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Use of Computer Designing for Architectural Infrastructures in Different Terrain

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***Abstract*:** The use of CAD in architectural practice and education has drawn fierce criticism in recent years, according to literature. The mental efficacy of modern students in institutions and, primarily, practicing architects was thought to be negatively impacted. Contrary to the prevalent practice of using Computer-Aided Design (CAD) in the design process, the earlier method of drafting was positioned favorably. This study is a moralist polemicist against broad generalizations like that. Before proposing a curative remedy, it aims to assess the viability of the goals of previous literature. In that respect, the objective goal of this study is to analyze and contrast quantitatively the advantages and drawbacks of using computer-aided design (CAD) vs conventional approaches in architectural practice and education. Secondarily, it seeks to vehemently amplify whether computer-aided design (CAD) use should be continued or discontinued based on an analysis of identified CAD users. Therefore, a variety of interdependent schemata were developed to organize the scope's boundaries in order to achieve the full phenomena of this expansive aim. The methodology sold follows the quantitative paradigm. From the viewpoint of experts, secondary data for the theoretical framework was gathered through databases, books, and journals.

Keywords: Architectural Practice, Architectural Education, Computer-Aided Design (CAD), Computer-Aided Drafting, Computer Software, Two-dimensional (2D) Space, Three-dimensional (3D)

Introduction

Since the development of information technology (IT) in the past few decades, professional practice and education in architecture have been at the forefront of fervently consuming the digital prowess in each of its special rights. It was energizingly stated in India (2002) that the architecture school had given a forceful launch pad for changing the profession's scope. Architectural schools have served as a testing ground for new, innovative architectural imagination and as a way to expand architectural domains into internet.

Dunn (2012) notes that, throughout time, architecture has come to be seen as a field with two interrelated primary activities: designing and making. Additionally, these two interdependent pivotal activities are transitive in a continuous dialogue as projects progress from initial ideas to final concepts, which is typically the construction of a building. Architecture continues to place a lot of emphasis on having the ability to effectively communicate inventive ideas. The variety of configuration processes that are now available to planners, which may have an influence on the production of architecture and its elements, is more than ever thanks to the development of multiple Computer Aided Design (CAD) as well as additional programming packages.

Additionally, computer-aided design (CAD) has applications in many design fields,

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including the design of all types of machinery in the architectural, mechanical, and engineering fields. All kinds of buildings, including industrial and residential ones, are being drafted and designed using CAD because it eliminates time-consuming manual drafting in favor of automated development. Given that the software documents lines as vectors determined by mathematical computations, Computer-Aided Design (CAD) tends to be more inventive and accurate (Bryden, 2014).

Implementation of Computer Aided Architectural Design (CAAD / CAD) and BIM:

CAD tools may produce design documents in 2D, 212D, and 3D. Standard building designs can employ 2D and 212D drawings. For polyaxial curvatures, variable curves, and dynamic structures, 3D software is required. Vector-based drawing components include points, lines, polylines, circles, etc. Materials and depth are simulated via textures. For the construction of models, certain libraries include complete building blocks. Different parameters can be used to specify these elements.

This database's single pieces can be linked together to create an interconnected model with parts that are interrelated, which implies that modifications to one area of the model may, if required, have an impact on other sections. Construction drawings can be created as elevation drawings, sectional views, and 3D views. These software tools' design data may be exported as well as imported for use in other applications utilizing a variety of interchange formats.

CAD frequently presupposes electronic forms for printing, production, and machining. The lifespan of a design includes several processes where CAD is used. Here are a few examples of how CAD is used in various professions:

- Architecture - Whenever it comes to CAD, architecture is one of the most complicated fields. The design of an architectural project involves several software-dependent processes. Building information modeling (BIM) tools like Revit are frequently used by more established businesses to increase efficiency. Smaller businesses may use different tools to accomplish the same task.
- Product design - To visualize components and to forecast and check their capabilities, industrial designers use CAD tools including Fusion 360, Inventor, or Solid Works.
- Graphic design - To visualize mockups, graphic designers also use 2D or 3D CAD software. Users of graphic CAD software can change backgrounds, shapes, effects, and fonts to help with artwork.
- Engineering - CAD software is used by engineers for a variety of tasks. Buildings, infrastructure elements, circuits and telecommunications networks, mechanical objects, medical equipment, utilities, and manufacturing parts are just a few of the often drafted aspects utilizing CAD.

