studied components. Such results support other debates in the literature on the importance of “experience” in the creative process (Lawson 2013; Celani 2012).

Other factors that were viewed in relationship to creativity are the learning environment (Taylor 2009; Thoring, Desmet, and Badke-Schaub 2018), the instructor (Oh et al. 2013), technology (Livingston 2011; Smith 1987), and sketching and visual reference (Huang 2018; Ibrahim and Rahimian 2010).

Another advantage of physically making things is the improved sense of responsibility and design ownership in the project, regardless of the result of the work being a failure or a success. Chen et al. (2012) argues that the problems faced by designers in introducing creative conceptual ideas often relate to their lack of sufficient multi-disciplinary knowledge. Thus, it is not only important to introduce hands-on experiences to students, but it is also essential to create groups of multi-disciplinary students (Charosky et al. 2018).

Other efforts to develop a more hands-on approach to architectural education include the famous Bauhaus workshops, the Rural Studio (Samuel Mockbee, Auburn University's College of Architecture), the Diversion Design/Build Studio (Clive Knights, Portland State University), the Design-Build BLUFF (University of Utah), and the Details Re-made Exercise (Tammy Gaber, Laurentian University). While all of these examples attempt in one way or another to develop a more hands-on approach to architectural education, the experiment presented in this article discusses how this can be achieved within current architectural programs with a particular focus on theoretical courses rather than a focus on design studios.

## Sustainable Urbanism through Architectural Education

Sustainability is a very simple term referring to the ability to be maintained at a certain level or rate (Stevenson 2015b). To sustain is to continue for an extended period of time without interruption (Stevenson 2015a). The notion of sustainability is, nevertheless, often linked to environmental considerations (Nascimento 2012) as opposed to any of the other pillars of sustainability such as the social, cultural, economic, or the political.

Similarly, sustainable architectural education is often related to the teachings of environmental design rather than the role of higher education in creating sustainable futures; see for example Mohamed and Özkan 2018; Altomonte 2009; Shari and Jaafar 2006. A study of twenty architectural schools in Asia concluded that ecology receives the most attention in general courses from the three main pillars of sustainability: the social, the environmental, and the economic. The study stressed that the economic aspect is almost totally absent (Álvarez et al. 2016).

There is limited literature on the ability of architectural education to be sustained—in other words, the ability of the acquired knowledge in architecture schools to be continued at the same rate for an extended period. Learners of architecture and other disciplines often forget what they were taught shortly after the final assessment of a specific course. The learning objectives in such cases are only attained in the short term. This research focuses on the educational pedagogies that allows architectural education to be sustainable in the long run and for the ideas taught to be remembered. This study contributes to the emerging sum of knowledge on the topic, nevertheless, with a focus on the sustainability of the architectural education system and its ability to foster creativity in dealing with the challenges of sustainable urbanism.

In a study on the curriculum of Asian schools, Alvarez et al. (2016) identified and compared the vision and commitment of various schools in implementing sustainable architectural education. The study suggested that theoretical courses help in discussing sustainability challenges through “traditional philosophies, strategies and technologies” which are “adequate” to the specific cultural and geographical circumstances (Álvarez et al. 2016). On another note, research suggested that entrepreneurship integration in architectural education is somewhat weak to instill an entrepreneurship culture amongst students (Álvarez et al. 2016).

This research attempts to examine the effect of reverting to a practice-based pedagogy on the transfer of knowledge in architecture. The study assesses how architectural education can be

sustainable in the long run to enable lifelong learners who can contribute positively towards establishing sustainable urbanism.

