

Survey of Computer Aided Design Software Users in Jeddah, The Kingdom of Saudi Arabia: A Case Study

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<https://doi.org/10.62345/jads.2013.2.3.4>

Abstract

The purpose of this paper is to explore the most used Computer Aided Design software by architecture, interior design, and design-build (AIDB) companies in Jeddah, the Kingdom of Saudi Arabia (KSA). The finding would help local higher educational institutes in deciding on what Computer Aided Design software to teach most often, so that graduates would have a smooth transition from school life to the real-world. The paper would also help new businesses and those who are in the process of starting new businesses to invest in the right Computer Aided Design software. Face-to-face surveys were conducted with local AIDB companies to find out what software they are using the most and why they prefer to use it.

Keywords: Computer Aided Design software, Saudi female, Jeddah, higher educational institutes, universities

Introduction

The city of Jeddah is located in the western part of the Kingdom of Saudi Arabia (KSA). The weather is mild for most of the year. It is the 2nd largest city in KSA and has the largest sea port on the Red Sea. According to the Saudi Central Department of Statistics and Information, it has a population of “3.5 million” (GeoHive, 2000-13) and it is growing faster than ever. Residential apartments, villas, private compounds, and commercial constructions are booming and can be seen not only inside the city but also in the exurbia. In 2012 the largest international building and construction exhibition in the Middle East was held by The Big 5 in Jeddah, the KSA. In this exhibition a report presented by Zawya commissioned, indicated that by The Big 5 Saudi, the KSA “construction market is expected to grow at a rate of 32%-35% year-on-year until 2015” (Arab News, 2012 p. 14). As this paper further revealed in a recent workshop on the Kingdom’s construction organized by Ashariqia Chamber of Commerce and Industry (ACCI), that the private sectors have invested SR 256 billion in construction in 2011 (Arab News, 2012 p.5). Also the chairman of ACCI Abdul Rahman Al-Rashid said, “The construction sector is the engine that drives and rejuvenates the national economy attracting domestic and foreign investments” (Arab News, 2012, p. 5). Figure 1 shows an example of booming construction inside the city of Jeddah.

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The author thanks all students for conducting interviews. Also, special thanks to architecture firms’ high level management, who took off time from their busy schedules to, answers all of the questions. Further, author thanks the anonymous reviewers for their detailed and helpful comments.





Figure 1: Simultaneous construction of 2 residential apartments inside the city.

(Photo by Vaid)

Jeddah has more than 25 public and private higher educational institutions (Jeddah Municipality, 2013). Some of the leading institutions are: King Abdul Aziz University, Effat University (first female university to offer an architecture degree in the KSA), and Dar Al Hekma College (female college), just to name a few. Enrollments at higher educational institution are increasing, thanks in part to the King Abdullah educational scholarships for both men and women. Lots of Saudi citizens are taking advantage of scholarships and are graduating in the fields of engineering, architecture, interior design (EAI) and many other fields. New graduates are ready to contribute to the local economy after graduating from higher educational institutes.

A little over a decade ago, proper drafting tables made of compressed fiberboard with sheets of Formica laminated to its surfaces with vinyl board covers and parallel bars (also called parallel rule) were exclusively used to teach design and drafting to EAI students. The same drafting tables (also called architect's table and drawing table) were also used as a multipurpose desk. Students would draw and make changes with the help of manual drafting tools such as: wood-encased pencils, lead holders with leads, triangles (i.e. 30°/60°, 45° or combination triangles), erasers, architect/engineer scales, Ames guides, erasing shields, French curves, protractors, compasses, and other drafting tools. Figure 2 shows a proper architect's table. However, currently very few institutes are using them for the purposes described above. Indeed, only a few institutions are only using them only in the 1st year foundation courses. Later they are used for only sketches or as a desk. There are several expressions that are used about the drawing board. For example, "back to the drawing board" (Martin, 2013) is used in architecture language when a design does not work and needs to be redesigned.



Figure 2: The author's drafting table since he was student. He still uses it to draw only sketches and as a desk. (Photo by Vaid)

Many educational institutions have decided to switch completely from drafting boards to Computer Aided Design. For this reason, they had to redesign their studio/drafting labs to accommodate PCs. The biggest challenge they faced was the design of an electrical system for PCs and a location for a projector screen. For instance, the Royal Military College of Science (RMCS) had decided after a lengthy discussion regarding existing drafting tables, that they need, "to scrap existing drawing boards and use the space for a large CAD facility based on PCs in a networked environment" (Reffold, 1998).

