The Use of Multi-Software in Undergraduate Architectural Design Studio Education: A Case Study

Asli Agirbas
Fatih Sultan Mehmet Vakif University, Istanbul | Turkey | asliagirbas@gmail.com

Abstract

In the architectural design process, instead of using the computer programs effectively, the ability of choosing the most suitable program for the purpose takes place. However, different programs used in the design process serve different purposes. Therefore, the use of more than one program throughout the project design process arises. Every day the number of programs used increases rapidly. Hence, the designers find difficult to adapt this speed. The same applies to the students of architectural design studio course. Therefore, in this study with undergraduate architecture students, a pilot study focusing on the use of multi-software was conducted within the scope of architectural design studio. The process and outputs were evaluated.

Keywords: Use of multi-software; Contextual design; Architectural design education; CAAD

INTRODUCTION

The use of a software efficiently was replaced with the selection of most appropriate programs, since the new software emerges continuously in the field of architecture overtime. Each of these software serves different purposes. For example, software like Rhino and Grasshopper are preferred for creation of complex forms. BIM software are mostly used for application-oriented projects. On the other hand, Grasshopper add-ons like Honeybee and Ladybug are the software, which are used for sustainable building design (Agirbas, 2017a). However, software such as Photoshop, Coreldraw, Illustrator and Indesign are mostly used for design presentation purposes. Software such as Cinema4D, 3DStudio Max, KeyShot, Maya, Modo, Houdini, Lumion, and After Effects are also used for design presentation purposes, but are especially preferred for rendering. Also, they are preferred for creating simulations and creating video presentations.

There are many experimental studies on the use of different digital tools in architectural design process (Agirbas, 2017b; Agirbas, 2018). Accordingly, it seems that the selection of most appropriate programs for the purpose also becomes an important issue in architectural education. Students choose the programs that they will use depending on what they want to do in their design projects. This situation inevitably requires a transition between software during the design process.

In this study, an experimental study was carried out for architectural design studio course with students of architecture department. The students were directed to the software, which were seen most appropriate, according to what students wanted to do in their designs. As a result, the students, who have had the experience of using many different programs at the same time, have achieved the closest results they would like to do or want to do in their design projects.

METHODOLOGY

At the department of architecture of the university, where this work was carried out, the architectural design studio 3 was a course of the second semester of the second year. The course, which was one semester long, was held in the format of the architectural design studio. Individual meetings with students were carried out and the critics were given to their projects. Also, additional talks were done to the students related to the software that they used or can use based on the progress of their projects.

The students had already taken two architectural design studio courses before they were registered to 'architectural design studio 3' course. They had designed a residence as independent from the periphery. Therefore, the students had already learned the architectural technical drawing rules and spatial organization principles. In addition, the students had experienced the use of different software since they had taken different computer-aided design courses before they were registered to 'architectural design studio 3' course. However, all the students had ability to use Photoshop, SketchUp and Rhino software.

Within the context of the architectural design studio 3 in this study, the students were asked to do a contextual design. The important issue in this architectural studio is to design a building related to its environment. That is, the

students first analyze the site that was given to them. Afterwards, they determine the deficiencies of this site. Later, they suggest the building(s) for to the site according to these deficiencies.

Students are expected to make various site analyzes while researching the region. These analyzes provide students with a better understanding of the environment in which they design. These analyzes can be as analysis of storey heights of the buildings, the functional analysis of the buildings, analysis of building materials, façade analysis, analyses of spatial organizations of the buildings at the region, parks and squares analysis (Sitte, 1889), green areas analysis, solids-voids analysis (Trancik, 1986), size of the buildings analysis, color of the building and environment analysis, urban pattern analysis, urban nodes analyses (Lynch, 1960), analysis of historical buildings and special buildings (Caniggia and Maffei, 2001; Panerai, et.al. 2004), topographic analysis, climate-related analysis, road pattern analysis, transportation analysis, accessibility analysis, historical urban pattern formation analyses (Agirbas and Ardaman, 2015), analysis of the historical maps of the region (Agirbas and Ardaman, 2015), analysis of the distribution of the activities of the region, population density analysis, social analysis, cultural analysis, analysis of the surveys of the region, smellscape analysis (Henshaw, 2014) and soundscape analysis (Schafer, 1994; Ge and Hokao, 2005; Irvine et. al., 2009; Leus, 2011).

