

# Software Application Employed in Architectural Design Education: The Case of KNUST

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## Abstract

Computer software has come to replace the manual form of designing in both architectural education and practice. The use of drawing boards had been employed in architectural education and practice for a long time. Since the first half of the twentieth century, computer hardware and corresponding software have seen dramatic change and development manufactured and tailored to meet the demand of changing technological and human needs. Architecture has had its fair share since the advent of computers and has seen major milestone changes in its integration into the profession. In the last century, architectural education in Ghana has also witnessed this revolution. From the year 2000 and thereon since Computer Aided Architectural Design (CAAD) was introduced in the Department of Architecture (DOA) in the Kwame Nkrumah University of Science and Technology (KNUST) there has been tremendous improvement in the CAAD tools used in architectural design education. There is therefore the need to evaluate the CAAD software used by the students and faculty. This paper looked at the existence and the mode in which CAAD software is applied in the department, the predominant software used by students and the mode of acquisition of the software. The findings proved that CAAD is taught as part of the curriculum in the DOA and has helped improve architectural design education over the years. However, the full potential and benefit of CAAD use has not been realized as a result of challenges faced by students and faculty in teaching, learning and acquisition of software.

**Keywords:** application, architecture, CAAD, education, Ghana, software

## 1. Introduction

With the rapid development in the use of computers and the adoption of technology, there has been the need to incorporate such development in our educational system. Computers have become one of the most powerful tools available in recent times which has dominated almost every sector including the field of architecture. Botchway et al. (2015), posits that architectural education in Ghana has seen tremendous improvement over the years since the introduction of Computer Aided Architectural Design in the Department of Architecture a decade and a half ago.

Elhardudi (2007) argues that architectural education should provide the right tools to students to enable them have information and knowledge of the realities of the architectural practice as it pertains in industry and the future. He however posits that although diverse research and concepts have been propounded in relation to the appropriate use of CAAD systems in architectural education, there is still no global framework for teaching CAAD in architectural schools and departments.

CAD teaching is now a part of curricula in almost every architectural school (Pektas & Erkip, 2006). Different software applications and concepts are used to teach CAAD in various schools across the world depending on the availability and knowledge base of teachers responsible for CAAD education. The different softwares available have made the teaching, learning and practice of architecture easier and more convenient. Elhardudi (2007) also suggests that CAAD systems lead to better representations, and allow architects' models and operations to correspond more closely. Guney (2014) shares in a similar thought that the usage of CAAD software ensures easy storage and sharing, faster design integration across the various stages, precise design detailing, better 3D visualization and saves time.

However, this is not to say CAAD softwares are without challenges. According to Moloney (2001), most CAAD software interfaces are intricate and require substantial time input to understand and deploy, while the hardware requirements to produce quality animations are continually expanding. Gokhan and Erkan (2012) also affirm that Architectural Design is a complex process and architects are continuously required to draw and analyze resources from various disciplines in their design decision making processes. Guney (2014) again states that CAAD softwares can lead to technology addiction, decreasing creativity among students, low quality of design, amongst others.

With the positive and negative impacts of CAAD softwares, Guney (2014) asserts that the most important thing is how to balance these effects to get the most out of the softwares.

After 15 years of the introduction of CAAD in the Department of Architecture (DOA), in Kwame Nkrumah University of Science and Technology (KNUST), this paper looks at the existence and the mode in which CAAD software is applied in the department, the predominant software used by students and the mode of acquisition of the software. The paper further recommends approaches to improving usage through teaching and learning of various softwares and ways to acquire these properly.

## **2. History and Status of CAAD in the Department of Architecture (DOA)**

CAAD was introduced in the 1950s to help designers assess the “goodness” of their creations (Elhardudi, 2007). After several years of its conception, a young professional (Botchway, 2001) introduced CAAD to the Department of Architecture in 2001 in a bid to provide a new paradigm for architectural design education.

The curriculum of the DOA requires students coming in as freshmen up to the sophomore year to design and draft using the old traditional pencil, T-square and drawing board while students in the third to sixth years encouraged to use various CAAD softwares for their studio work.