The question arises, why do AIDB companies and higher education institutions teaching EAI switch to Computer Aided Design software? The answer is simple; because the Computer Aided Design software has become the industry standard for AIDB professionals. The other advantages are that, software saves time and is more accurate than designs done by hand. Files can be exchanged easily when there are several users. Also it makes it easy for companies who are working on international projects where team members are working in different parts of the world. To be successful in design today, students must be proficient in the use of Computer Aided Design software especially in AutoCAD as it relates to AIDB (J. Kirkpatrick, 2009; B. Kirkpatrick, 2009).

The new drift of technology is producing new software faster than learners can master it themselves. This leads to challenges for the higher educational institutes to align their curriculum, and to make sure their graduates have a smooth transition from school to the real world. At the same time design firm owners are facing problems on deciding which Computer Aided Design software to purchase, especially the ones who are in the process of starting new companies. Also in some cases companies have already entered the AIDB arena without thoroughly checking what other companies are using in terms of Computer Aided Design software.

There are some basic guidelines, which all higher educational institutes should follow to align their curriculums regarding new technologies and trends. In this regard for Computer Aided Design software, all AIDB departments should keep a record of the information listed below:

- All AIDB departments must have an advising board and seek recommendations from them on the Computer Aided Design software.
- Keep updated recommendations on Computer Aided Design software from department advisory board members recorded.
- Keep a record of companies where students take internships.
- Keep a record of which Computer Aided Design software's students used during internships. This can be done by asking a series of questions immediately after students finish their internships.
- Maintain a record of companies which hire the most AIDB graduates.
- Keep a record of which Computer Aided Design software most companies are using in Jeddah and perhaps in KSA.

The above guidelines would help the higher educational institutes in aligning their curriculums related to Computer Aided Design software.

CAD is a generic term used for Computer Aided Design software. There are 3 different spellings used for CAD, but all of them are pronounced as "CAD". Additionally, there are 5 different words referred to as CAD, 2 for CADD and 3 for CAAD. Figure 3a, 3b and 3c illustrate words used for CAD, CADD and CAAD.

