

# International Collaborative Design Studio: Green Transformable Buildings

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**Abstract.** *Current trends in architectural practice such as an increased focus on sustainable design, integrated design, and the globalization of architecture are increasing the need for practitioners that are skilled in collaboration. Collaboration fosters innovation and creativity. It is a key operating principle for the 21<sup>st</sup> century and an important skill that an architecture student must be exposed to. The change in knowledge generation and creative problem solving is transforming education towards collaborative learning forcing architecture and engineering schools to address new course structures with “collaborative” aspect. The work presented in this paper draws its base from collaborative design learning. It describes an international collaborative design studio titled “International Design Studio: Green Transformable Buildings” conducted between three institutions, Yildiz Technical University (YTU)–Istanbul, University of Twente (TU)-Enschede Engineering Sciences and Industrial Design School, and Architecture Faculty of Sarajevo (AFS).*

**Keywords.** *Collaborative design; collaborated learning; team work; design process.*

## COLLABORATIVE DESIGN LEARNING

The concept of collaborative learning, the grouping and pairing of students for the purpose of achieving an academic goal, has been widely researched and advocated throughout the literature. The term “collaborative learning” refers to an instruction method in which students work together in small groups toward a common goal. *“Collaborative learning is based on the idea that learning is a naturally social act in which the participants talk among themselves (Gersch, 1994). It is through the talk that learning occurs.”*

Collaborative design learning is based on the methods of collaborative learning that is adapted for design teaching. Collaborative design has been applied in many engineering design practices such as aircraft, software, electronic devices, automotive

industry, ect. The subject has been integrated in related school curriculums and research about collaborative design teaching pedagogy has been investigated.

Design is the crucial subjects in the school of architecture and design studio is the fundamental course of architecture education in which the students are expected to be trained in the actual collaborative environment of architecture making. However, the education of an architect has been highly individualized and based on the personal skill development rather than collaborative engagement that is inherent in the process of design making. Architecture occurs in collaborative environment. It is widely acknowledged that collaborative skills are

necessary foundation for successful architecture projects.

Collaborative design requires multi-designer and multidisciplinary involvement in which the individuals act collectively as single body. In collaborative group work the students are responsible for one another's learning as well as their own. Participants work together to solve a problem.

In order to have effective collaboration students are required to develop basic skills as identified by Bosworth (1994): Interpersonal skills; Group management skills; Inquiry skills; Conflict resolution skills; Synthesis and presentation skills. Group members must want to help each other learn, feel as group member and have a personal stake in the success of the group. They also must have the skills necessary to make the group work effectively and be able to regularly analyze the group's strengths and weaknesses to make adjustments as needed. The students should understand that collaborative design learning is a skill, and like any other skill, it must be learned (Straus 2002). In the early stages of a studio that uses a collaborative model the instructor must help the students to develop the requisite teamwork skills to be successful in the studio.

The initial step to collaborative design in the studio is the establishment of design groups or teams. Barkley (2004) establishes three basic topic areas that must be considered when forming design learning groups: group types, group size, and group membership. It is important to understand the different types of design learning group structure and how they can be the most effective. Barkley establishes three typologies for groups: formal, informal, and base. The group format is determined by the studio instructor according to required design exercises. Informal groups are groups with shorter duration that can be quickly assigned. Usually they are formed at the beginning of the design project. They play an important role at the beginning of the design process for students to get know each other.

Formal groups are often formed when the pursued design task become more complex. The formal group is assembled based on the task assign-

ment and participants continue to work together until the task is completed. Based on design task complexity the duration for a formal group can range from a period of several studio classes to several weeks. Typical sizing for both groups is between two and five participants.

The base group can be formed for the full length of design studio with maximum three to four participants. However, fixing groups from the beginning of the design studio can cause studio work to stuck because of human interaction problems. Dynamic forming of the groups based on the pursued design assignment give flexibility to students to work in different substages of the design task.