## Research Methodology

This research was conducted on two stages and is built upon two experiments, a survey, and a series of interviews and focused groups. Two experiments were conducted of a term project assigned to students in the first terms of the academic years 2017–18 and 2018–19. The processes were observed and documented throughout the two semesters, and the observations were interpreted in relation to a survey following the first experiment and interviews and focus groups following the second experiment; the term projects comprised building a full-scale installation on a specific topic. The installations were then judged and discussed with students, several faculties, and practitioners from the industry (Figures 1 and 2). The first experiment was followed by a survey administered to the students in the second semester of the academic year (2017–18), and the second experiment was followed by a series of interviews and focused groups.



Figure 1: Examples of the Students' Spatial Installations in the First Experiment

Source: Al Khalifa 2017

## The First Experiment

The first experiment focused on “tryphobia” or the fear of clusters of circular shapes (often hollow) and its relationship to repetitive patterns in contemporary parametric architecture as a visual disturbance (Figure 3). A total of 110 fourth-year architecture students (25 male and 85 female) undertook the project. Thirty-five points out of a total of sixty points were awarded for the assessment of the term project, and the remaining twenty-five points were distributed on attendance and performance (5%) midterm examination (10%) and a research paper (10%).



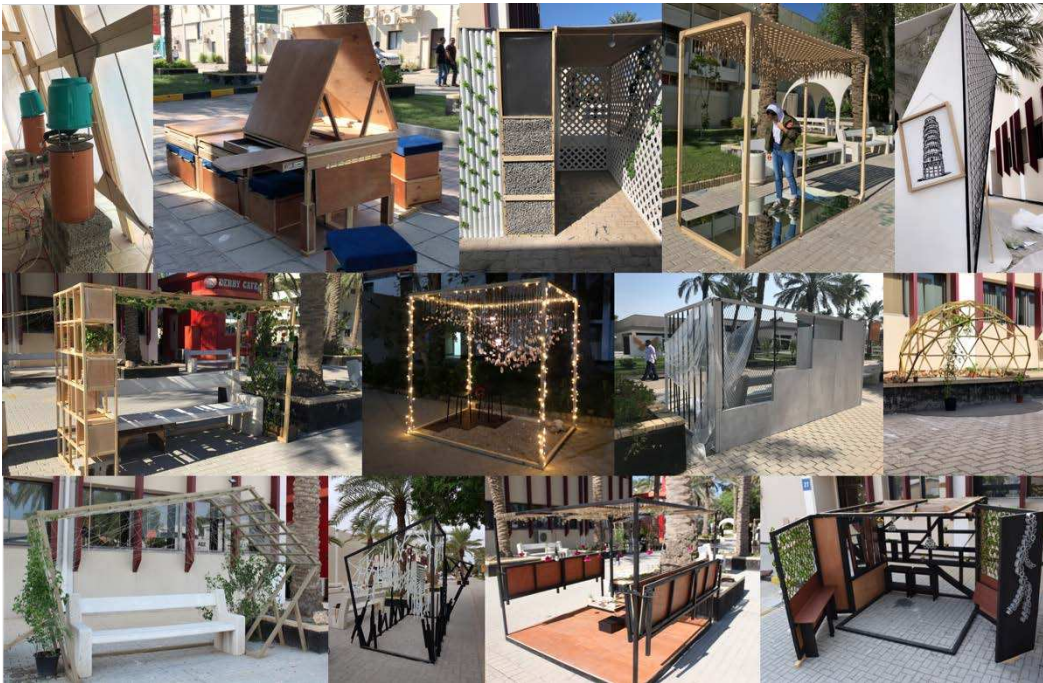


Figure 2: Examples of the Students' Spatial Installations in the Second Experiment  
 Source: Al Khalifa 2018

Literature suggested that due to the amount of work typically involved in practical design and built assignments, students should work in teams. The teamwork allows the design to become a collaborative process, which brings additional value to the learning experience of making. Building things as part of a team also promotes peer learning (Chamel 2016). Students were, thus, grouped into nineteen groups, each of five to seven students with an average of six participants. Students were advised to choose their group members from any section carefully and were given a week to make their selection. The students were also encouraged to select a team leader for their group and to give their group a name. The groups were then assigned numbers from one to nineteen for an easier assessment and sorting of data.