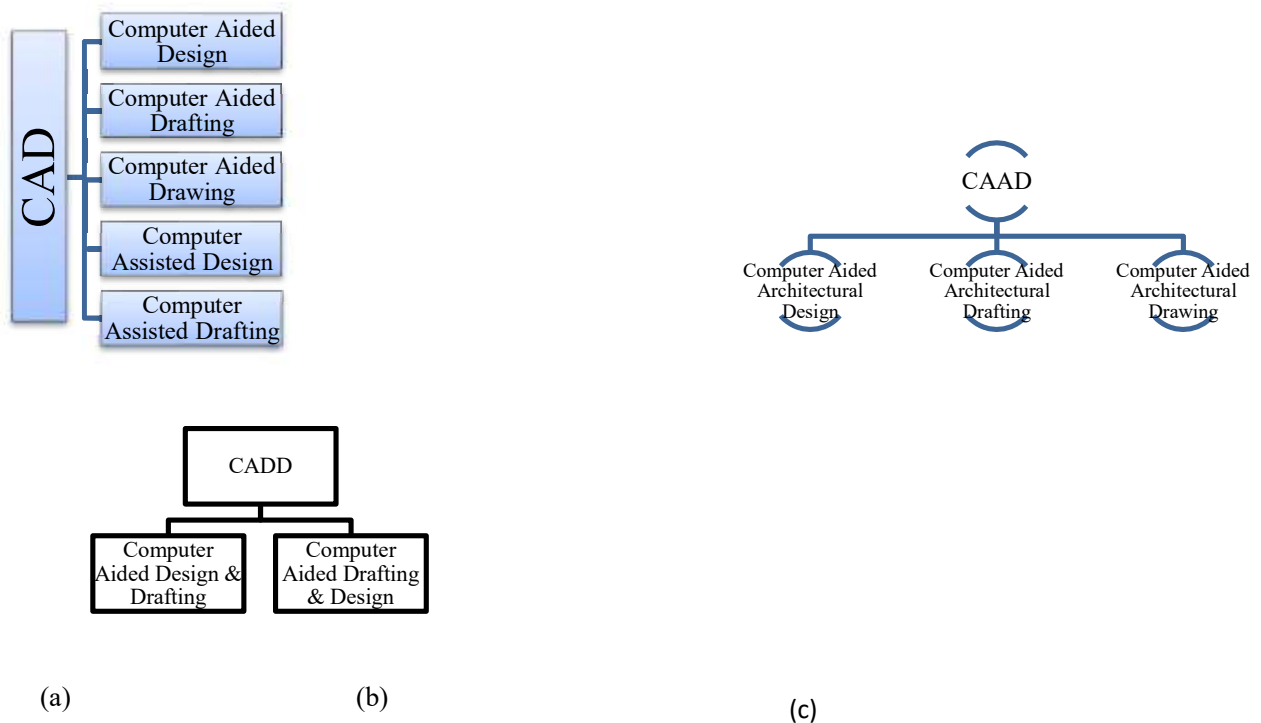


Figure 3: 3a indicate words used for CAD. 3b indicate words used for CADD. 3c indicate words used for CAAD.

Uses of CAD Software

Computer Aided Design software is used in many ways by professionals such as: architects (i.e. residential & commercial), designers, drafters, engineers (e.g. mechanical, electrical,

civil, industrial, etc....), interior designers, pipe line engineers, automotive engineers, structural designers/detailers, artists, teachers, instructors, professors, product designers, builders, prosthetics designs, aerospace designers, ship designers, bus skeleton designers, and by many more technical related professional. Similarly, it is also used by fashion designers, fashion companies, and pattern technologists to modify existing designs or to create new clothing collections. In term of practical applications architect uses it to draw plans and construction documents. Similarly electrical engineers, architects, and architecture designers use it to draw electrical architecture drawings which indicate switches, TV cables, phone outlets, wires, fixtures, diagrams or schematics, and other related symbols. Additionally, in power plan drawings same professionals draw outlets and other information related to voice data. CAD is also used together with other tools, which are either stand-alone products or integrated modules such as: photo simulations, estimations, frame layouts, truss layouts, construction material catalogs, photo realistic rendering, product data management, computer aided engineering, finite element analysis, computer aided manufacturing, computer numerical control, and many more. The other use of CAD is to show architecture engineering analysis such as tensile strength, yield strength, stress, strain, and effect on elements in certain temperature. Moreover, it is also used with conjunction of flexible diaphragms, rigid diaphragms and similar situations to investigate lateral force distribution (Willard & Quinn, 2012).

History of CAD

The history of CAD is 6 decades old. Originally, all design and drafting work was done manually on boards. The process was slow and time consuming. A small mistake would take a long time to fix. The Discovery of CAD sped up the work similar to the discovery of word processors. According to Beach, "In 1950, Dr. Paul J. Hanratty invented a numerically controlled program that allowed designers to draw simple lines with a computer" (Beach, 2013). Dr. Hanratty's work continued to improve and in 1957 MIT researchers developed Pronto. Furthermore, in 1963 Mr. Sutherland developed Sketch Pad. That was the turning point of 2D CAD. He was able to demonstrate the use of pen to draw arcs and lines. Initially, the CAD systems could only be run on large size computers as big as the size of a room. The use was limited to giant companies such as electronic, aerospace and automotive companies, because of the high price. The main reason for using CAD by large companies was to speed up their work save drawings for future use, and modify them quickly. Soon advances changed the CAD systems and transferred them from mainframe computers to minicomputers to desktop to laptop, and now they can be run on tablets (Osakue, 2013). In the beginning CAD was run on DOS but now it works on the Window, which makes it very easy and user friendly for user. In 1982 Autodesk introduced AutoCAD. Since, then they have improved a lot and continue to improve.

The Study

This study is to investigate the most widely used Computer Aided Design software among AIDB companies in Jeddah, KSA. The author has been supervising internships for over 3 years and noted students' complaints of insufficient preparation in Computer Aided Design software prior to an internship. As a result this study was conducted to find solution(s) which would help in aligning curriculum. The case study highlighted in this paper included 33 female undergraduate architecture students. They were asked over 2 semesters to conduct face-to-face interviews with local AIDB companies. Thirteen questions were prepared related to expectations of employers from interns including questions on Computer Aided Design Software. However, this paper concentrates only on finding the answer to 1 question listed below. Other questions may be used to align higher educational institute curriculums beside

Computer Aided Design software, company expectations from interns, and mastery in specific fields prior to receiving a full-time job offer. The author will be using other results in other papers.

- What Computer Aided Design software do you use?

