

How the Professional Practice and the Architecture Education in Malaysia is Catching up with the Development of CAD

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Abstract

In the last two decades, the world of built environment has been supported eminently by the usage of Computer Aided Design (CAD) application, from being a drafting tool to a design counterpart. Due to this, more and more computer application tools have been developed and created to accommodate the demands of the market over the years. As the usage of CAD has become part and parcel of the daily running of architecture firms, higher-learning institutions such as universities and colleges have produced great efforts in preparing the built environment market with workforce that is equipped with the essential skills and ability to operate CAD. This paper aims to look into the insight of how higher learning institutions are keeping up with equipping their graduates with the right CAD applications that are actually being used by architecture firms. Apart from that, this paper also looks into how architecture firms use CAD in the daily running of their offices. The approach is by conducting a survey within 25 architecture and urban planning firms of various sizes within Kuala Lumpur, the capital and largest city in Malaysia, to find out the actual CAD application tools used by them. The findings from this survey will then be counter checked with the tools/software taught in the higher-learning institutions.

Keywords: Building Information Model (BIM), Computer Aided Design, Graphic Editor, Software, 2D Drafting, 3D Modeling and Rendering.

1. Introduction

Computer Aided Design (CAD) application tools have been on the sell since the 1970s in the US and 1980s in Malaysia. However, the relatively sophisticated CAD tools, with 3-D modeling and colored graphics enhancements, have only become more common only in the mid 1990s. Computers, in general, on the other hand have been used 5-6 years earlier in producing non-drawing documents such as letters, spreadsheets, tables and charts, memos and notes of meetings. However, the usage of computers, be it through Computer Aided Design (CAD) systems or non-drawings applications, have impacted the professional practice, education, and the research associated with architecture tremendously since the final years of the last millennium.

2. CAD and its Implications

Today, computers are being used by nearly everyone in the architectural and design line, be it fresh graduates who just entered the workforce, or senior designers and managements officers, or owners of such companies. Whether it is used only as a tool or to the extent of a working partner, nobody could

deny the importance of computers in the daily running of any design or architectural firms. Gone were the days where only pencils and pens that mattered to this nature of job. In parallel to this development, all higher learning institutions have now equipped their architectural graduates with skills of using computers that will help them in carrying their daily tasks as architects.

However, limited information could be found in relation to whether university architectural programs of today are training recent graduates properly in the computer applications which are actually used in architectural firms. With computer technology becoming a very important addition to the fields of architecture and design, students need to be taught to the capabilities of these resources prior to graduation. However, with the introduction of countless new computer application in the market, it is vital for students to be exposed to the capabilities to the right application that will be later used in the working world. For this, both the educator and practitioner have a similar goal in wanting a graduate student who is fully competent (Harwood, 1989)³.

Another issue that relates to this is how architect firms are taking advantage of the introduction of countless new computer applications that now not only produces documentation, but also assists architects in designing more energy-efficient, economic, and comfortable buildings. With ecological and sustainability awareness have risen to a great level among designers and the public itself, it is considerably important for architects to make sure that they design buildings that is sustainable and ecologically friendly. Studies suggest that building designers who use building simulation tools can reduce the energy use of a new building by 15-20 percent on average compared to buildings designed without these tools. Software that function as simulation tools to help estimate the performance of proposed buildings with respect to various performance aspects such as energy and environmental impact are important for architects to achieve the above.

Looking to the above matter, a survey was done on **25** architectural firms of various sizes in Lembah Klang with every each currently running active projects worth more than US\$30 million. The respondents from every of the surveyed firms were the principal, the head architect, the head of production team and its graphic designer. A part of the intention from doing the survey was to determine which computer applications and software programs are being used in the architectural professions. The results obtained from this survey have provided architectural programs and UKM's Department of Architecture an insight which would help enable them to determine the degree to which computer application competencies are current and appropriate for the needs of the architecture profession of today.

It is a common fact that today's computer-aided design (CAD) programs have definitely reduced the need for manual drawing. All particulars of a building, including its floor plans, sections, elevations, perspectives views, and model renderings can be created or generated in a much shorter period of time than by the old traditional way of manual drafting. Although the computer improves efficiencies, cuts down on labor costs, and avoids repetitive work, complications arise with the initial costing, software management, and in training the staffs. With constant advancements in computer equipment and techniques, preparing design students for the profession is an ongoing process for the educational system (Allen & Stimpson, 1990)².

By looking at the questions employers ask out during interviews, we would find out that these practitioners want students who are fully prepared upon graduation to work with them in the field. They want graduates to have a great amount of specific knowledge as well as utilizable skills that will make them productive straight away, such as in the ability to use and run CAD application. As for this, therefore both the educator and practitioner have a similar goal in wanting a student who is fully competent (Harwood, 1989)³.