The class discussions introduced the students to the topic of visual discomfort in architecture, with a particular focus on trypophobia as a psychological reaction towards architectural stimuli comprising of clusters of circular shapes, a common feature of contemporary parametric design. Students were advised to read on the topic and to decide on what space they wanted to build and why. All the installations were constructed in the campus, mainly occupying the central inner road.

### *The Survey*

A survey was designed to test the students' understanding and ability to recall the philosophical topic introduced to them during the experiment. The survey was administered to the students during the second semester of the same academic year (2017–18), a few months after they completed the assignment. The survey included eleven questions; ten of them were directly related to visual discomfort in architecture. Students were asked to define “trypophobia” and reflect on the importance of considering visual discomfort in design. They were also asked to assess their level of understanding of visual discomfort and trypophobia after having completed

the project. Students were asked if their involvement in the practical project affected their level of understanding of the topic and if indulging in a practical project helped them learn better.

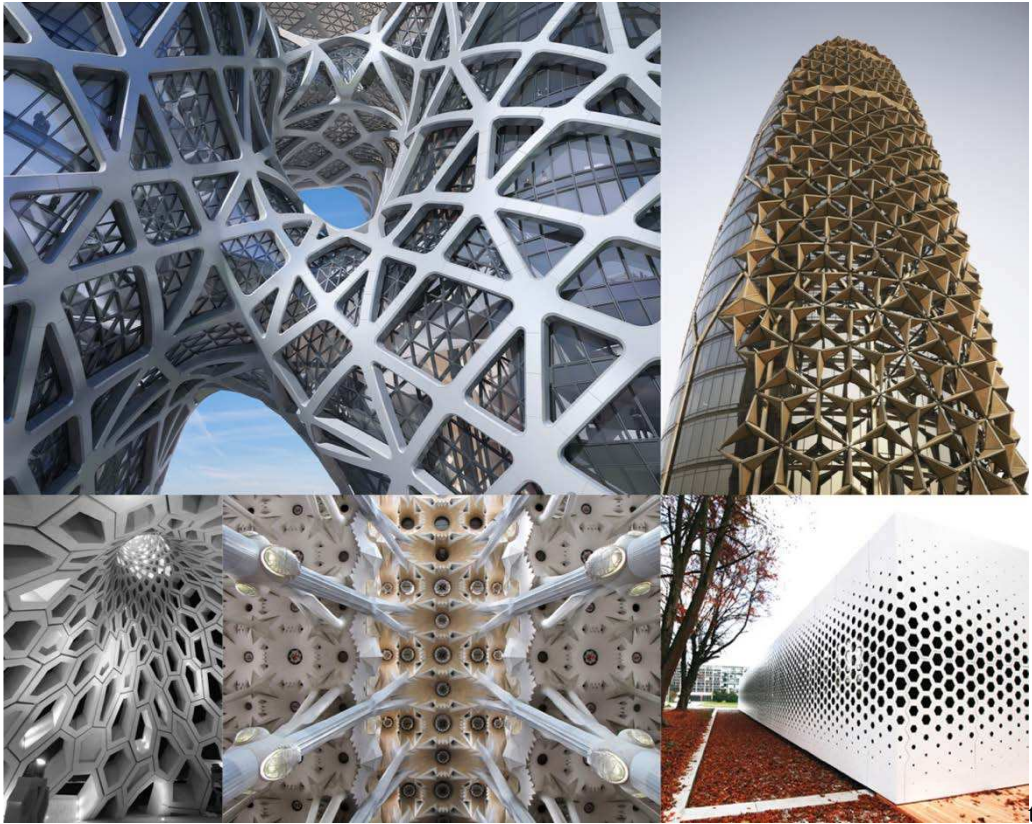


Figure 3: Parametric Design and Trophobia Stimuli in Architecture  
Source: ArchDaily 2019

### *The Second Experiment*

The second experiment was also a term project assigned to fourth-year students as part of the same course in the first semester of the following year (2018–19). A total of ninety-seven students, thirteen male and eighty-four female, were enrolled. Students were grouped in a total of sixteen groups of five to seven students (only one group had four), with an average of six. Twenty-five points out of a total of sixty points were awarded to this project. The remaining thirty-five points were distributed on the attendance and performance (10%), midterm exam (15%), and two quizzes (10%).