One of the biggest problems of a group situation is the balance of power. More problems occur when one person is dominant, not willing to trust the abilities of others in the group. This results in a lack of cooperation amongst the group members. Usually quiet people not feel comfortable in group work they are shy or reserved and feel awkward when working with others. Sometimes the students personalities clash. This leads to arguments, causes waste of time and lead to an unproductive group.

The difficulties in collaboration are communication, compromise, and coordination as pointed in (Bosward 1994). Communication in design collaboration is one of the most common problems, since the team members are from multiple disciplines working together. A common language and method must be used for optimum communication among the team members, and the communication channel must be open at all time.

Another problem faced in design collaboration is that each discipline will have different opinions and interpretations of the problem, and therefore have different methods in approaching them. One of the most difficult jobs in collaborative design is organizing and coordinating the program for the diverse disciplinary teams. The instructors are responsible for the program coordination among diverse discipline teams.

An instructor must also act as facilitator of collaboration in order to create collaborative environ-

ment. This requires new profile of instructor who gives responsibility of learning to the students group while he/she is focusing effort on maintaining the overall structure of the course. The instructors preparation plays a key role in the the maintaining the structure of the studio. Each phase of collaborative activity should be carefully planned and followed by the instructor. The instructor should be trained or be skilled in conflict resolution. The main obstacles in international collaborative design learning set up are cultural, social and educational clashes among the participants. Many times these clashes are solved among the students however, there could be cases that would require instructor intervention in order to maintain the structure and work of the studio.

The instructors should monitor project content on regular base and note individual failures. They need to reinforce the notion of 'team' when discussing project development and point out the importance of collaborative effort in the success of the project.

Further sections of this paper will describe the process of two international collaborative design studios conducted between above given schools.

### **International Design Studio**

"International Design Studio: Green Transformable Buildings" has been initiated in 2008 between above given schools as a case study for long term research project titled "Integrated Collaborative

Design: Green Transformable Buildings." The main objectives of research project are: integrated design, collaborative learning and creativity, and design for disassembly. As mentioned in the beginning paragraphs here the research is not treated separately rather is carried out through real design projects conducted in the studio.

The goals of the research project are:

- to expand collaboration among international community of architecture design educators for current urban and architecture problems,
- to develop, implement, and refine processes for international team-based design in architecture education by simulating internationally distributed workplace environment,
- to develop collaboration between construction industry and university,
- to expand collaboration among interdisciplinary community of architecture design education.

International design studios are set up within the scope of the research project as cases through which the goals of the research project will be explored. The projects presented in this paper are results of international cooperation between mentioned three universities. During this cooperation the students of architecture, industrial design from the three universities have designed a transformable multipurpose pavilions in international and multidisciplinary teams.

Figure 1  
Design and Construction of  
Transformable Exhibition  
Pavilion in SARAJEVO, 2008.

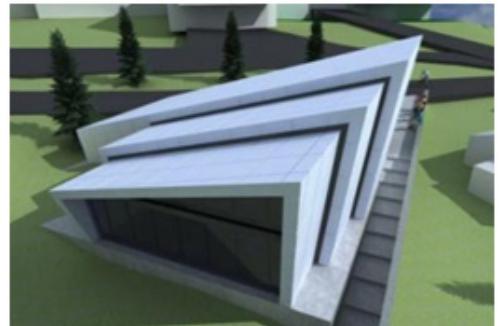
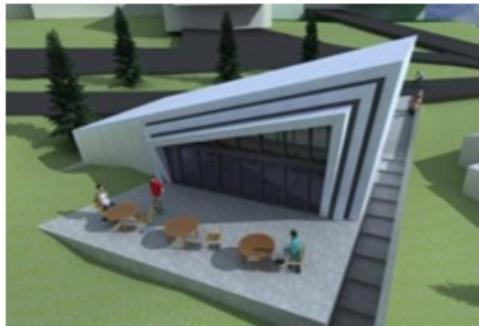




Figure 2  
Project presentation through video conferencing.

