



CONSTRUCTION STUDENTS' AWARENESS OF CAD PROGRAMS OF POLYTECHNICS IN GHANA

Humphrey Danso

Department of Design and Technology Education, University of Education, Winneba, Ghana.

Abstract

Today, computers are being used by nearly everyone in the construction industry, be it fresh graduates or experienced construction professionals. It has become therefore imperative that at the higher education level, students would be introduced to computer application software relevant in their area of specialization. The purpose of this study was to assess the level of awareness and usage of CAD programs by students in Polytechnics offering Civil Engineering and Building Technology programs in Ghana. The study was a cross-sectional survey of 247 respondents using structured questionnaire. It found that 76.9% of the respondents knew at least one CAD software program, while shockingly 23.1% of the respondents did not know any of the CAD programs at all. In addition, it found AutoCAD as the dominant CAD program among the Polytechnic students in Ghana. Another worrying finding was that, 27.1% of the students do not use any of the CAD programs at all as against 72.9% who used at least one of them. The study concludes that though majority of the students knew and used CAD programs, much needs to be done to ensure application of the CAD software by all students.

Key Words: *AutoCAD, Construction Industry, Construction Education, Computer Aided Design (CAD), Polytechnics.*

1. Introduction

Computer Aided Design (CAD) software programs are used worldwide in many fields of engineering such as architecture, building and construction, electronic, electrical, machinery, automotive, aerospace and ship building (Herron, 2010). The software programs have assisted engineers and designers in a wide variety of industries to design and manufacture physical products such as dams, bridges, roads, buildings, cars and aircraft, to mention a few (Danso, 2012). CAD is used in most of the manufacturing process from creating drawings to three-dimension (3D) modeling. The entire process saves time and money and ensures precision and accuracy (Jason, 2010). Some of the software programs available are ArchiCAD, AutoCAD, Corel Draw, Autodesk Revit, 3D Studio Max, Robot, Lira, Sketch UP Pro, Monomakh and AccuRender (Carlson, 2003).

In 1957, Dr. Patrick J. Hanratty developed the world's first Computer-Aided Design and Drafting (CADD) software called PRONT, commercial numerical control program system. For this reason it is Dr. Hanratty who is most often called 'the father of CAD'. In the early 1960s, Ivan Sutherland also created CAD software called 'sketchpad' (Euclid, 2004). CAD software started its migration out of research and into commercial use in the 1970s, and was still two-dimensional (2D) replacement for drafting. In the 1980s HP set up its commercial CAD software group to develop its CAD software, and UNIX workstation also inevitably shifted the CAD market to 3D and solid modeling (Farin & Hoschek, 2002). In the 1990s, Microsoft released its first 32-bit operating system for PCs, Windows NT, and Intel also released the first 32-bit Pentium Pro chips (Pillers, 1998). CAD software vendors breathed a sigh of relief as it became evident that fear of Y2K problems were not to materialize in the year 2000. Autodesk released AutoCAD 2000 in mid 2000 which was their first Web enabled CAD software (Harrington *et al.*, 2001). Ford also released the Mondeo 3D CAD software for internet usage. In July 2004, the CAD software industry was dominated by IBM-Dassault Systems and Autodesk (Herron, 2010).

Today, computers are being used by nearly everyone in the construction industry, be it fresh graduates or experienced structural designers (Danso, 2012). CAD software programs have become popular in most Construction Industries and Polytechnics offering Civil Engineering and Building Technology programs in the globe. In parallel to this development, most higher learning institutions have now equipped their graduates with adequate skills of using computer software programs that will help them in carrying their daily task in the industry (Bozdoc, 2004).

As far as the researcher is concern, limited information could be found in relation to whether Polytechnics offering Civil Engineering and Building Technology programs in Ghana are training recent graduates in the use of CAD software applications which are relevant and useful in the construction industry. There is therefore the need to assess the level of awareness and usage of CAD programs by students of Polytechnics in Ghana. With computer technology becoming a very important to the field of construction, students need to be taught the skills of using these resources prior to graduation so as to expose them to the right application that will be useful later in the working world (Harwood, 1989).

