Evaluating the Benefits of Computer Aided-Design (CAD) in Fashion Education, the Case of Accra Polytechnic

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Abstract
The main purpose of this research was to evaluate the introduction and use of Computer-Aided Designing (CAD) in Fashion Education in Accra Polytechnic over a three - year period (2009-2012). It was revealed that some level of CAD has been inculcated into Fashion Education in the institution in the three specializations (Fashion production, Textiles and Fashion design) as they use the softwares available to draw garments, developing motifs for textiles prints and also to draw human figures. However, there were some challenges confronting the department and the students as well, some of which include insufficient computers and the requisite software equipment. It was recommended, that a CAD Resource Centre for Fashion Education should be set up in Accra with a state-of-the-art hard and software which will provide a suitable environment for teaching and learning for the training of Fashion Design and Textiles students. Also, CAD should be introduced early so that it will motivate students to search for and learn the commands that allow for actions and operations in CAD to enhance creativity and innovation.
Keywords: Computer Aided Design (CAD), Skills, Nuffic

1. Introduction
Computers have transformed the way people conduct business and perform their daily tasks. Now with computers one can draw, paint, make dress patterns and do a lot more. Computers have led to the development of new technology for which fashion has not been left out. Now, in the advanced countries most of the fashion and textiles illustration processes have been computerized which makes work fast, convenient, cost effective and increases productivity. Many softwares are available to fashion designers to perform various tasks namely fashion research, fashion design and illustration, pattern design, patternmaking, textile design, garment construction and production management, marketing and sales. Williams & Agbo (2013) indicated that there is scarcely a field of human activity today that has not been touched by the dramatic changes in information and communication technology (ICT) for the past 10-15 years. The fields of Clothing and Textiles are no exception. Most developed countries like France, China, and United States of America, developed their economies through the fashion and textiles industry (Biney-Aidoo & Antiaye, 2013). The Fashion and Textile industry therefore can be a strong economic force in the country's development when given the needed attention right from the training institutions before students get into the world of work.

In 2003, Ghana was included as a beneficiary in the Netherlands Programme for Institutional Strengthening of Post Secondary and Educational and Training Capacity (NPT- Project). Polytechnic education was identified as an integral part of the programme with Fashion Design and Textiles (FDT) studies as one of the priority areas for consideration. Subsequently, the Department of Fashion Design and Textiles of Accra Polytechnic was selected as an entity for the implementation of the Capacity Building Programme. As part of the programme, a new Competency Based Training (CBT) curriculum was developed and implemented in August; 2007. One of the main goals of this new method was the type of training that focuses on the acquisition of the competencies necessary to be able to perform professional tasks, including the use of computerised methods of production. This emphasis was as a result of the need to respond to the changing skills/demands of the workforce as revealed by a number of government publications and research reports (COTVET 2011; Tamakloe, 2011). The new curriculum aimed at promoting creativity, innovation, entrepreneurship and the use of Computer Aided Designs (CAD). To this effect design oriented ICT facilities such as computer design laboratories, internet connectivity, hard and softwares catering for computer - Aided Design, 2D design software, printers and projectors were provided.

This paper presents an insight into the application and use of Computer-Aided Designing (CAD) in the Fashion Design and Textiles Studies in Accra Polytechnic over a three - year period from 2009 to 2012. Over this period,

students have taken courses in computer design and application in all the six semesters of the HND Fashion Design and Textiles programme as compared to the previous practice where students took only one mandatory computer literacy course in the first semester of the first year. The research will encourage fashion institutions and students to use the CAD softwares for clothing and textiles design as it enhances speedy work sessions, increases production and cuts down on costs in the fashion industry. It will also encourage the fashion students to use a range of softwares to broaden their knowledge on the use of CAD and to visualize production methods, garments and fabrics. At the advanced level, students will be able to use CAD in the process of pattern manipulation and adaptation, grading, and pattern cutting. The research will emphasize how computer skills can be applied to the fashion world and its design processes which will ensure higher productivity in the fashion industries by aiding garment delivery in comparatively short periods and also groom skilled teachers in CAD. Finally, CAD will help fashion students to create design concepts or ideas for their fashion collections.