Due to limited length of this paper two international design studios “Design and Construction of Transformable Exhibition Pavilion in SARAJEVO, 2008” and “Design for Disassembly: Design and Built Multipurpose Pavilions in ISTANBUL, 2009 are explained.



Figure 3  
Jury presentations in the first workshop.

The project brief of International Design Studio 2008, is prepared by AFS. The project focused on design and construction of a flexible exhibition pavilion which can be transformed for different purposes and whose system and components could be reconfigured and reused for different purposes. (Figure 1, 4) The project site was located in the campus of Sarajevo School of Architecture. The project addressed issues of collaborative working, integrated design process, use of ICT Technologies in design and construction, flexibility and design for disassembly.

Total of 18 students from three universities worked together in three international groups (two students from each university, total of 6 students per group). The collaboration was structured around the workshops (three workshops were organized during the studio, first in Netherlands, second in Istanbul and third in Sarajevo) and regular video and skype conferences. (Figure 2)

One student from each group had a role of the group manager and one student was manager for the construction industry. The group managers had intense communication with group itself and between the managers of the other groups. Task of the group managers was to control the integrity of the overall design concept.

Figure 4 (left)  
The structure and interior of  
the pavilion.

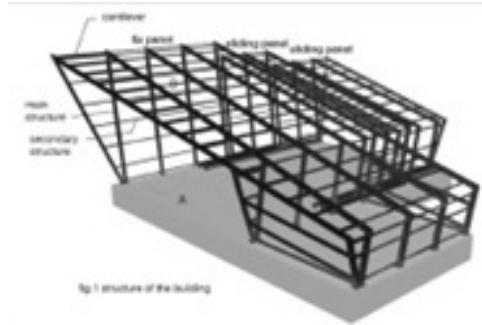
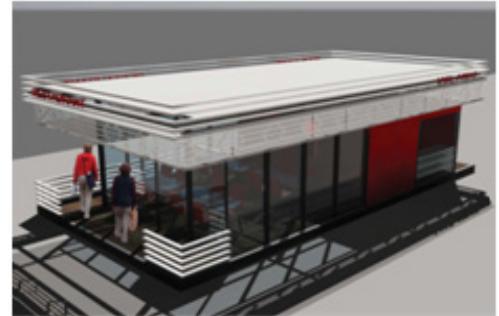


Figure 5 (right)  
Design for Disassembly,  
Transformable Pavilion.



During the first workshop each group worked on their own design concept. Prior the design concept development a multi-criteria design matrix had been discussed with students. During the conceptual design phase students have been asked to develop three alternative design solutions and to evaluate them according to multicriteria design matrix. This evaluation had been used as criteria to choose the final solution. Among three design alternatives the jury has chosen the most promising one for further design development (Figure 3).

Until the second workshop in Istanbul students collaborated using ICT Technologies over internet and worked on the development of the project. They presented their group work every other week through video conferans meetings to other groups and professors. The groups received task list prepared by professors for presentations. During the second workshop the groups worked on the enhancement of the design project. During the last workshop the groups worked with construction in-

dustry on final construction details and produced the book titled "International Workshop: Transformable Multipurpose Pavilion – Design and Construction with Industry" [2].

The project brief for International Design Studio 2009 is prepared by YTU in collaboration with old town municipality (Eminonu). The design task was to design multipurpose pavilions for summer season whose parts could be dismantled, replaced or reused in different configurations. The project aimed at integrating issues of flexibility, multi functional-



Figure 6  
Pavilion Designs.

ity, energy and material reduction. The design task was to design a pavilion(s) that has capacity to be transformed from one use scenario to another on a weakly base without demolition and additional material use. Pavilion should accommodate different functions and its components should be removable and reusable in different situations or configurations. (Figure 5) It should also be possible to contract the structure to a minimum space of 100m<sup>2</sup> and to extend the structure up to additional 100% while taking into account physical and environmental conditions of the site.