The purpose of this study was to assess the level of awareness and usage of CAD programs by students in Polytechnics offering Civil Engineering and Building Technology programs in Ghana. The objectives of the study were:

1. To examine the CAD programs known by students of Polytechnics offering Civil Engineering and Building Technology programs in Ghana.

2. To examine the CAD programs used by students of Polytechnics offering Civil Engineering and Building Technology programs in Ghana.

2. Methodology

The design used for this study was that of survey which relied on questionnaire to generate data for the analysis. The population for the study consisted of students in Polytechnics who were offering Civil Engineering and Building Technology programs in Ghana. Five (Bolgatanga, Ho, Koforidua, Sunyani and Tamale) out of the ten Polytechnics were randomly selected for the study.

A stratified sampling technique was adopted for the study according to students' levels (thus 100, 200 and 300; these levels represent first, second and third year of being in the university). This was based on explanation by Hunt and Tyrrell (2001) that in statistical surveys, when subpopulations within an overall population vary, it is advantageous to sample each subpopulation (stratum) independently. 50% of students from each level were selected for the study. This was based on the assertion made by Nwana (1992) which states that if the population is a few hundreds, a 40% or more sample size will do.

The questionnaire items were based on the demographic characteristics of the respondents, CAD programs known by students, and CAD programs used by students. The questionnaires were administered by the trained researcher assistants. Enough time was given to the respondents to answer the questionnaire of which they were collected few days later. 247 questionnaires were returned out of the 400 distributed, representing 61.75% response rate.

3. Results and Discussion

The results obtained are presented and analysed under three main subheadings. These are respondents' demographics (Table 1), CAD programs known by students (Figure 1 and Table 2) and CAD programs used by students (Figures 2 and 3).

3.1 Respondents' Demographics

The characteristics of the respondents are presented in Table 1.

Table 1: Demographic profile of respondents (n = 247)

Category	Number of respondents	Percentage (%)
<i>Gender</i>		
Male	237	96.0
Female	10	4.0
<i>Age</i>		
≤ 20 years	15	6.1
21 – 30 years	185	74.9
31 – 40 years	37	15.0
≥ 41 years	10	4.0
<i>Polytechnic</i>		
Bolgatanga	50	20.2
Ho	59	23.9
Koforidua	28	11.3
Sunyani	65	26.3
Tamale	45	18.2
<i>Level/Year</i>		
100	85	34.4
200	86	34.8
300	76	30.8

In terms of gender, 96% of the respondents were males and 4% were females. The result shows that majority of the respondents were males. For age group, 6.1% of the respondents were 20 years and less, 74.9% were between 21 and 30 years, 15% were between 31 and 40 years, 4% were above 40 years. The result indicates that greater percentage (74.9%) of the respondents were young adults (between 21 and 30 years). In terms of the polytechnic they attend, 20.2% of the respondents were from Bolgatanga, 23.9% were from Ho, 11.3% were from Koforidua, 26.3% were from Sunyani and 18.2% were from Tamale, implying that majority of the respondents were Sunyani Polytechnic students.

3.2 CAD Programs Known by Students

In finding out the type of CAD software program the students know, they were asked to tick the general software programs they know that are common in Ghana. The responses of the respondents are presented in Figure 1.