After site analysis, the students are expected to determine the proper site of their proposed buildings based on various reasons that they defined. The proposed buildings may contain many functions such as youth center, sports hall, public library, public education center, outpatient clinic, school, kindergarten, exhibition center, shop and museum. Since the proposed building will be a multi functional building, the establishment of a good relationship between the selected functions are also expected. All of the buildings are preferred to cover the area of 1000-1500 squared meters. The buildings can be designed as a single mass or as many masses. In this case, the student can propose more than one site.

In this study, the instructor encouraged the design studio students to use various software according to their design purposes. In the end of the course, many design projects have been produced with the usage of various software. In this paper, the projects of 3 students (who had been given grades above 80/100) and the software that they used were evaluated.

RESULTS
PROJECT 1

First, the student made a survey on the site. At this point, the municipal maps of the area, which were done in AutoCad platform, were converted into Photoshop platform and transformed into analysis boards. The boards gave the present case of the area. The site survey showed the missing qualities of the area and so contributed to the student to define the function to be suggested.

Then, the student offered construction of a sport complex via bringing an additional function next to the stadium in the area. During the design, he started to make 3D sketches using the SketchUp program for the specific area, which he chose in the region. At this point, the student, in fact, entered the process of reinventing with digital sketches (Graves, 1977; Schon, 1983; Goel, 1992; Schon and Wiggins, 1992; Garner, 1992; Goel, 1995; Suwa and Tversky, 1996; Do et al, 2001; Do, 2002; Agirbas, 2015). Therewithal, he began to produce the site model. The student started to produce triangular shaped masses, beginning from the form of the land and concept of linking nodes in the surrounding site.
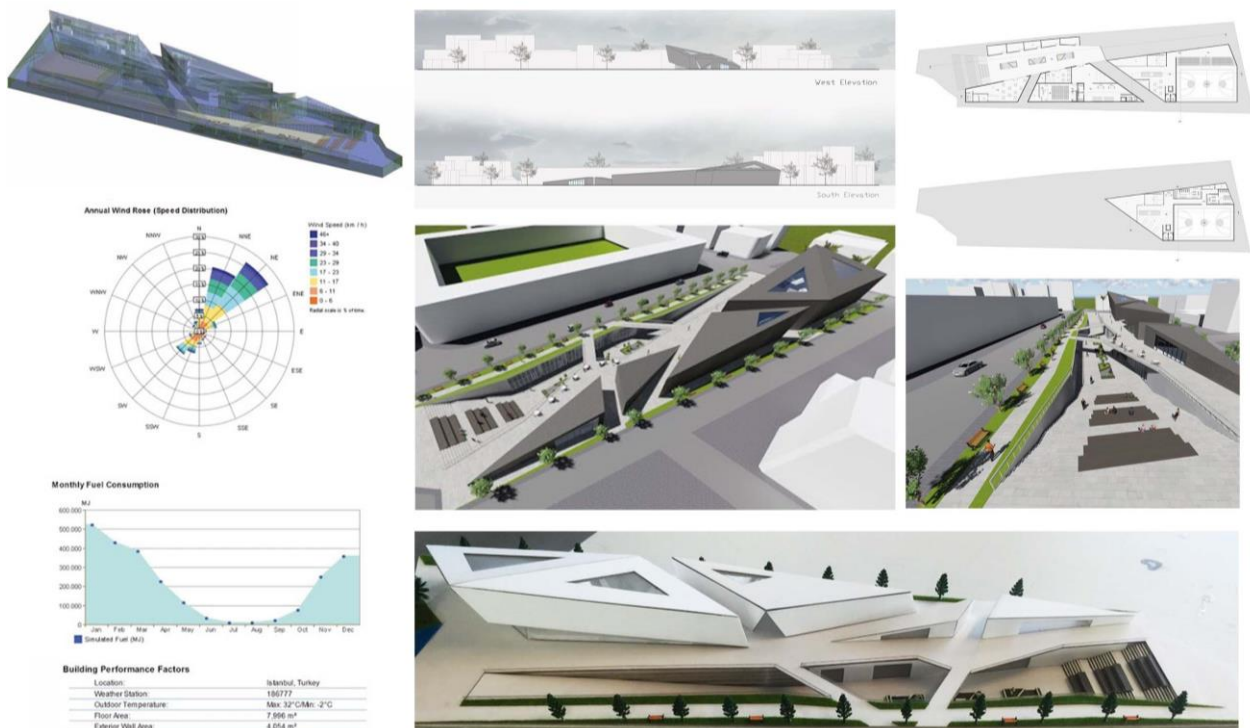
Figure 1. Sports center project of a student. Source: authors.