The application of CAD in architecture educational and professional settings has been fiercely criticized in recent years by literature. The mental effectiveness of modern students at institutions and, primarily, practicing architects was thought to be negatively impacted. However, paradoxical debates about whether information technology contributes to user efficacy or whether it is just a compulsive tool forced upon the younger generations by this era of advancement exist in professional practice (Dong & Gibson, 1998). Since the invention of technology, it has been argued that computer instructors' effectiveness has been significantly reduced, and this

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effectiveness is inferior compared with that of students themselves (Smith, 1986). Contrary to the prevalent practice of using Computer-Aided Design (CAD) in the design process, the earlier approach of drawing was positioned favorably.

The Theoretical Framework:

"Computer-aided design (CAD) is the practice of developing digital two-dimensional and three-dimensional product drawings utilizing computers and specialized software. For usage in a variety of applications and sectors, many kinds of software for CAD have been developed (Bryden, 2014). It's exciting to note that Computer-Aided Design (CAD) as used here refers to computer software that computer systems employ to create, modify, or improve designs as well as to assist precise drawing (Englander, 2009). It is additionally known as computer-aided drafting, according to Sapidis (2005). Curvatures and figures can be designed using computer-aided design (CAD), which can be used to create surfaces, solids, and curves in either two- or three-dimensional (2D or 3D) space**.**

Three different categories of computer-aided design (CAD) can be made: premium 3D hybrid systems like Pro/ENGINEER and NX (Unigraphics); 2D drafting applications like Auto CAD LT (also known as Auto CAD Light); and 3D solid feature designers like Chief Architect, Archi CAD, Vari CAD, SolidWorks, and Solid Edge. However, visualisation, as defined by Pilkaite (2010), remains a modern design tool that supports the representation of various infrastructure types. However, for the presentation and advertising purposes, visualization became a crucial 3D object. Without the need of costly external resources, things may be precisely recreated to look as they will in real life with the use of visualizations.

The Emergence of Computer Aided Designs (CAD) Software:

A design/drafting tool known as computer-aided design (CAD) has been around for a while and was originally created as an invention for designers who used drafting tables and drawing tools. The typical interface for using CAD software is a mouse, trackball, pen, or tablet. Andia (202) clarified that due to the widespread usage of personal computers (PCs) and the development of commercial sized CAD, the application of CAD evolved during the mid-1970s and mid-1980s. However, it wasn't until the early 1990s that the use of CAD received full recognition and was integrated into the architectural education curriculum. Additionally, in the early 1990s, having experience with CAD became a requirement for graduates seeking employment. In the 1990s, the computer to student ratio went up from 1:50 down 1:10 (Lawson, 2002). Today, thanks to advancement, students can afford their own computers because the ratio is on the upswing.

In general, Computer-Aided Design (CAD) has been utilized to create technical drawings for a variety of businesses in addition to the subject of architecture. But the focus of this study is on architecture. Dong and Gibson (1998) assert that the advancement of CAD technology in three-dimensional drawings, three-dimensional digital models, and computer simulation could offer designers new ways to identify additional solutions throughout the schematic design process. Sanders (1996) & Demirkan (1998) both refer to architectural design as a repeating process where the goal is to find the optimum solution. Initially, CAD systems

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often represented the final product of the design, but as computers with faster processors and 3D modeling became more prevalent, CAD advanced to a new level. CAD technology may now be utilized for decision-making throughout the design process rather than only for creating drawings thanks to recent advancements in computer technology (Husain, 2007).