In the second year, students were not assigned a specific topic but were instead asked to select a theme of their choice for their installation. The topics were, nevertheless, all related to the future of Sustainable Urbanism and can be grouped into:

1. Interactive Architecture.
2. Compact Architecture.
3. Resilient Architecture
4. Green Architecture
5. Human health and Urbanism
6. Therapeutic Architecture

7. Political Architecture
8. Space Architecture

### ***The Interviews and Discussion Groups***

Interviews and discussion groups were conducted throughout the first and second semesters of 2018–19 to learn more about the effectiveness of this pedagogy and the students' perception of this teaching method. The interviews were a one-to-one conversation between the instructor and students while the focused discussions were conducted in two parts: (a) between the instructor and two groups selected randomly, and (b) the instructor with different sections. Each section had members of the same and different groups because students were given the freedom to choose their group members from any of the four sections of the module. The data from the one-to-one interviews and discussion groups were recorded in a notepad during the conversation and later transferred to NVivo for the analysis.

## **Findings**

### ***Visual Discomfort in Architecture and Active Learning***

The first experiment and the survey aimed to test the student's ability to understand and recall a complex philosophical design problem by indulging them in a hands-on experience. The results showed that the students' understanding of trypophobia as a visual discomfort was evident from the depth of the philosophical approach of their spatial installations and their response to the survey. The majority of the students were able to define the condition clearly and explain their opinions on the topic adequately even after several months from having completed the course. The findings also indicated that the student's involvement in the project increased their interest in the philosophical issue being studied. The groups were eager to learn more about visual discomfort in architecture to compete in building their spaces. The groups invested some time studying their alternatives, looking up some of the very latest literature on the topic and finding pictures of buildings and products that could stimulate a trypophobic reaction or resemble a metaphor of it to share in the class and use as inspiration.

In a brief time, all groups had a proposal for their installation and were competing to discuss the proposal with their instructor to receive feedback on their approach (Figure 4). They also consulted other instructors who are specialised in various fields: theory for their ideas of the philosophical approach, construction for the structure of their spatial installation (Figure 5), and even the civil engineering department for the use of their workshops and materials labs (Figure 6), a practice that is unprecedented throughout the relatively isolated nature of their education. Students also discussed their ideas amongst themselves (with different groups) either to check out what others are doing or to sincerely share knowledge.

Students were asked to design and build spatial installations that are expressions of the condition. The students had the choice of whether the installation would induce the condition, represent it hypothetically, or aim to spread awareness about the severity of it. Students were, nevertheless, instructed to show, through their process and completed work, an understanding how to avoid visual discomfort in architecture and the implications visual discomfort has on sustainable urbanism.

The competition that the experiment created pushed the students to work harder. This was particularly evident when the students started marking the location of their installation on the campus. Students were asked to select a location on the campus of where the installation would eventually be built. They were instructed to mark their territory using white duct tape on the floor and a sheet of paper indicating their names. Knowing that space on the campus is limited and that there are a few good spots, groups were eager to select theirs before the others. This task encouraged the students to take quick decisions and listen to each other. This was particularly

important for the selection of the group leader—the student who would rise at this occasion and lead the other members by taking charge-.