Results and Discussions

All of the respondents were professionals and had degrees in either engineering or architecture and are involved in construction and are in the design business for a long time. Surprisingly the survey results indicated that all 33 respondents are using AutoCAD. However, some companies are using other Computer Aided Design software along with AutoCAD. Twelve companies are using 3D Max, 1 is using Form-Z, 11 are using Revit, and 1 is using Maya. See table 1 and figure 4.

Name of Computer Aided Design software	Number of user
AutoCAD	33
3D Max	12
Form-Z	1
Revit	11
Maya	1

Table1: A list and users of Computer Aided Design software used in Jeddah, KSA.

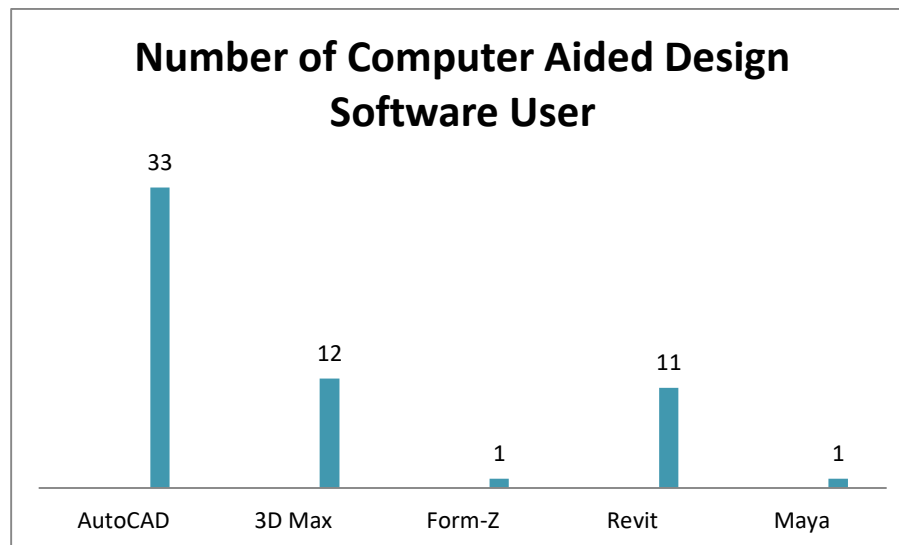


Figure 4: Computer Aided Design software names and number of users in Jeddah, KSA.

The survey results also showed that 25 companies are using other supporting Computer Aided Design software along with AutoCAD. Twelve companies are using 3D Max with AutoCAD. One company is using Form-Z with AutoCAD. Eleven companies are using Revit with AutoCAD and 1 company is using Maya with AutoCAD. See table 2 and figure 5 for details information.

Name of other Computer Aided Design software used with AutoCAD	Number of other Computer Aided Design software used with AutoCAD	% of other Computer Aided Design software used with AutoCAD
3D Max	12	48%
Form-Z	1	4%
Revit	11	44%
Maya	1	4%
Total	25	100%

Table2: A list of other Computer Aided Design software used with AutoCAD including the number of user and %.