The current concept of architecture design education is a blend of both the traditional methods of designing and drafting with the drawing board and T-square in conjunction with the use of CAAD tools as part of the design process (Botchway et al., 2015).

## **3. Methods**

This paper adopted both qualitative and quantitative approaches to research to obtain and analyze data. As part of the qualitative survey, focus group discussions were held with some students and faculty on the use of software in the department. In addition to this, open and closed-ended questionnaires were administered to obtain data and evaluate CAAD softwares used by students in the Department of Architecture of Kwame Nkrumah University of Science and Technology. The population for the study comprised the faculty and students of architecture in KNUST. A simple random sampling method was used to come up with the sample size. The response rate for the questionnaire was 66.3%, which concludes that the findings are valid and reliable.

## **4. Findings and Discussion**

### *4.1 Focus Group Discussion*

The outcome of the focus group discussion with the faculty and students of architecture showed that CAAD has been included in the architectural curriculum although the lessons are inadequate. Friends, online tutorials, internships among others were stated as some of the means through which CAAD is learnt by students due to the inadequacy of the CAAD lessons taught in class. The discussion further revealed that, although most students used AutoCAD, there is no limitation on the type of CAAD software used for coursework. The choice of softwares used by students was mostly influenced by availability, simplicity, popularity, among others. The major challenge noted was that the cracked version is mostly used since the department does not provide the original version for their use and the students on the other hand cannot afford to buy the original versions of these softwares. Hence the only means of acquiring the software is to copy the cracked version from friends or download from the internet. Since the software are not genuine they often crash and data is lost.

The responses from the questionnaires are discussed below.

### *4.2 Status of CAAD in the Department*

343 respondents confirmed that CAAD was taught as part of the curriculum in the department while 10 respondents indicated otherwise. As to its adequacy, all the respondents indicated that CAAD courses taught in the department are not adequate. For this reason, most students resort to other means to learn and understand the complexities of these softwares.

Table 1. CAAD courses as part of curriculum

	Frequency	Percent
Yes	343	97.2
No	10	2.8
Total	353	100.0

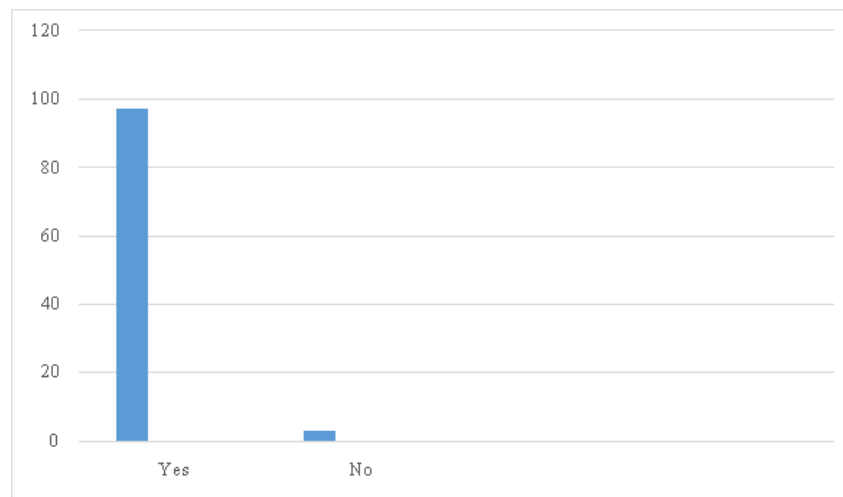


Figure 1. CAAD as part of curriculum

#### 4.3 Means of Learning CAAD Software

As posited by Ghani and Azwar (2006), software learning can be considered as a long term process in order to have a grasp of the commands. In this regard, self-learning is also vital for students to have a deeper understanding in the software as well as the tutorials in class.

From the responses received from the questionnaires, 17.9% of students learnt to use CAAD softwares on their own. 19.3% learnt to use the software through CAAD lessons in class, 21.5% learnt from friends, 19.8% by online tutorials whiles the remaining, representing 21.5% learnt to use the software through vacation internships.