In securing a future for the architecture industry, educators must respond to changes in technology, management, service orientation, and the legal recognition of the profession. The curriculum of architecture programs should reflect both contemporary and future trends for society and industry in computer use, particularly in CAD.

3. Findings

Figure1: Types and nos. of users for software applications

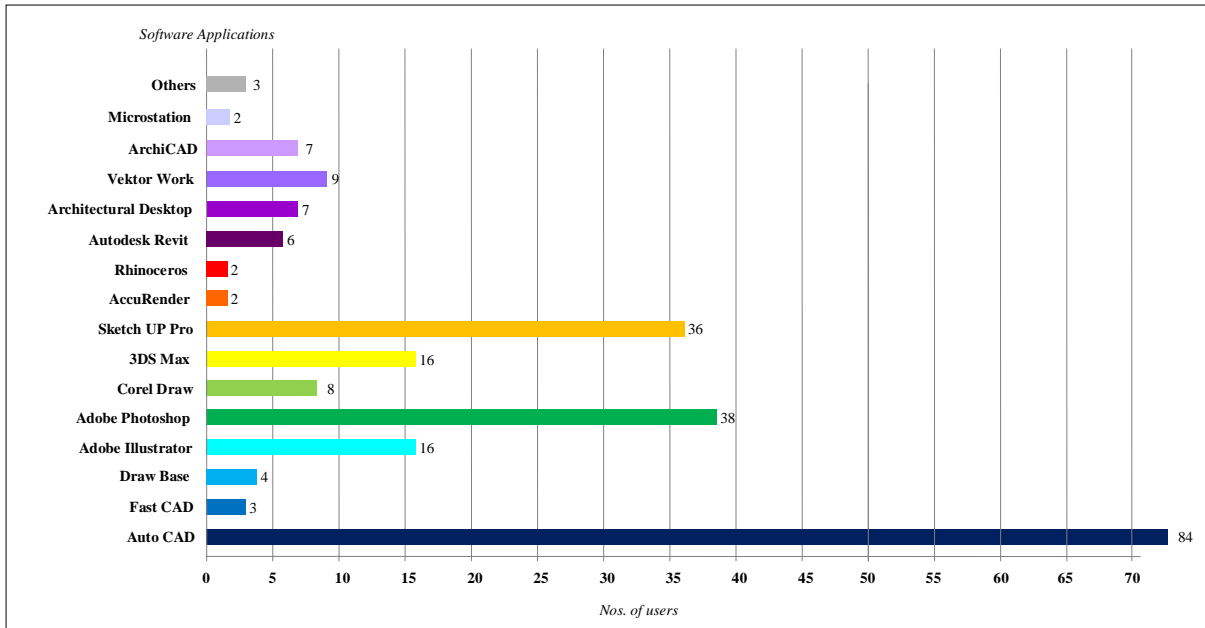


Figure 1 shows the types of software applications used by 100 nos. of respondents from 25 architectural firms. In reference to this, *AutoCAD* by *Autodesk* has the highest nos. of users with a total of 84. Next in second place goes to *Adobe Photoshop* with 38 nos. of users. This is followed very closely by *Google's Sketch-Up*, which carries a slight margin difference of just 2, which is 36 nos. of users. Sitting at fourth and so on are *Adobe Illustrator* (16), *3D Studio Max* (16), *Vector Works* (9), *Corel Draw* (8), a tie between *ArchiCAD* and *Autodesk's Architectural desktop* (7), *Autodesk's Revit* (6), *Draw Base* (4), *Fast CAD* (3), *Microstation* (2), *Accu Render* (2), *Rhinoceros* (2) and one (1) each to three (3) other software applications.

The huge difference on the nos. of users between *AutoCAD*, which sits at first place, and its closest rival shows that *AutoCAD* seems to be dominating the current CAD market. There may be a number of reasons as why this happens. *AutoCAD*, a software traditionally used for the production of 2D drawings, was one of the first 2D drafting application introduced in the country. Therefore, being the earliest 2D drafting application, coupled with tremendous marketing effort during its introduction, the *AutoCAD* name has been synonymous to architects and draftsmen when it comes to 2D drafting (Harrington, David, 2001). Apart from that, the transfers of drawing files from one consultant to the other consultants in a construction project demanded the project team to use the same software application as an application may not have the ability to open and edit a drawing file through a different application. Thus *AutoCAD*, which was one of the earliest 2D drafting application to be introduced in the country, set an informal rule that any new office that intends to implement computer drafting has to have *AutoCAD* to be able to read *AutoCAD* drawings that comes from more senior or leading firms. Although this is no longer a problem as most software applications of today are able to read files from other applications, by the time this happens, *AutoCAD* has already been brought and used by most architect firms in the country.