2. Review of Related Literature

The fashion designer has to improve competence and capacity to produce and sell locally and also in the international markets in order to meet corporate goals which will in the long run translate into national goals. Fashion Education which is the foundation of garment production can be enhanced by using CAD softwares, so that firms within the industry can take advantage of the opportunities in the markets. Productivity can increase with CAD because CAD is uniquely fast and easy.

2.1 Importance of Computer Aided-Design (CAD)

Fashion Design Technology is the development of skills to identify and generate ideas and investigate into the manufacturing of clothing and accessories. This vital role is performed by the fashion designer. The area a fashion designer covers may range from the prediction or generation of the next season's range to pattern cutting and responsibility for the finished sample as stated by Aldrich (1997). Fashion Design has three main branches namely Clothing technology, Textiles technology, and Fashion illustration which needs to be exploited with CAD. Wikimedia (2007) indicated that Computer Aided Design is a tool used by engineers and designers and it is used in many ways depending on the profession and the use and the type of software in question. CAD software is used to increase the productivity of the design, improve the quality of design and improve communications through documentation and to create database for manufacturing. He further goes on to say that it is used in many fields; it is used in electronic design, fashion design and other fields which describe the process of drawing with the use of computer software. Leach (2002), also mentioned that CAD is a tool that can be used for design and drafting activity, and can also be used to make rough idea sketch although it is more suited to create accurate finished drawing. CAD has powerful tools which aid creativity and visualization. The media industry started using CAD before the fashion designer integrated it in computer drawings and designing. Computer Aided Design also known as Computer Aided Drafting first hit the fashion scene in 1987 and it is used in the designing of tools and machinery and also used in the manufacture of components of garments, production of patterns and the manufacture of garments. There are different types of CAD and each of these types of CAD system requires the operator to think differently about how to use it to design virtual components in a different manner.

2.2 Some Fashion Design Software Packages

The computer can make the design from the scratch, using a tablet and stylus, with colour and texture. Software packages or programme for fashion designers satisfy a particular need such as apparel designing, pattern making/grading, fashion illustration and accessories designing. Some software programmes are made especially for some particular computers such as the Mackintosh. Some examples of modern computer software for the fashion industry are; Gerber, Lectra polygon, Apparel Computer Aided-Design (CAD), Snap Fashun, CADTERNS, CAD Fashion, Fashion Computer Aided-Design (CAD), Design concept 3D, Assyst Bullmer, Investronica, and APS-ethos embroidery software. These softwares are not common in Ghana because of their high prices and also there are no experts to operate them.

Some CAD softwares that can be obtained in Ghana are AutoCAD, CorelDraw, Illustrator and Photoshop. Students can make the best out of these softwares in these aspects of Fashion Design.

- Clothing Technology -   Pattern making and marker making.
- Textile Technology - Fabric design, motifs and logos.
- Fashion Design - Drawing of figures, garments and garment features.

Burke (2006) professes that the universally accepted computer software in fashion and graphics industries are:

- Graphics (drawing) package – Adobe Illustrator, CorelDraw or Freehand and AutoCAD
- Image editing programme – Adobe Photoshop.

2.2.1 Automated Computer – Aided Design (AutoCAD)

Leach (2002) stated that AutoCAD is the first Computer Aided-Design system that gives the foundation to learn other CAD packages because most concepts and commands introduced by AutoCAD are utilized by other

systems and added that AutoCAD provides great compatibility in the CAD domain. Wikimedia foundation (2008) indicates that, this is a programme which creates technical drawing and that measurement precision is important. AutoCAD is a complete environment for drafting and designing.

2.2.2 CorelDraw

 CorelDraw is a vector graphics developed and marketed by Corel Corporation. It was revealed by CREL (2008) that Corel Corporation is Canadian computer software, with a vector- based illustration programme developed to bundle with desktop publishing systems. Additionally, it stated that it is the first software which combines vector graphics software with a photo editing programme. It has a full range of editing tools that allow users to adjust contrast and colour balance. CREL (2008) stated that CorelDraw is capable of handling multiple master layers from within the main programme. CorelDraw is used to make simple technical drawing, create figures, garments and garment features with the aid of grids and guides, design textile fabric, embroidery, mood board, and collage for wall hanging and develop presentations for the screen and for print.