At the time that the design reached a certain level, the student wanted to carry on designing in the Revit platform, since he thought that he could make sections, elevations and plans for his triangular forms easier in Revit. Following, the student transferred triangular form to the Revit platform as a mass and started to detail these mass models in the Revit platform (Figure 1). The design process continued in this platform for a considerably long time.

After bringing the design to a certain level in the Revit platform, the student was asked to make the energy simulation in Revit. Therefore, the energy simulation was done this way in the Revit platform.

Then, the student transferred the 3D model to Lumion platform for presentation purposes. The student took renders and made animation of the project in Lumion platform. Consequently, he collected followings in Photoshop platform: the renderings in Lumion, plans, sections, elevations and perspectives obtained in Revit platform and map drawings in AutoCad. Later, he created boards in Photoshop platform.

PROJECT 2

The student started his project with the consideration of multiculturalism of the site. After making some research on multiculturalism, the student came up with the idea of cultural hub project which includes many activities for young people. He utilized Photoshop and AutoCad when making the site research.

He considered to start his sketches in a 3D modeling platform and spent a lot of time in the Rhino platform. He simultaneously worked on his model/ maquette (Figure 4). Then, he made a decision about the general mass of the building.

Afterwards, he started to think about the facades of the general mass and he suggested put a custom solid-void ratio on the facade. To create this, he developed a script by using Grasshopper program that works as a plug-in to the Rhino. At the same time the student was interested in kinetic structures. He wanted to reflect this on the facade, and made suggestion for making kinetic sun-breakers. For this, he used Arduino and Firefly. At this stage, he also benefited from ready-made codes in the internet platform (Figure 2).

For the presentation, he collected his model, drawings and various analyses in boards. To do this, he used Photoshop program.

PROJECT 3

Since, the student was interested in street pattern, she obtained the visibility graph of the region by using the space syntax method. She used the DepthmapX program for this study. Afterwards, based on her analysis, she selected a specific area for her public library proposal.