Apart from that, *AutoCAD* is also used extensively as a 3D modelling software. User often use *AutoCAD* to produce 3D models before they render it in a different software that has better rendering ability. Not being able to offer high quality rendering is seen as the only weakness that *AutoCAD* possesses.

The second most popular software among architectural firms, which is Adobe Photoshop, is a software of different nature than *Autodesk's* AutoCAD. Photoshop is a software which deals with raster graphics; producing touched up final presentation drawings, photos and images. Therefore, while being second most popular software overall, it is actually the most popular as a raster graphic and image editing software. Its traditional global rival as in the same category of raster graphic and image editing software, which is Corel Paintshop, does not have any user at all from the survey.

SketchUp by *@Last Software*, and now owned by *Google Inc.*, stands at third place, and founds itself as the most popular 3D modelling software in the Malaysian market. Although the software is considered new, as its first release in the country was in late 2000, its popularity rose sharply over the years as many consider it's *Push/Pull Technology* (U.S patented 2003) has made it probably the easiest 3D software available on the market. However, as the application is meant for conceptual 3D modelling, as reflected by it's name, SketchUp's popularity would most probably stays stagnant due to it's inability to provide high-end 3D renderings. This is where 3D modelling and rendering software such as *Autodesk's* 3D Studio Max, Cinema4D by *Maxxon*, Form Z by *AutoDesSys, Inc.* and Lightwave 3D by *New Tek* comes in. Most SketchUp users end up having their 3D models rendered in these applications because of their high-end renderings ability.

3D Studio Max, a product of *Autodesk*, which also produces AutoCAD, had been the most popular 3D modelling software for many years before the introduction of Sketch Up into the local market. It's early introduction since the early 90's, which leaves a long heritage on the Microsoft Windows platform, coupled with its strong modeling capabilities and a flexible plug-in architecture, made it an industry-standard application and is even still very much popular among the design sectors in the country. Most of the respondents in the survey indicated the ability of high-end rendering through various multiple plug-ins have are the reasons for using 3D Studio Max.

Adobe Illustrator, which is a vector graphics based application that is used for illustrating vector artworks, seems to be the most popular software for its category. CorelDRAW by *Corel Corporation*, which was once considered the industry-standard editor during the 1990's, captures only about a quarter from this category's users. According to the survey, constant redevelopment in line with other *Adobe* products may have probably kept *Adobe* Illustrator an almost compulsory choice of vector-based editing software for architectural firms, especially since its integration with *Adobe's* Creative Suite packages, which was introduced in 2003.

Coming on to seventh, eighth and ninth place are the Building Information Modeling (BIM) based application; ArchiCAD of *Graphisoft*, Revit and Architectural Desktop of *Autodesk*. Although the newer versions of Vector Works (Vector Works ARCHITECT) by *Nemetschek* has been built as a BIM software, the survey found out that it was not used for BIM purposes, rather as a mere 3D modeling software that generates 3D perspectives for viewing. There is a specific reason as to why these users choose Vector Works to generate 3D. Being Macintosh users, they are much more accustomed to Vector Works, a CAD software that started off as MiniCad in 1985, and was created specifically for Macintosh users. However, the number of overall users for BIM based software shows that BIM has not yet been popular among consultants and builders in the country.

4. Taught CAD Software in Malaysian Public Universities

Most Malaysian public universities teach CAD as part of their overall Architectural program syllabus. CAD skills are now being taught in these universities through courses that are made compulsory for all architecture students to undertake. Even though the contents of the given course touches mainly on beginning-intermediate skills of CAD, this is still seen as a development for architectural education in the country as CAD courses were not made compulsory to be taken just 10-12 years ago. Some universities at that time did not even offer the course as part of their elective architectural courses.

The followings are the software that is being taught in public universities as part of their compulsory CAD courses:

Figure 2

No.	Institutions	Software Taught
1	UTM ⁹	AutoCAD Vector Works SketchUp 3D Studio Max Adobe Photoshop Corel Draw
2	USM ¹¹	AutoCAD 3D Studio Max
3	UM	AutoCAD 3D Studio Max
4	UIAM	AutoCAD 3D Studio Max Art-Lantis SketchUp Adobe Photoshop
5	UKM	AutoCAD Adobe Photoshop Adobe Illustrator SketchUp
6	UPM	AutoCAD Sketch Up Adobe Photoshop Accu Render

UTM - Universiti Teknologi Malaysia,
 USM - Universiti Sains Malaysia,
 UM - Universiti Malaya
 UIAM - Universiti Islam Antarabangsa Malaysia,
 UKM - Universiti Kebangsaan Malaysia
 UPM - Universiti Putra Malaysia

Based on the above table (*figure 2*), we could see that most of the public universities in Malaysia teach their students on CAD software that are being used by most of the architectural firms. AutoCAD by Autodesk, which seems to be on every University's list when it comes to teaching 2D drafting, reflects the wide usage of the software among architecture firms in the country. Adobe's Photoshop, Sketch Up by Google and 3D Studio Max by Autodesk is quite popular among most of the Universities, as seems to be the choice for image editing, 3D modeling and rendering.