2.2.3 Photoshop

Adobe Photoshop is a pixel-based editing programme developed and published by Adobe systems. It is the current market leader for commercial image manipulation and the leading image editing programme in the world. Burke (2011) indicates that Photoshop is a market standard image editing software. In Fashion, it can be used for editing and correcting digital photos and preparing images for mood/story board, magazines and posters. It can be used to create designs for wall hangings and print designs for fabrics and 'Tee' shirts. It can also be used to make basic patterns, figures, simple garments and garment features with the aid of grids and guides. It is also used to create digital design portfolio which provides visual evidence of capabilities, strengths and qualities. Digital portfolio allows students to send their work to any part of the world.

2.2.4 Illustrator

 Centner and Vereker (2008) indicated that Adobe Illustrator is an excellent CAD application used for detailed technical drawing and fashion illustrations. It is superior for text and vectors graphics editor made up of lines and curves defined by mathematical objects. Vector graphics are especially useful for items that would need to be both in print and on the web. When scaled, reduced, rotated or stretched, vector graphics maintains clarity without pixilation or loss of quality. Creating documentation of design is one of the most important parts in designing with the Adobe Illustrator as is a perfect format for creating detailed technical drawing and fashion illustration which can be stored and used later when needed. The Illustrator application allows the use of symbols and brush stroke libraries to create and store different silhouettes, basic garment shapes, useful accessories, stitches and trims.

3. Methodology

The descriptive research design was used; this was useful because the study was concerned with the conditions that exist at a given place. The design was also appropriate because the study sought to examine the prevailing condition, practices and attitudes of students of Accra Polytechnic towards the use of computers in designing. It was an assessment which sought to examine the types of Computer – Aided Design software used and how fashion students can use them to enhance their designing and drawing, starting from the polytechnic level.

4. Results and Discussions

Both lecturers and students saw the need to be trained in CAD. They knew that CAD could be used to enhance their teaching and promote effective design development in all aspects of the programme, although, some of the lecturers were not familiar with CAD, they could anticipate the benefits that could be derived from its use.

4.1 Observations

Teaching Duration: Most students said that time for CAD lessons was not enough to cover vital areas but they indicated that the class size was small enough for the lecturer to go round all the students to check the work. The second and third year students have two (2) contact hours every week for the Photoshop and Illustrator respectively apart from the computer literacy class in the first year.

 Teaching Materials: There are three (3) big computer laboratories for training for the institution; in addition to that of the Department of fashion design and textiles, however, the computers that are in good condition are insufficient for the number of students. In the Department of Fashion Design, a student group consisting twenty (20) are allowed into the room at a time with two students sharing one computer. Unfortunately, the Apple computers which were donated by the (HKU) Utrecht School of Art Netherlands numbering thirty-three (33) have broken down and only ten (10) of them are in good condition. It was observed that the computers are insufficient because they were not replaced when they broke down. The department also took delivery of computers, scanners, printers, old magazines, fabric samples and camera at the onset of the course.

Presentation: It was deduced that it was always difficult to do oral presentation with few or no images at all but the electronic presentation is much easier to understand, comprehend and also give variety. It also makes lively

and interesting discussion on issues or topics. Students now do their own presentation and concept development, drawing figures, garment parts and motif development with little or no help.

Work Space: This used to be a problem but with the help of GetFund and NPT project a bigger work area was provided. The Fashion department has moved into a three (3) storey building to solve the accommodation problem for all courses.