Table 2. Means of learning CAAD

Means of learning CAAD	Frequency	Percent
Self	63	17.9
Lecture	68	19.3
Friends	76	21.5
Online tutorials	70	19.8
Internship	76	21.5
Total	353	100.0

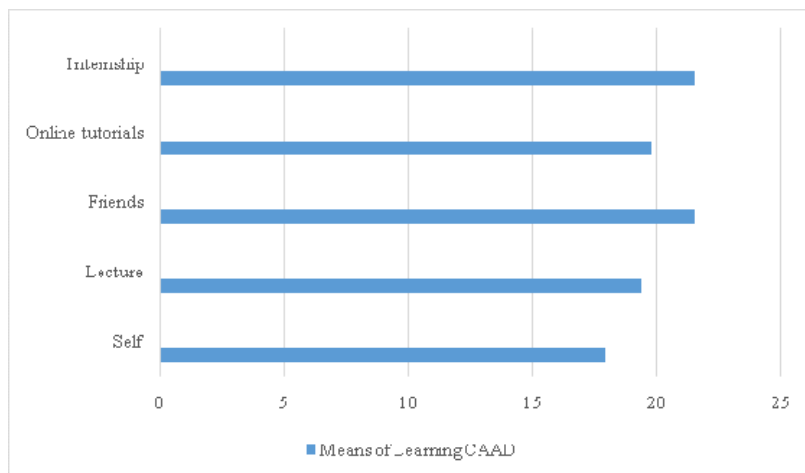


Figure 2. Means of learning CAAD

4.4 Means of Acquisition

From the findings as of 2015, the department does not make CAAD softwares available to students. Therefore, the only available means is the pirated (cracked) versions. The findings proved that they either download cracked versions from the internet or copy them from friends since they cannot afford to purchase the original softwares.

Table 3. Means of acquisition

	Frequency	Percent
Friends (cracked/pirated version)	231	65.4
Free Download (cracked/pirated version)	122	34.6
Total	353	100.0

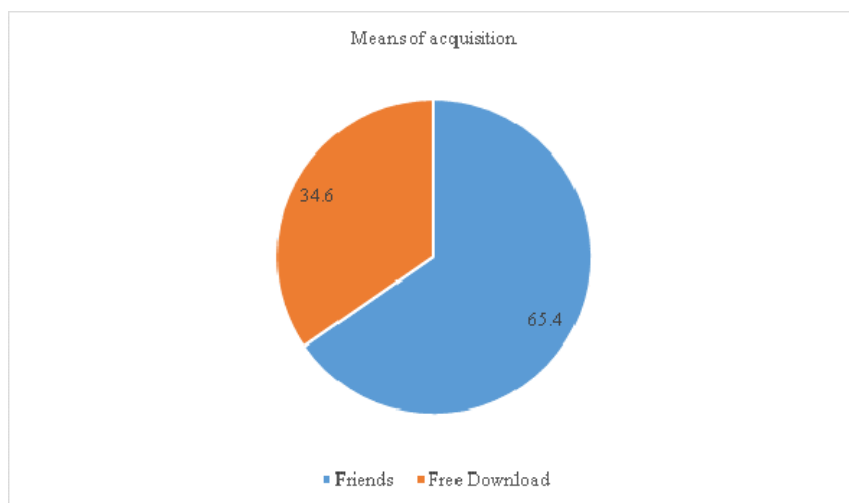


Figure 3. Means of acquisition

4.5 Types of CAAD Software Used by Students

All the respondents indicated that they use computer aided design softwares in their design works. However, the type of CAAD software used varied. CAAD softwares used by the students included Autodesk AutoCAD

Architecture, Revit Architecture, Google Sketch up and Layout, Adobe CS6 Master Suite, Photoshop Illustrator, Archicad, Corel Draw and 3Ds Max. From the questionnaires distributed, AutoCAD had the highest frequency representing 34.7% which affirms the assertion by Hannu (2003) that AutoCAD is “the marketing leader” in architectural platforms. 30.5% of the respondents use Revit, 22% use Sketch up, 5.1% use Corel Draw, 3.4% use Photoshop, 2.5% use 3Ds Max, 0.9% use Adobe CS6 Master Suite and Archicad. Issues of availability, simplicity and familiarity accounted for the differences in CAAD software used by students for their design work.