The international work groups were organized in same way as in previous studio. Here, the students had three different backgrounds, architecture, industrial design and civil engineering. The industrial design and civil engineering students get the task of managing the process and try to use their team work experience to coordinate the work. During the first workshop in Istanbul each group worked on the master plan for the whole area of the former hippodrome. This area accommodates 1 million people during one month in summer. The main challenge was how to provide clear communication lines without obstacles and how to distribute visitors along the whole area. After the master plan has been agreed upon the area has been divided into three zones. Each group has been given one zone for further development. Group one was dealing with the central zone and had to design the information pavilions for the entrance area, exhibition area with integrated solar panels and shading elements and

seating area at the end of the central zone. Group 2 had a task to develop a system for flexible pavilions that be integrated along the park side of the site. (Figure 6) Group 3 designed the system for flexible pavilions along the wall of the Blue mosque. (Figure 6).

Same as in the first studio prior to the design of the pavilion a Multi-criteria design matrix has been discussed with students. The discussion about design criteria's helped the students to understand the scope of the program and the essence of design tasks. During the second workshop the students worked on the development of the Project and at the last workshop they finalized their conceptual design and worked on the book "International Design Studio 2009, Design for Disassembly: Design and Build Multipurpose Transformable Pavilions" [3].

In this studio, the professors were split up among three groups giving every group a specific expert. It was supposed that all groups assigned one member to be the leader of the group for communication between the teams and the professors. The leader was also responsible for the presentations of the work done. Next to these roles two students and an assistant got the task to set up and maintain the communication channels for the time in-between the workshops. Some students were more experienced in working in a team and with deadlines, other students worked better individually. Integrating these two groups of students into one working team was quite a task and succeeded partly and with different success over the different teams.

## STUDIO STRUCTURE

The studios were one semester long international team projects that focused on the development of design for disassembly, reuse of components and materials, flexibility, rule based design system, spatial transformations, and the use of CAD/CAM technologies in direct cooperation with manufacturing and construction industry. They explored management and communication issues in team based design work and stressed integration and innovation in architectural design.

Collaborative learning in the studio was based on student-centric learning and students to students teaching model rather than teacher-centric guided learning. Former allows students to engage more actively on exercises and reflect on the material being learned, and requires students to be active, responsible participants in their own learning.

In international design studios the students were instructed to research and learn different subjects, and share their knowledge to accomplish together the design project. Listening, asking questions, critiquing and sharing expertise were all skills that were developed throughout the studio. This happened in the studio environment, as well as in online social platforms that were used as collaboration platforms such as skype and msn. A unified design process shared by each collaborator was dictated by the design instructor allowing the design student to be more productive over the course of the semester.

The active exchange of ideas within groups not only increased interest among the participants but also promoted critical thinking. The groups achieved higher levels of thought and produced knowledge. They were much more productive than students who work quietly as individuals. Other important skills that were aimed to be learned with an active engagement in the studio were: Interpersonal skills; Group management skills; Conflict Resolution skills; Synthesis and Presentation skills. These skills are required for effective collaboration. (Bosworth, 1994) However, it is observed that due to existing studio

culture where the students produce individual work, developing skills for effective collaboration was formidable task for the students of architecture.

In collaborative studio the collaborative learning environment provided students with opportunities to analyze, synthesize, and evaluate ideas cooperatively. The group interaction helped students to learn from each other's scholarship, skills, and experiences.

## CONCLUSION

Collaborative design work requires specific socio-technical skills which are very difficult to acquire by students during architecture courses. Indeed the design and technical aspects of architecture design are often addressed in the school but sociological, psychological, management and communication skills of collaborative works in design group are a real challenge for architecture teaching. In fact there is a lack of framework and tool for teaching and characterising collaborative practices during architecture design education.

In 21<sup>st</sup> century, changing the model of pedagogy and the model of knowledge production is crucial for the survival of the university. The universities and their faculties cannot continue to operate as separate ivory towers but must work toward collaborative learning and collaborative knowledge production.

This challenge is also an opportunity for architecture schools to re-engineer their education system for necessities of 21<sup>st</sup> century.

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