She chose to progress her design with using SketchUp. She created a mass model for her design in this platform. However, she simultaneously continued to work on plan drawings in the AutoCAD program and made models/maquettes. In the meantime, she constantly made transformations from AutoCad program to SketchUp program.
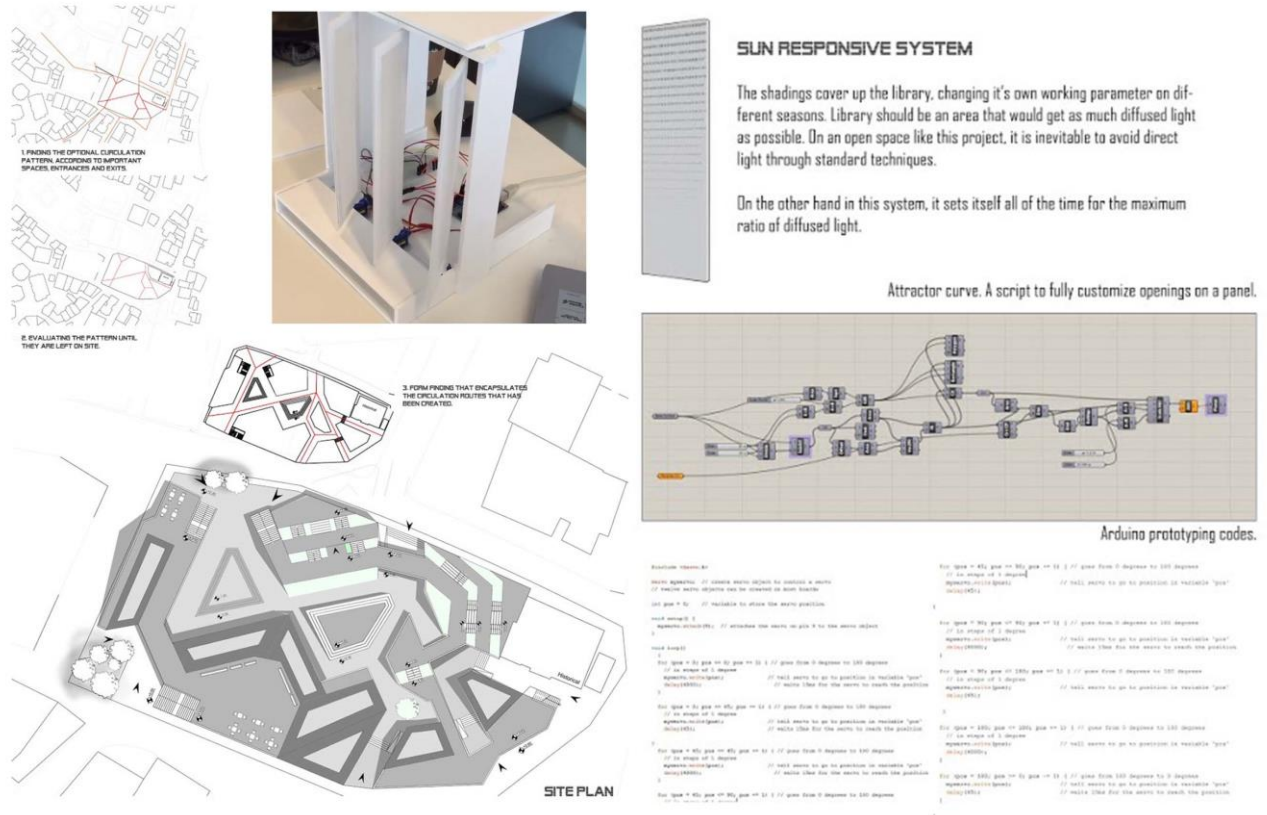
Figure 2. Cultural hub project of a student. Source: authors.

The student wanted to create a difference on the facade of the building. For this, to use Grasshopper program, which works as plug-in to Rhino, was recommended by the instructor. Therefore, the student transferred the 3D model that created in SketchUp to Rhino. She focused on voronoi geometry, and tried to apply voronoi geometry to the facade of the building design. In order to provide the harmony between the roof of the building and the created voronoi facade, various trails related to the roof was continued in the Rhino platform. Again, the student preferred to take a render in the Rhino platform.

The student transferred voronoi facades (created in Rhino) to AutoCAD in order to include them in the elevation drawings. She completed drawings of the plan, section and elevations in AutoCad platform. Then, for the presentation purposes, she transferred these drawings to Illustrator platform. In this platform she adjusted the line thicknesses. Then she transferred them into Photoshop platform to add colors. The final presentation boards were prepared in the Photoshop platform (Figure 3).

EVALUATION

Design process of 3 student projects can be divided to 4 sections. These sections are 'site analyzes' stage, 'early design process' stage, 'design process' stage and 'presentation' stage. The project site and its environment were examined in 'site analyzes' stage, sketches and conceptual designs were made in 'early design process' stage, plans, sections and elevations were drawn in 'design process' stage and renders and boards were prepared in 'presentation' stage.

It is observed that, students used different software at different stages. In Project 1, Photoshop and AutoCad in site analysis stage; SketchUp in the early design process; Revit in the design process stage; Lumion in the presentation stage were used. In Project 2, Photoshop and AutoCad in the site analysis stage; Rhino in the early design process stage; Grasshopper, Firefly and Arduino in

the design process stage were used. In Project 3, Photoshop, AutoCad, and DepthMapX in the site analysis stage; SketchUp in the early design process stage; Rhino and Grasshopper in the design process stage; Illustrator in the presentation stage were used (Figure 4).