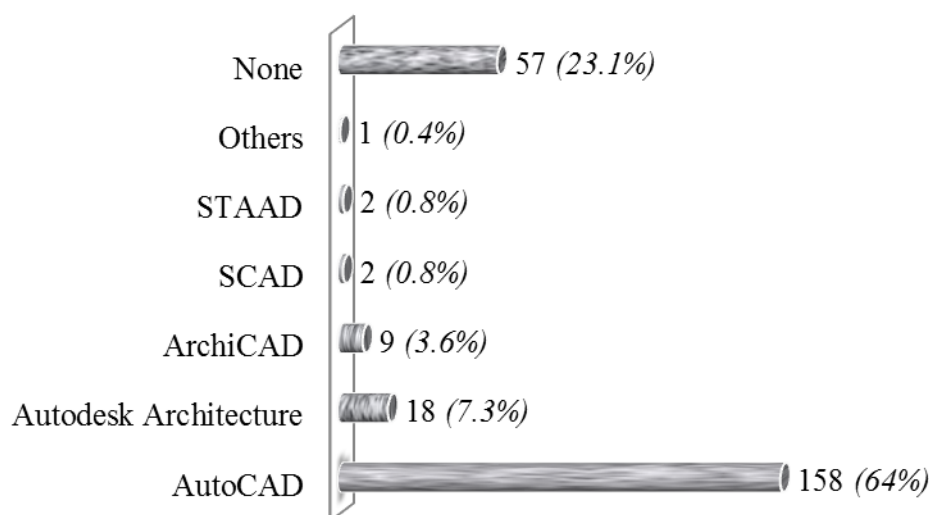


Figure 1: Type of CAD program known

The result as presented in Figure 1 depicts that 158 respondents representing 64% knew AutoCAD program, followed by 18 respondents representing 7.3% knew Autodesk Architecture. 9 respondents representing 3.6% knew ArchiCAD, 2 respondents representing 0.8% each knew SCAD and STAAD, followed by 1 respondent representing 0.4% who knew other program. However, 57 respondents representing 23.1% did not know any of the CAD software programs.

The result indicates that 76.9% of the respondents knew at least one CAD program, of which majority (64%) knew AutoCAD. The shocking finding is that 23.1% of the respondents did not know any of the CAD programs at all. In order to find out the known CAD programs by the respondents' institutions for the purpose of comparison, Table 2 presents the result.

Table 2: Known CAD Programs by Institutions

Polytechnic	Type of CAD known						
	AutoCAD	ArchiCAD	Autodesk Architecture	SCAD	STAAD	Others	None
Bolgatanga	50 (100%)	-	-	-	-	-	-
Ho	37 (62.7%)	1 (1.7%)	9 (15.3%)	-	-	1 (1.7%)	11 (18.6%)
Koforidua	18 (64.3%)	1 (3.6%)	2 (7.1%)	-	2 (7.1%)	-	5 (17.9%)
Sunyani	20 (30.8%)	2 (3.1%)	5 (7.7%)	2 (3.1%)	-	-	36 (55.4%)
Tamale	33 (73.3%)	5 (11.1%)	2 (4.4%)	-	-	-	5 (11.1%)

From the result as presented in Table 2 indicates that all (100%) of the students from Bolgatanga Polytechnic knew AutoCAD, implying that AutoCAD has been introduced to the students at the initial stage or level of their studies. The result also means that the students from Bolgatanga Polytechnic are not introduced to any other CAD software program besides AutoCAD which indeed limits students' scope in CAD programs. For students of Ho Polytechnic, 62.7% knew AutoCAD, 1.7% knew ArchiCAD and 15.3% knew Autodesk Architecture. This implies that most of the students knew AutoCAD, meaning the students are introduced to the program not at the initial stage or level in their studies. Some of the students knew other CAD programs of which 15.3% of them knew Autodesk Architecture. For Koforidua Polytechnic, 64.3% of the students knew AutoCAD, 3.6% knew ArchiCAD, and 7.1% knew Autodesk Architecture while 7.1% knew STAAD. 30.8% of students from Sunyani Polytechnic knew AutoCAD, 3.1% knew ArchiCAD, and 7.7% knew Autodesk Architecture while 3.1% knew SCAD. 73.3% of students of Tamale Polytechnic knew AutoCAD, 11.1% knew ArchiCAD and 4.4% knew Autodesk Architecture.

Across the Institutions, the most known CAD software program was AutoCAD, implying that students are introduced to the program at some level of their studies. Some of the students also knew other CAD programs which might be introduced to them during their industrial attachment activities and also through their friends who knew the program.

The study found AutoCAD as the dominant CAD program among the Polytechnics in Ghana. This might be due to the fact that it is the first CAD software program that was introduced in the country for use in the construction industry. Harrington et al. (2001) explained that the AutoCAD is the earliest 2D drafting application, coupled with tremendous

marketing effort during its introduction. 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 (Mohd-Nor et al. 2009). 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. Therefore, the training Institutions also have to equip their students with the skills required to function in the construction industry after their graduation. The finding is consistent with that of Danso (2012) that AutoCAD is the software program taught in most of the universities in Ghana. He further explained that the knowledge and application of the CAD programs helps one to be abreast with and acquired the necessary skills and competencies of the technological requirement of the modern construction industry.