Another way that the competition pushed the students to work harder was when they initiated work on the site. Students were not allowed to work off campus on their installations and, given the large size of the project, they could not hide their work from others. This meant that throughout the construction period, the campus was vibrant with the students building and assembling their designs. This was an enjoyable experience that allowed the students to interact with other faculty, students, and administrators who would pass by their work all day and comment on their work. For their architectural design project, students at the University of Bahrain usually work at home, as there are no dedicated desks for each student outside of the studio hours because the facilities are shared with other programs. Thus, students are usually not fully exposed to each other's work and progress except in the midterm and final juries. On the contrary, students in this project were exposed to the progress of others all the time. The results show that obliging the students to work on the campus allowed them to compete and initiate tasks faster.

It was evident throughout the experiment that students were aware of the time, space, and budget constraints and attempted to find the cheapest and fastest ways to design and build their projects in a way that would give them the best results. Students had to share the cost of the installation and the responsibility with each other; thus, soft skills were sharpened throughout the process, including project management, time management, communication skills, and teamwork. Also, students better understood the technical design requirements, for example, structures, construction techniques, procurement processes, and materials.

Members of each group shared the cost of their installation. Although the majority of the students did not raise any concerns in regard to the cost of the installation, two students reflected negatively in the course feedback form about the cost of the materials. Time and space were expected to be two other challenges. Nevertheless, all groups were able to submit their projects on time and within the limited space available on the campus.

Sixty two out of a hundred and ten (56.36%) of the students enrolled in the course responded to the survey administered via SurveyMonkey in the following semester. The survey was sent to the students' email addresses, and the students volunteered their time to complete the survey. The results of the survey showed that the students were able to clearly define and explain trypophobia as a psychological reaction to clusters of repetitive circular patterns even a few months after the completion of the course. They were also able to reflect on the importance of visual discomfort as a field of study and an essential consideration in designing healthy environments.

The majority of the students indicated that visual discomfort is not a common topic of discussion in their studios with their design instructors. Only 16.13 percent of the students thought that the topic is discussed often, and 3.23 percent indicated that it is always discussed. Consequently, 70 percent of the students were only slightly or not at all aware of the condition before the beginning of the course, and merely 9.68 percent of the students were moderately aware of the condition. The majority of the students indicated that the assignment changed their perspective on how important it is to consider visual discomfort in designing. Only one student indicated that his/her perspective did not change at all, and seven indicated that the assignment only influenced their perspective slightly. The students indicated that their concern about visual discomfort in their architectural solutions dramatically changed after their involvement in the project, and the majority of them specified that they will always (50%), often (33.87%), and sometimes (14.52%) consider visual discomfort in their architectural design solutions in the future.