It seemed that, during the transitions between the design stages, the transitions between various software were necessary. This process can be very time-consuming if the student didn't use the software before. At this point, instructors' suggestions can be crucial for the students to step forward their design processes.

Time to time, the instructor suggested the students to use the software, in order to progress on their projects according to their design intentions. This process might slow down the design progress, because the student may not have any idea about the software discussed with the instructor. Therefore, the student might have some difficulties to use the suggested software. However, with the help of the instructor, the problems related to the use of the software can be solved easily.

It was seen that more than one software could be used simultaneously in every stage. Therefore, there were continuous transitions among the software used in every stage. For example, in Project 1 and Project 2, transitions were made between Photoshop and AutoCad during the site analysis stage. As another example, in Project 3, there was a transition between AutoCad and SketchUp in the early design process. As the other example, Rhino, Grasshopper, Firefly, and Arduino were used simultaneously in Project 2 in the design process stage (Figure 4).

The software used by the students in some stages were very similar. For example, all of the students used Photoshop and AutoCad in site analysis stage, and all of the students used Photoshop in the presentation stage. However, the software preferred by the students in the
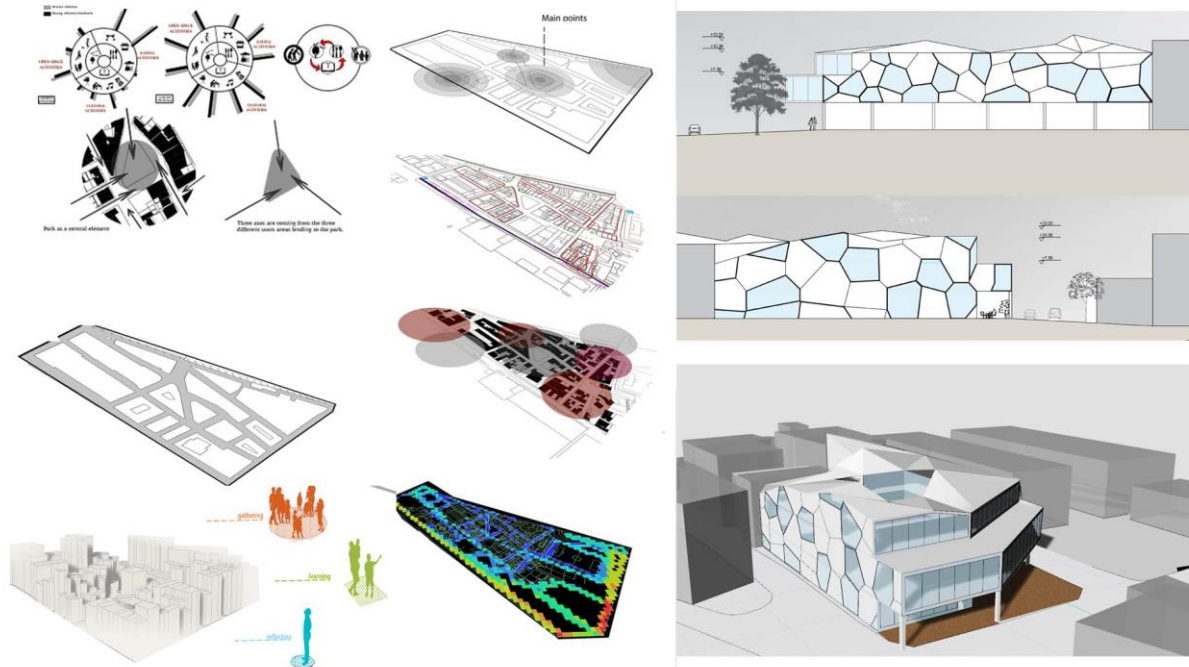
Figure 3. Public library project of a student. Source: authors.