3.3 CAD Programs Used by Students

The study went further to find out the CAD programs the students use because knowing the program and using it are two different issues. Figure 2 presents the responses from the respondents on the CAD programs they use.

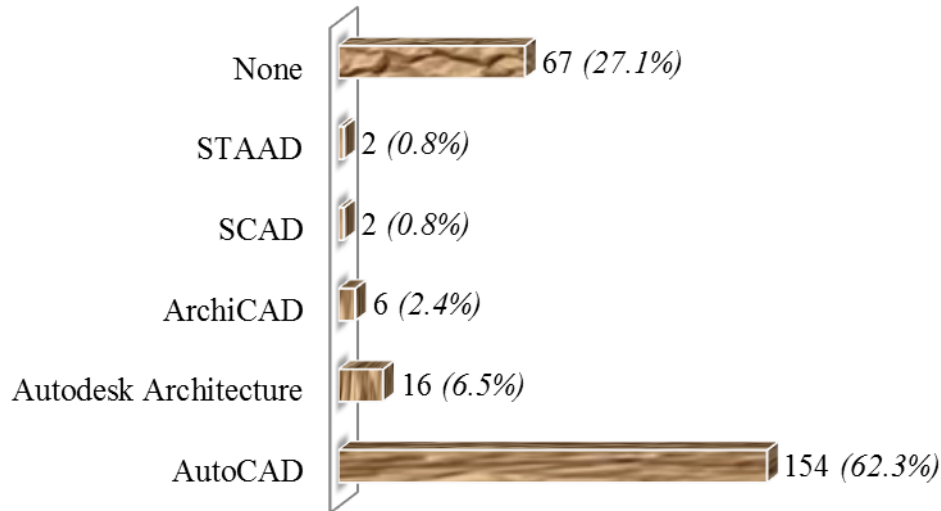


Figure 2: Type of CAD programs use

The data in Figure 2 shows that 62.3% of the respondents use AutoCAD, 6.5% use Autodesk Architecture, 2.4% use ArchiCAD, 0.8% each use SCAD and STAAD while 27.1% use none of the CAD programs. The result indicates that majority of the students use AutoCAD, implying that AutoCAD is the most used CAD program by students of polytechnics in Ghana offering Civil Engineering and Building Technology. It would be noted that there is a relationship between those who know (64%) and use (62.3%) AutoCAD. However, not all the students who know AutoCAD use it, but, majority of them use it.

The worrying trend is that, 27.1% of the students do not use any of the CAD programs as against 72.9% who used at least one of the CAD programs. It should also be noted that there is a relationship between those who do not know (23.1%) and use (27.1%) any of the CAD programs. This means that there are more students who do not use the any of the CAD programs than those who do not know the programs.

In addition, the study sought to find out the source from which the students who use the CAD programs acquired their skills from. The results obtained are presented in Figure 3.

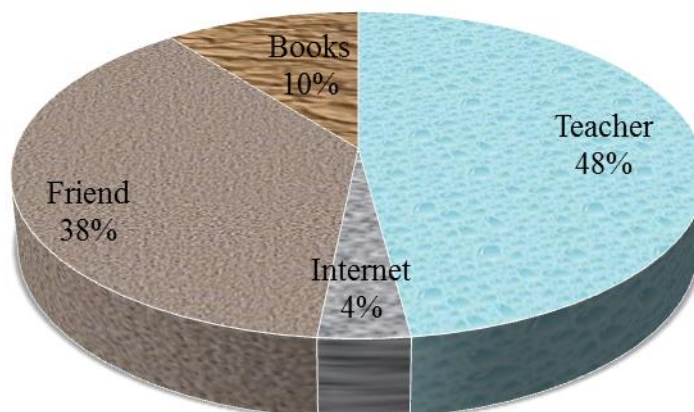


Figure 3: Source of acquisition of CAD skills

The result shows that 48% of the students who use CAD programs acquired their skills from teachers, followed by friends (38%), while 10% and 4% of them acquired their skills from books and internet respectively. This means that majority (86%) of the students were either taught by their teachers or their colleagues, implying that those who acquired the skills from their teachers, also passed it on to their friends.