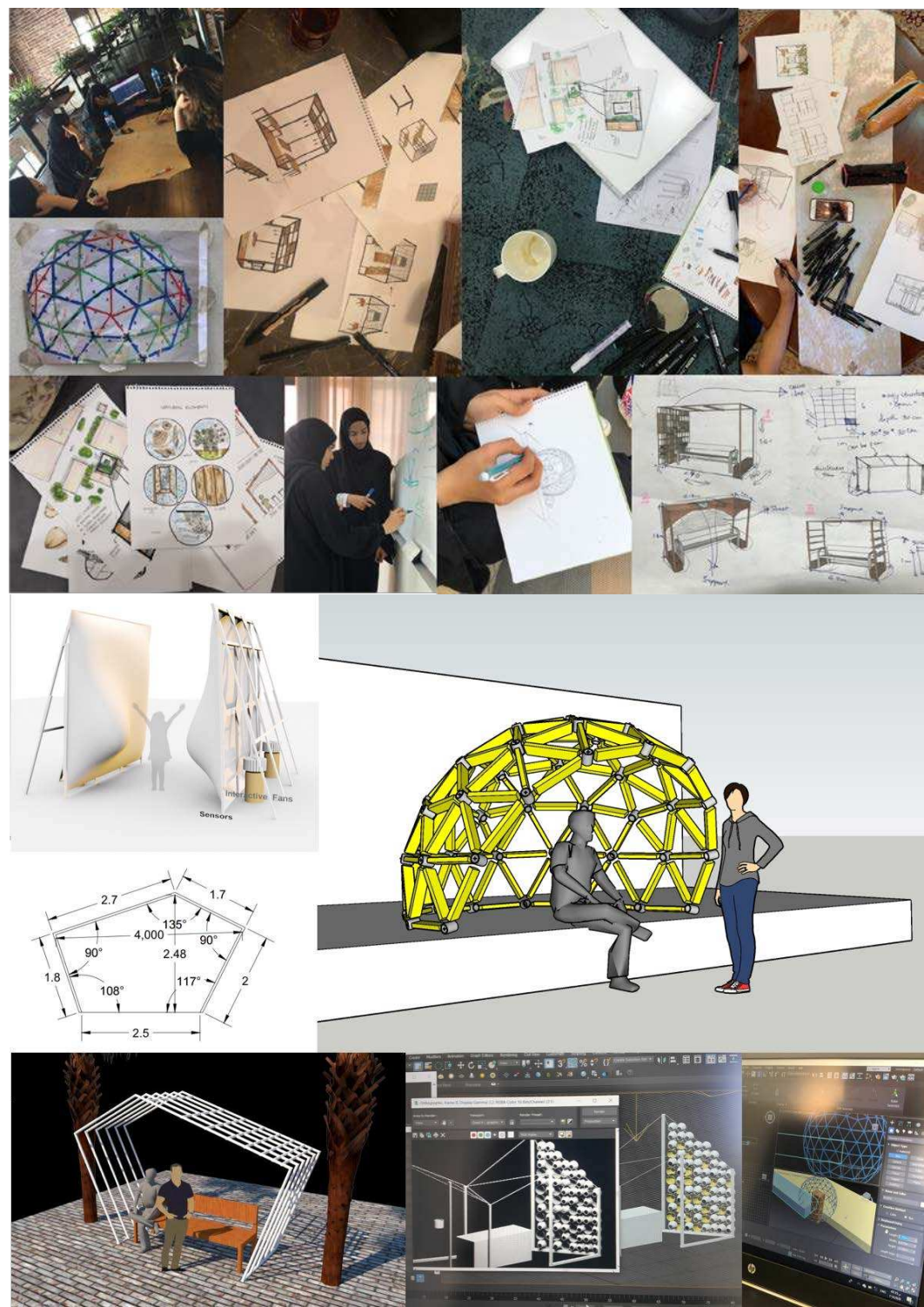


Figure 4: The Thinking Processes of some of the Groups  
Source: Al Khalifa 2017-18