However, software for vector graphics based application such as Adobe Illustrator and Corel Draw seems not to be getting the attention by these institutions, as only UKM and UTM makes it compulsory for the software to be taught to students. This seems to be strange as quite a substantial number of architecture firms are using these software in their firms.

3D modelling and rendering software such as Form Z, Cinema 4D, Lightwave, Microstation and Rhinoceros seems not to be popular among the Universities even though these software are being used by a number of architecture firms as it's development has also shown great improvements of its abilities over the years.

Building Information Modeling (BIM) based application such as ArchiCAD, Revit and Architectural Desktop are not being taught in any of the above architectural schools even though its popularity has grown over the years among architecture firms.

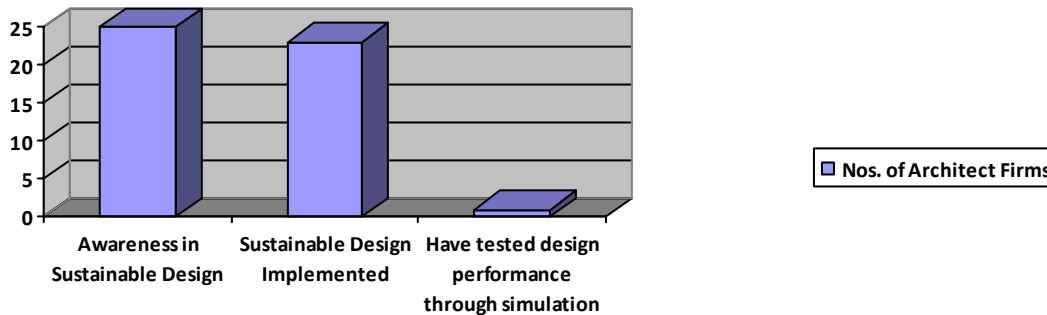
5. CAD and Sustainable Design/ Green Architecture

Sustainable and ecological friendly design, which intention is generally to eradicate negative environmental impact effectively through skillful and sensitive design, has recently been one of the fastest growing subjects among not just architects, but also urban planners, landscape architects, engineers, interior designers, industrial designers and even politicians. For the past decade, awareness for the need of a more energy-efficient, economic, and comfortable buildings have risen to a great level

that most clients and users in general demand their architects and design consultants to implement sustainable qualities in their design.

From the survey, we found out that all the firms are well aware of the importance of adapting sustainable architecture. *Figure 3* shows that 23 out of 25 of the surveyed firms claimed that sustainable and ecological friendly approach is part of the firms' principles of design. Based on this, all of the 23 firms claimed to have implemented sustainable approach in designing all of their current projects. However, we also found out that only 1 of the architect firms had actually carried out dynamic performance assessments on their design through computer simulation.

Figure 3



On the architecture education level, while the principles of sustainable architecture has been taught and carried out in their program syllabus, none of the architecture schools have introduced the usage of computer simulation software to test the dynamic performance of the students' design works. Though most of the students are aware that the design of any building could now be tested and analyzed through computer simulation that includes photo-realistic lighting simulation, solar mapping and insolation studies, simulation of infiltration and inter-zone bulk air flow, Computational Fluid Dynamics simulation of air flow, simulation of building energy and occupant comfort and many more, they seem to have their design assessed by their lecturers only by theory.

6. Conclusion

Most of the universities in Malaysia teach traditionally industry-standard CAD applications such as AutoCAD, 3D Studio Max and Adobe Photoshop eventhough developments of CAD software over recent years have seen many new and very much improved CAD software and even system, such as the Building Information Modeling (BIM) system that integrates everything to a master model. These software have shown great ability to carry out tasks that even the traditionally industry-standard CAD applications could not achieve. It is a great lost to the country if both of the higher education and professional practicing level do not open their eyes to look at other alternative options and explore the greater and higher possibilities other application have got to offer.

Another shocking revelation from the survey was that none of the surveyed firms or any of the higher learning institutions uses or teaches any software simulation tools. Software simulation tools such as DOE 2/DOE 2.2 by James J. Hirsch (JJH), BLAST, FRAME, ESIm, LightSim helps architects solves complex decisions involving many performance considerations, such as comfort, energy requirements, code compliance, environmental impact, aesthetic appeal and many more that leads to a sustainable and ecological friendly building design.

Universities and other higher institutions should therefore study these alternative options and lead the way in introducing various options to the professional market by equipping graduates with abilities to use many other developed applications that will offer professional practices with various choices that suits best to the firm's needs in the design and construction industry.

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