	Site Analyses Process	Early Design Process	Design Process	Presentation Process
Photoshop	P1, P2, P3			P1, P2, P3
AutoCad	P1, P2, P3	P1	P3	
Rhino		P2	P2	P2, P3
Grasshopper			P2	
Firefly			P2	
Arduino			P2	
Revit			P1	
SketchUp		P1, P3		
Lumion				P1
DepthMapX	P3			
Illustrator				P3
Model (maquette)		P1, P2, P3		P1, P2, P3
Site Model (maquette)	P1, P2, P3			P1, P2, P3

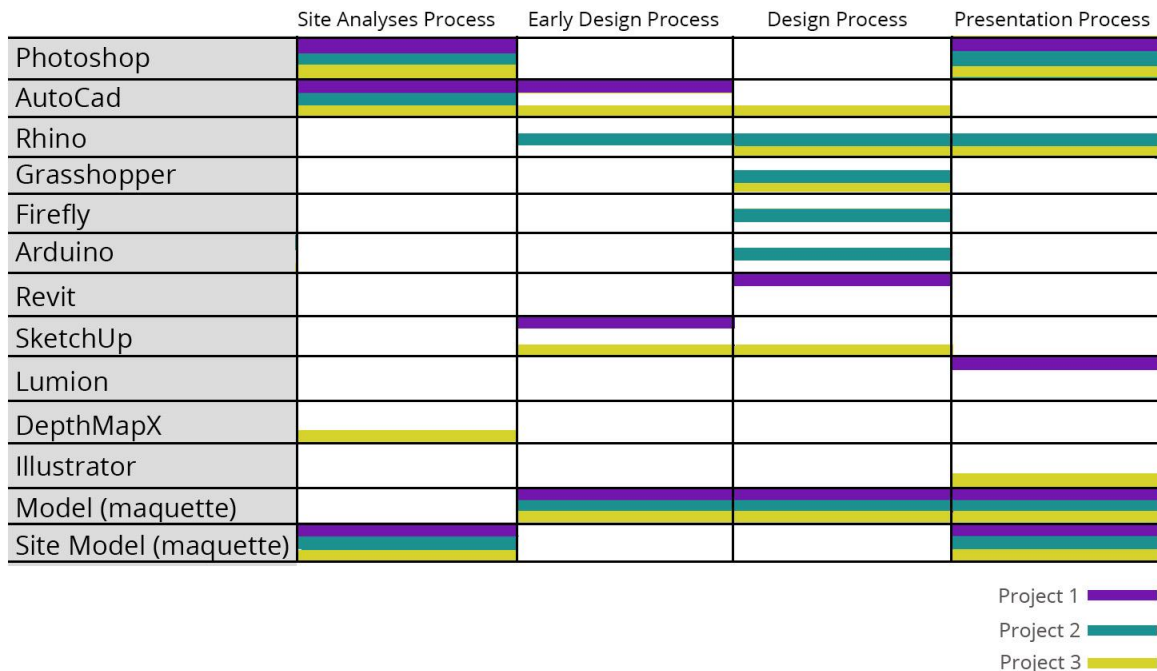Project 1 (purple) · Project 2 (teal) · Project 3 (yellow)

Figure 4. Computer programs used by 3 students for different purposes throughout the design stages of the architectural design studio course. Source: authors.

early design process and design process stages were different (Figure 4).

In this study, the best 3 projects in the design studio were evaluated in terms of multi-software use. According to the author's observations, in this design studio, multi-software was used in other projects, though not as much as these three projects. A minimum of two software (AutoCAD and PhotoShop) was seen to be used in the projects of all students who took this course.

The next step of this study might be to assess the relationship between the student's use of multi-software and their success in the studio, and to assess the relationship between the student's use of multi-software and their computer and technology interest.

CONCLUSION

It is obvious that, the students use more than one software in contemporary architectural design studio education. Therefore, they need to do transition between these software.

We can conclude that, if the architectural design studio instructors are knowledgeable about many software, they can pass on information about how the transition between these software might be. Also, the instructor can suggest software to students to use according to their design project intentions.

The use of specific software by architecture students directly related to their design project intentions makes them more investigative. Because, they get the habit of searching information about for which purpose different software can be used. This is important because, it provides the students to know the digital design tools' features, which are getting more and more complex every day, in their early years of architectural education.

The students may have different design knowledge. This leads the students to prefer different working platforms. However, the experience of the investigative process, which is mentioned above, helps the students to find the platform in which they feel more comfortable.

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