Impact of Computer-Aided Designs (CAD) On Architecture:

Although CAD has aided in the production of designs, its use by designers comes with restrictions. He or she will need greater computer programming expertise as they work through these restrictions. The teaching, learning, and practice of design have all been significantly changed by computer-aided design (CAD) [13]. With the use of CAD, one may quickly and efficiently produce conceptually comprehensive models of 2-D and 3-D illustrations, studies of environmental impacts, change the shape of pictures, and address more challenging design issues. The use of CAD technology in architecture involves two main goals: to apply it to the human cognitive process of designing using computer smart technology as well as to turn it into a medium for concept representation in architectural design (Koutamanis, 2003). Therefore, the following framework will be used to discuss the effects of using computer-aided design (CAD).

Architectural Practice and CAD:

According to Andia (1997), other sectors have also used technology to influence their business methods. Generally speaking, CAD is only used by professionals in two contexts: first, at a level of work process and professional ethics, and second, at the level of skill. The digital model for this case, as stated by Dong & Gibson (1998), allows the architect opportunities to ponder, envision, link, and make assumptions during the design process. The most powerful CAD software comes bundled with a variety of simulations to help create better visual conceptions for designs. Andia (2002) added that the conventional design construct approaches used in drawings, reports, and documentation are transformed by CAD. Furthermore, Novitski (1992) argued that, in the case of architectural organizations such as Frank Gehry & Associates, a more technologically advanced system denigrates conventional design practices in addition to facilitating design efficiency.

The foundation for experimenting with different architectural visions has been supplied over time by architecture schools. As a result, according to Salama & Wilkinson [17], modern approaches to architectural education have been horribly impacted by developments in digital technology and design. However, it is well known that the development in information technology (IT) has redefined the fundamental principles as a construct for architectural education. Additionally, Reffat [18] argued that the conventional approach of hand drafting along with craft modeling is being robbed of its essential significance in the advancement of design ethics by the implementation of CAD in architectural drawing. By undermining the benefits of the connections that should exist between students and instructors, which is a standard interaction in architectural education, Brown (2009) asserted that the introduction of CAD towards architectural education has overpowered traditional methods of drafting.

Lawson (2002) & Robertson, Walther & Radcliffe (2007) argued that contrary to what

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CAD suppliers have said in their advertising and how we have been led to think, CAD does not significantly enhance designing. In addition, Dutch architect Herman Hertzberger stated in his book that CAD is not a tool for creative design since the software predicts how the design would turn out rather than actually allowing for true originality. In his book "Lessons for Students of Architecture", he harshly criticized the usage of CAD as a drafting tool.

Architects choose computer-aided design over conventional drawing methods. Though not many prefer the utilization of traditional drafting processes over CAD in the practice of architecture and education, some actually favor an amalgamation of both traditional methods and CAD methodology.

Many architects believe that using CAD, or Computer Aided Design, is more cost-effective than using a traditional drafting method. While a few individuals felt that the use of CAD in architectural education and practice was less cost-effective than traditional drafting methods.

Most architects agree that projects created with computer-aided design (CAD) are often of greater quality than those created using the conventional drawing approach. Although the designs created using CAD are of lower quality than those created using the standard drafting procedure for architectural practice and education, the respondents are unconcerned about this.

As a result, it is clear that the majority of respondents use computer-aided design (CAD) in everyday design executions. CAD is known to be quicker, more cost-effective, of higher quality, and to have better presentation because it offers a variety of ways to carry out a design endeavor that visual realization.

Compared to the conventional design build, using computer-aided design (CAD) offers significant advantages. These benefits include a higher level of productivity, better design quality, cheaper design development expenses, and a significant reduction in the amount of time needed to achieve deadlines.

Conclusions

Drawing exercises are essential to the creation of architectural designs. Without digressing from the topic at hand, it is advised that modern architectural practices adhere to the conventional method of sketching prior to drafting as the standard for the design process. As the foundation of the design process, traditional sketching techniques should be taught to students at architectural schools, according to the instructors. This research makes the claim that a successful fusion of conventional design principles with technology Computer-Aided Design (CAD) applications would result in outstanding amalgam designs as completed goods. Therefore, there should be a balance between the use of conventional approaches and Computer-Aided Design (CAD) for a complete architect who knows how to use various techniques to offer design solutions in architectural training and practice.

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