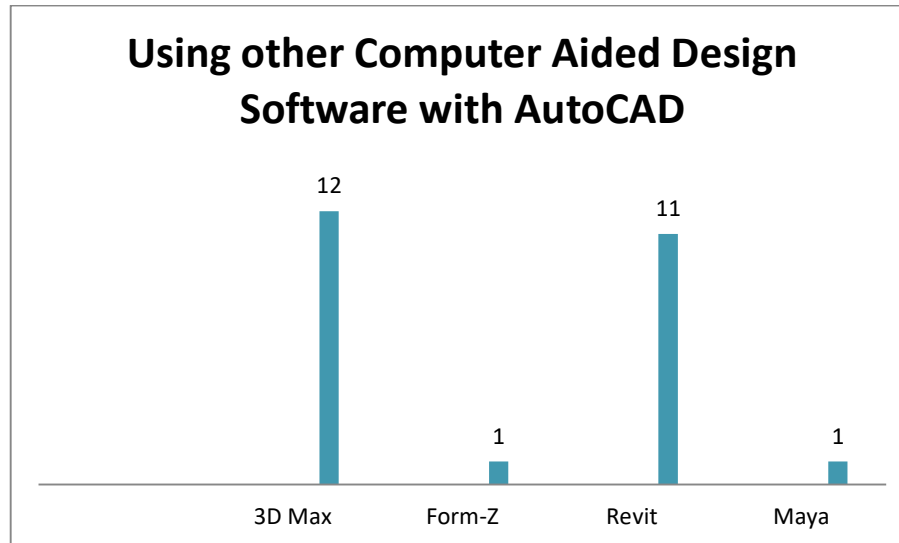
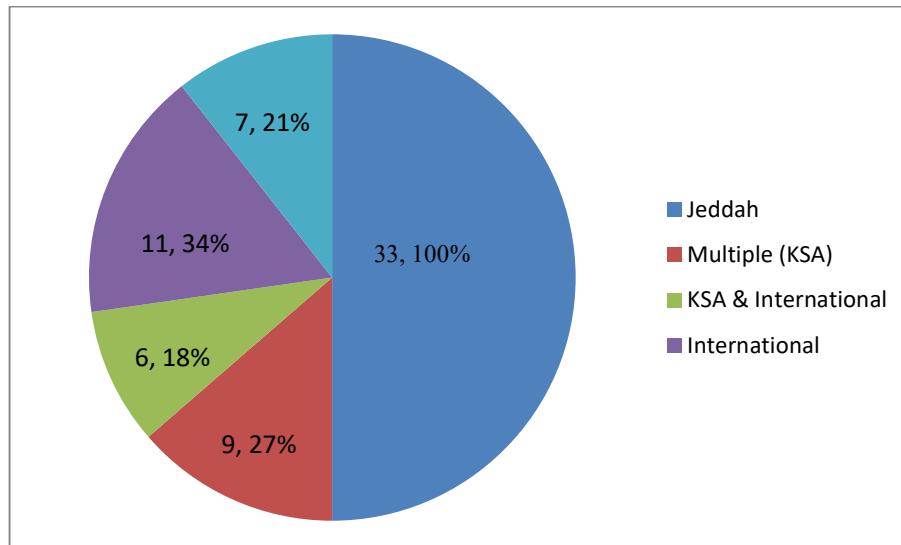


Figure 5: Other Computer Aided Design software used with AutoCAD

Local, National and International Offices

The main target of this survey was the local AIDB companies in Jeddah but out of curiosity students asked company representatives if they have offices in other cities in KSA or perhaps in other countries. Interviewers were surprised to found out that some companies have offices in other cities of KSA and other Middle Eastern countries. The 33 randomly picked companies for the survey that have offices in Jeddah are indicated on the pie chart. Nine companies (27% of total companies) have offices in Jeddah and other cities in KSA. Six companies (18% of total companies) have offices in Jeddah, other cities in KSA and other Middle Eastern countries. Eleven companies (33% of total companies) have offices in Jeddah and other Middle Eastern countries. It should be noted that companies are using the same Computer Aided Design software in other branches for compatibility, consistency and ease of access on all projects. See figure 6 for complete information on offices.



**Figure 6: Local (i.e. Jeddah), National, KSA/International, International, No other offices.
Current Curriculum and Technical Elective Courses**

Curriculum Review

Currently there are 2 Computer Aided Design courses that are required to be taken in the 5 years architecture program. In the 1st course, students learn AutoCAD and later Revit. Students enroll in the AutoCAD course during the 2nd semester of the 1st year, and Revit in the 2nd year. Students are not encouraged to use AutoCAD in the remaining of 4 years except occasionally. On the other hand students are encouraged to use Revit. There are 3 technical elective courses required to be taken from a list of elective courses to fulfill graduation requirements. However, there are flexibilities on the technical elective courses where other courses could be substituted by department permission.

Conclusion

It is the responsibility of higher education institutes to prepare students who are professional and equipped with the skills required for an internship; as well as to produce graduates who can have a smooth transition from school life to the real-world. Survey finding indicates that the most widely used Computer Aided Design software in local companies is AutoCAD. However, findings also indicated that other software's are used in conjunction with AutoCAD. The findings in this paper would be beneficial for higher education institutions to review and align their existing curriculums according to the most used Computer Aided Design software's in the local market, followed by other software to fulfill the Computer Aided Design software knowledge. One course is not sufficient for students to master the most demanded design software. Therefore, more than 1 course of AutoCAD should be required. Also professors, lectures, and instructors need to encourage students to use AutoCAD more in other courses, especially in studios to keep them in loop. The other way to advance students skills would be to offer advanced AutoCAD courses during the summer or breaks. Further, to offer Revit and 3D Max seminars. Both courses can be substituted in the technical elective courses. Finally, the other 12 questions' findings need to be analyzed to align current curriculums and to satisfy local company needs for interns and new graduates.

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