Table 4. Types of CAAD software

Type of CAAD software	Percentage
AutoCAD	34.7
Revit	30.5
Sketch up	22
Corel Draw	5.1
Photoshop	3.4
3Ds Max	2.5
Adobe CS6 Master Suite	0.9
Archicad	0.9
Total	100

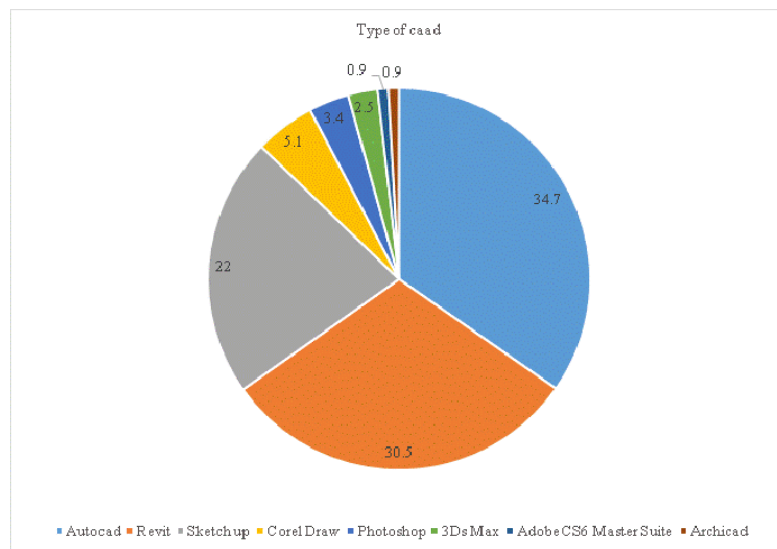


Figure 4. Types of CAAD software

#### 4.6 Benefits of Using CAAD Software

Since the introduction of CAAD in the department, several benefits have been realized. When asked the benefits of CAAD in architectural education, 151, out of 320 respondents indicated that CAAD makes work faster and easier as compared to the traditional methods of drawing. This affirms Minialoff's (2000) assertion that it is faster to make changes to a CAD drawing than with a pencil and paper drawing and also provides easy storage and retrieval of files. 69 respondents indicated that CAAD provided a better and detailed graphical representation of ideas while 100 respondents indicated that CAAD helps to produce more realistic models and also helps to visualize the whole design in 3Ds and 2Ds.

Table 5. Benefits of CAAD

Benefits	Frequency	Percent
Faster & Easier	151	47.1
Better graphical representation	69	21.6
Produces realistic models	100	31.3
Total	320	100