The acquisition of the skills for CAD programs is now a prerequisite for entering into the construction industry; therefore, it has become important for Polytechnics who are training the middle manpower of the country to position themselves as the source for which the future professionals they are training will acquire the CAD application skills. There are other sources such as books and internet which can be helpful for students in acquiring the CAD application skills. These sources offer self tutorial guide for people to acquired the skills and be able to apply them.

4. Conclusion

It has become imperative that at the higher education level (such as Polytechnic and University) students would be introduced to computer application software relevant in their area of specialization. Therefore, assessing the level of awareness and usage of CAD programs by students in Polytechnics offering Civil Engineering and Building Technology programs in Ghana is necessary. The result showed that 76.9% of the respondents knew at least one CAD software program, while shockingly 23.1% of the respondents did not know any of the CAD programs at all. The study found AutoCAD as the dominant CAD program among the students of Polytechnics in Ghana. Another worrying finding was that, 27.1% of the students do not use any of the CAD programs as against 72.9% who used at least one of the CAD programs. In addition, it was found that 86% of the students who used the CAD programs were taught by teachers and their friends. Though majority of the students knew and used CAD programs, much needs to be done to ensure application of the CAD software by all students of Polytechnics offering Civil Engineering and Building Technology programs in Ghana so as to be well equipped for the world of work after their graduation.

5. Recommendation

From the result, it can be seen that some of the Polytechnics offering Civil Engineering and Building Technology programs in Ghana do not teach CAD application as part of their courses. It is therefore recommended that Polytechnics' management should ensure the inclusion of CAD application programs in their curriculum to introduce students to this modern approach in the construction industry. In addition, the Polytechnics' management and Government should sponsor some of the tutors to learn the skills in CAD application so that they can impart the skills to student. Finally, the students should make effort to learn the CAD programs through the use of books and internet which provide self tutorial guide.

References

1. Bozdoc, M. (2004). The History of CAD. Retrieved from: www.mbinfo.mbdesign.net
2. Carlson, W. (2003). A Critical History of Computer Graphics and Animation. Ohio State University.
3. Danso, H. (2012). Assessment of the awareness of structural computer aided design programs of universities in Ghana. *European Journal of Social Sciences*, 30(1), 41-47.
4. Euclid, S. (2004). History of CAD/CAM. Retrieved from: www.cadazz.com.
5. Farin, G.E. and Hoschek, J. (2002). A History of Curves and Surfaces in CAGD: Handbook of Computer Aided Geometric Design. Elsevier Science, Amsterdam.
6. Harwood, B. (1989). Patterns: A View of the Relationship between Interior Design Education and Practice. *Journal of Interior Design Education and Research*, 15(2): 41-50.
7. Harrington, D. Burchard, B. and Pitzer, D. (2001). Inside AutoCAD 2002. New Riders, Press Indianapolis.
8. Herron, J. (2010). 3D Model-Based Design: Setting the Definitions Straight. Retrieved from: www.mcadcafe.com.
9. Hunt, N. and Tyrrell, S. (2001). Stratified Sampling. Webpage at Coventry University (Accessed 12 July 2012).
10. Jason, G. (2007). CAD Engineering: Computer and Technology, Retrieved from: <http://ezinearticles.com/?CAD-Engineering&id=408176>.
11. Mohd-Nor, M.F.I. Usman, I.M.S. and Mazlan-Tahir, M. (2009). How The Professional Practice And The Architecture Education In Malaysia Is Catching Up With The Development of CAD. *European Journal of Social Sciences*, 9(4), 677-683
12. Nwana, O.C. (1992). *Introduction to educational research*. Ibadan: Heinemann Educational Books (PLC).
13. Pillers, M. (1998). MCAD Renaissance of the 90's. Cadence Magazine.
14. Piotrowski, C.M. (1994). Professional Practice for Designers: (2nd. Ed). Van Nostrand Reinhold, New York.