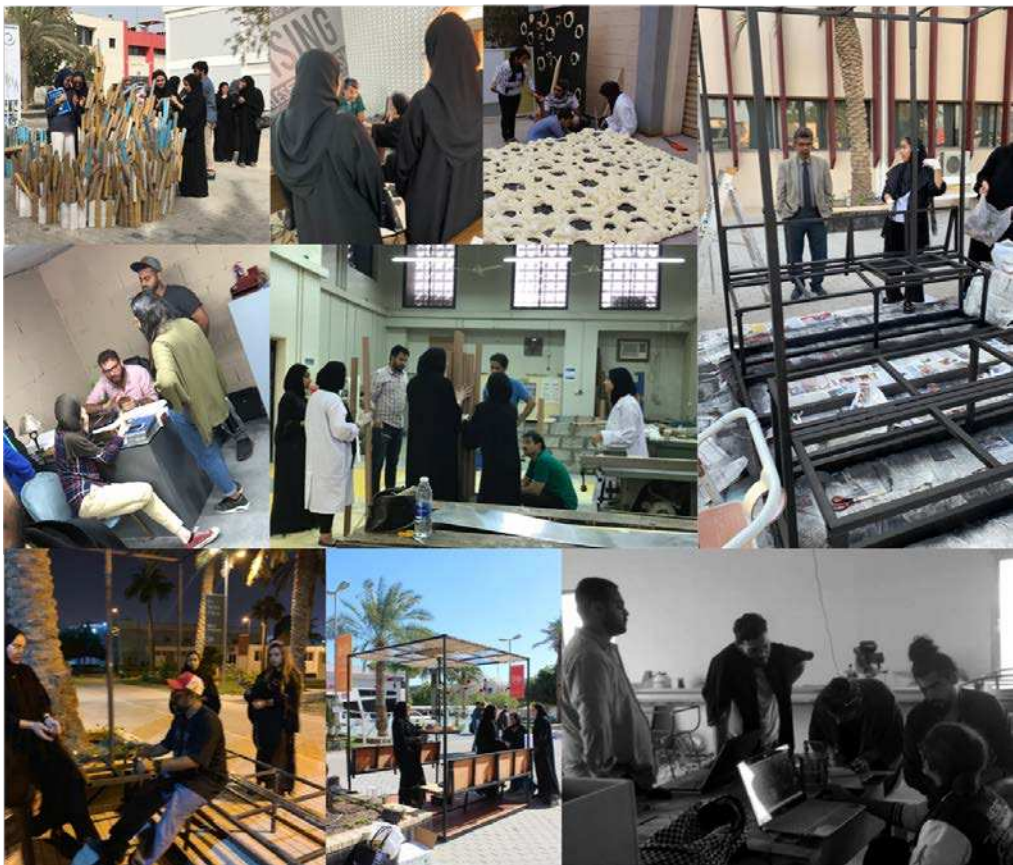


Figure 5: Students Discussing their Installations with Faculty, Students and Practitioners  
*Source: Al Khalifa 2017-18*



Figure 6: Students Using the Construction labs of the Civil Engineering Department  
*Source: Al Khalifa 2017-18*

### *Sustainable Urbanism and Active Learning*

The second experiment, interviews, and focused groups aimed at testing the same pedagogy but with several topics related to sustainable urbanism. Students commented that they were excitedly waiting to take this project since they were in their first year and saw the first group of students in 2016–17 building their installations around the campus. The results of the first-year experiment were published in the *International Journal of Architectural Research*. Unlike in the first experiment, the term project was here allocated only 25 percent instead of 35 percent of the total semester coursework grade. This, however, did not affect the student's commitment to the project. Students, though, complained about the low percentage compared to the amount of work required for the successful completion of the work. It is, thus, advised that when a spatial installation project is assigned, it should comprise the majority of the course grade.

The results showed that when students were given a choice to select from various topics, they spent more time—two weeks—than the students in the first experiment to define their ideas and come up with a proposal. Nevertheless, the second experiment allowed for more discussions and collaborations between the different groups. When the topics were different, students were more likely to help other groups and felt less threatened; the competition was much healthier. Although the selection of the topic took a longer time, nevertheless, students agreed that selecting a topic of their choice (under the umbrella of sustainable urbanism) allowed them to reflect more positively on their built environment. The time spent researching current challenges facing the urban environment opened up doors for in-depth conversations in the classroom.

Similar to the first experiment, the second experiment indicated that using learning-by-doing as pedagogy in architectural education resulted in a better understanding of the topics being studied. “Fun,” “innovative,” “different,” “enjoyable,” and “engaging” were amongst the positive recurrent themes throughout the interviews and discussion groups with the students (Figure 7). The students collectively agreed that undertaking this project has helped them tremendously in applying the theoretical knowledge they received in other courses, particularly “structures,” “materials,” and “construction” were the most mentioned.