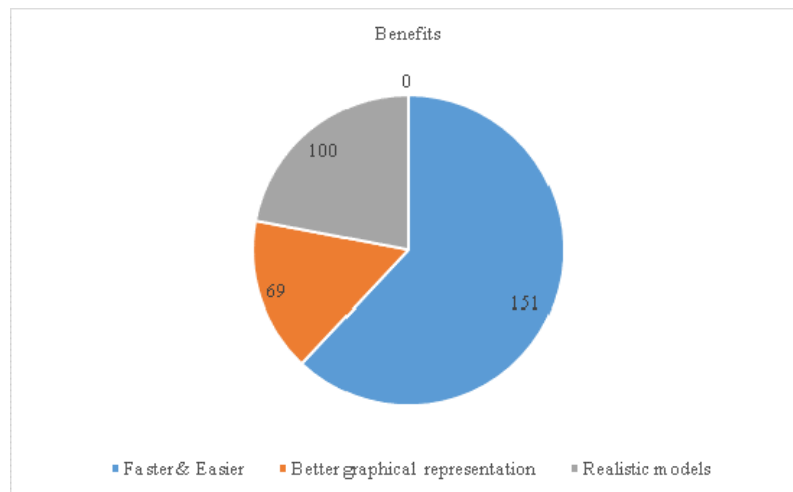


Figure 5. Benefits of CAAD

#### 4.7 Challenges Associated with the Use of CAAD Software

The respondents mentioned complexity, crashing of software and less knowledge on the use of the software as the setbacks in using CAAD softwares. Out of 285 respondents, 80 indicated that the software is complex and most of the toolbars on the interface are difficult to understand. 120 responded that since they do not use the original version, the software normally crashes which leads to the possibility of losing all files. 85 respondents indicated that they do not have adequate knowledge on the software use.

Table 6. Challenges of using CAAD

Challenges	Frequency	Percent
Complex	80	28.1
Crash	120	42.1
Less knowledge	85	29.8
Total	285	100

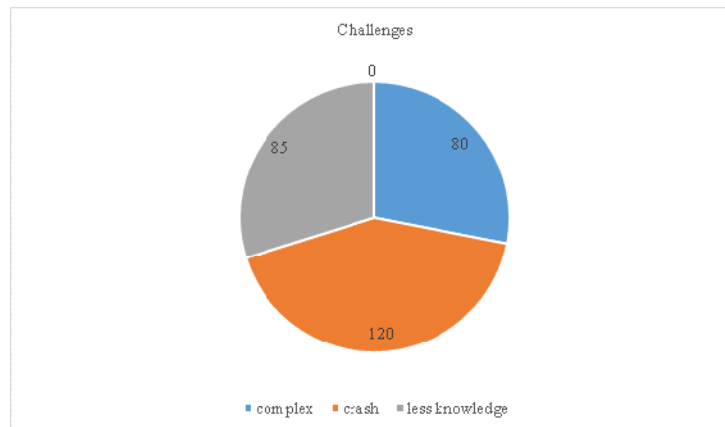


Figure 6. Challenges in using CAAD

## 5. Conclusion and Recommendation

From the findings, it can be concluded that CAAD has led to an improvement in architectural education in the Department of Architecture, KNUST after 15 years of its introduction by making work faster and easier, providing better graphical representation and producing realistic models. However, the full benefits of using CAAD softwares have not been derived due to the following:

- 1) Inadequacy of CAAD lessons in the curriculum leading to the inability to understand the complexities associated with the software.
- 2) Inadequacy of properly equipped computer laboratories for teaching CAAD.
- 3) Use of pirated/cracked versions which results in the loss of work when crashed.

To derive the full benefits from the use of CAAD, it is recommended that CAAD lessons should be well structured as part of the curriculum in the department. Also the department should as much as possible try and contact the manufacturers of the CAAD softwares and acquire the genuine versions of these softwares for students' and faculty use.

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## References

- Botchway, E. A., Abanyie, S. A., & Afram, S. O. (2015). The Impact of Computer Aided Architectural Design Tools on Architectural Design Education. *J Archit Eng Tech*, 4, 145.
- Elhardudi, M. A. (2007). *Integrating CAAD into Architectural Education*.
- Ghani, I., & Azwar, D. H. (2006). *Trends and Issues in Computer Software Usage in Landscape Architectural Education*.
- Hannu, P. (2003). *Survey of Architectural-ICT in the Educational Curriculumns of Europe*.
- Minialoff, R. (2000). *Introduction to Computer Aided Design*.
- Moloney, J. (2001). 3D game software and architectural education. In *Proceedings of the 18th Conference of the Australasian Society for Computers in Learning in Tertiary Education* (pp. 10-12). Melbourne, Australia.
- Pektaş, Ş. T., & Erkip, F. (2006). Attitudes of design students toward computer usage in design. *International Journal of Technology and Design Education*, 16(1), 79-95. <http://dx.doi.org/10.1007/s10798-005-3175-0>
- Yazici, A. P. D. G., & Yazici, A. P. D. Y. E. (2012). The use of finite element analysis applications in architectural education. *Int. J. New Trends Educ. Implications*, 3(4), 148-155.

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