Figure 7: The Learning by Doing Approach  
Source: Al Khalifa 2017-18

Students stressed that working with a group was not easy and that some of them had to resolve several conflicts. Nevertheless, they agreed that despite the tension they sometimes encountered, the experience enabled them to develop their “negotiation skills,” “decision-taking skills,” and their ability to “tolerate other people” with different mindsets. During the focused groups, students showed an understanding of the topics of other groups as well as their own. For example, a group that has worked on resilient architecture was able to discuss and elaborate on the ideas and philosophical understandings of the group working with political architecture. Similarly, a group working with green architecture showed interest and was able to converse on the topics related to space architecture and the possibility of inhabiting other planets.

The discussions on the challenges, constraints, and possibilities of the contemporary built environment in the class after the completion of the project were, thus, much more in-depth than after the topic was introduced in a lecture setting. The students showed a better understanding, were able to give more real-life examples of the topics being discussed, and seemed, in general, more interested and engaged in the discussion. Students agreed that they have learned a lot about the built environment, its challenges and opportunities through their engagement in the project. They highlighted that the exercise presented to them “in real life” the many aspects related to sustainability beyond their conventional understanding of it as just an ecological response to climatic change. For instance, having to design a spatial installation on political architecture highlighted the importance of policies and governance to ensure sustainability. A group mentioned that they have “never thought” that international politics could have an influence on the sustainability of the urban environment and that having to complete a spatial project that tackles the issue of the borders made them realise the many interconnected and complex challenges that need to be resolved to ensure a truly sustainable future.

Amongst the challenges encountered, the students stressed that working outdoors enabled them to adjust to the environment and climatic conditions. Two groups had to relocate their installation because their first location was completely exposed to the south, which made it harder to work under the sun and was causing the material to heat and expand or melt. A student highlighted that having witnessed the distractive influence of the hot sun on materials, she will now “never forget” the importance of doing a proper climatic analysis of the site.

## Conclusion and Discussion

The literature presented and stressed the negative impact of the increasing gap between architectural education and its practices. Studies discussed the impact of separating the trial and error from the production of architecture through using scaled drawings instead of the architectural product as an arena for experimentation, and existing empirical evidence highlighted the direct effect individual students’ assessments on widening the gap between architectural education and its practices.

Research in education stressed the importance of incorporating a learning-by-doing approach as opposed to traditional lectures that do not enable students to engage with the studied subject. This research investigated the impact of using an active learning pedagogy on the ability of fourth-year architectural students to understand and recall theoretical and philosophical ideas that are usually presented to them in a traditional lecture setting.

The findings show that when students are involved in a practical project, their curiosity and interest in the topic being studied increases. The experiments showed that practical assignments can be used to change the student’s perspective on a crucial contemporary issue related to the built environment and that despite the various levels of the students’ technical skills, their projects would not depend merely on their ability to hand draw, create physical models, or elaborate digitally (Chamel 2016). The study showed the effectiveness of the design-build project in allowing students to understand better and recall philosophical issues related to the built environment. It also showed that learning current topics on urbanism is more enjoyable using an



active learning approach and will lead to a better understanding of the topic, thus, a more sustainable architectural education.

The results confirm that when students worked in groups and were exposed to each other's progress, a sense of competition between the groups was created that pushed them to work harder and compete to initiate tasks faster and deliver better outcomes. The competition was healthier when the topic of the group differed from other groups; students were more likely to share information, discuss their topics, and help each other. Having to work in groups in a project of big scale polished the students' soft skills and lead to a better understanding of the technical design requirements, like structures, construction techniques, procurement processes, and materials.

The study concludes that although it is hard to revert to the apprentice system that shaped the training of architects during the eighteenth century, it is, nevertheless, possible to employ an active learning pedagogy to theoretical courses in architectural programs. The study also showed that bringing back the trial and error as an integral part of the educational process in group projects helps boost the students' soft skills and technical understanding of architecture. The study, thus, recommends reconnecting architectural education to the site, trial and error as a sustainable learning methodology, and assessment of the success of the group rather than the individual realization of learning objectives to attain sustainable urban futures.

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