4.2 Benefits outlined

One hundred (100) points were gathered from the questionnaire. The most frequent occurring point was the ability to raise the standards of designing (88%), which was closely followed by time saving which was mentioned eighty (80) times representing 80% and the least 20% suggesting good presentation as shown in table 1

Table 1 Benefits expected from CAD

Benefit	Frequency of response	Percentage
Accuracy	66	66%
Creativity	57	57%
Time saving	80	80%
Effective teaching	45	45%
Innovation	76	76%
Good presentation	60	60%
Raise the standard of designing	88	88%
Total no. of response	100	

Total more than 100% due to multiple responses

4.3 Training

In an interview with the director and coordinator of the NPT project at Accra Polytechnic to find out the impact of the NPT project which sought to incorporate the study of CAD into the curriculum of fashion education, they both stated that students needed to use the knowledge and skills in computer literacy to apply the tools in designing to generate design and make presentation for their projects. They indicated that during the grooming stage students should be encouraged to find the best possible ways of using the computer software at their disposal to enhance designing. On the issue of whether there has been recruitment of staff, the response was negative but emphasized that there were a series of workshops to improve skills and knowledge of staff and students. Also, a resource person, Irene from Utrecht School of Arts, Netherlands did the installation of the softwares and the training of the staff of the computer department together with some fashion design staff. In addition four (4) members of staff had Computer application training at IPMC for a period of one year courtesy a Nuffic grant in 2009. The course was designed to cater for the needs of fashion lecturers, the contents of the workshops was carefully selected to guide, support and prepare the CAD lecturers to help the students to direct the basic CAD application to drawing and design. Fashion lecturers from Accra Polytechnic, Ho and Kumasi Polytechnic were trained in the basics of CAD at one of the workshops organized.

4.4 Curriculum

The curriculum has been restructured to inculcate the Computer-Aided Design subjects into the existing curriculum. Photoshop and Illustrator software have been made available for students to install and practice. The new curriculum provided a clear framework to upgrade the resources in the department, strengthen the course and link the programme to industry and community enterprises. Also, the revised curriculum was to meet the articulated need for creativity and innovation with emphasis on student-centred and project based training packages allowing for increased effectiveness. They have also reinforced the computer literacy course by introducing some basic design elements in word application like PowerPoint presentation and Microsoft drawing. The new curriculum is hoped to bridge the gap between competencies of the Ghanaian students and the overseas-trained students.

4.4.1 The Course Objectives

With the aid of CAD some of the competencies addressed in the course were:

1. Capacity to design
2. Capacity to communicate
3. Capacity to collaborate
4. Capacity to reflect, learn and innovate

The specific learning objectives include;

1. Students ability to scan and store data
2. Take good photographs of their works.
3. Manipulate basic shapes and images into complex and abstract ones.
4. Do basic editing of images collected in Photoshop.
5. Be able to transform data such as crop and repair images collected.

6. Be able to use different lines, shapes and objects to develop designs.
7. Make computer presentation using PowerPoint and other software with effective visual effects like sound and movement.

4.5 Assessment of the Curriculum

The new CBT/ FDT curriculum requires a student take courses on computer Word, excel, PowerPoint presentation, image designing, poster preparation and finally, drawing and illustration with the Illustrator application. Fashion institutions have been able to equip students with enough knowledge to do tremendously well in the fashion industry but not enough of CAD is seen in their training. Accra Polytechnic's fashion department is battling with the problems of giving CAD training as well as changing student's perception of the use of CAD in industry today. They train students to use CAD in textiles technology, design and fashion illustration. The programmes used for training in designing and drawing are Word, PowerPoint, Photoshop, and Illustrator. These applications are graphic design packages that can be adapted for use in pattern and garment technology, illustration and drawing. Emphasis is also placed on integrating CAD subject matter into all courses. All CAD programmes are of no use if students do not first understand the basic process of pattern drafting and drawing.

On the progress made so far, students are able to perform in computer skills using Photoshop and Illustrator applications in designing and presentation. They are able to combine text with images for desirable effects. The course has enabled students to perform creditably in computer skills in operating the computer as a drawing and presentation media. They are able to perform complex tasks using a combination of softwares like Photoshop and Illustrator in drawing, designing and presentation of data collected and processed into new silhouettes.

a. Reference Books
   Some available reading materials for the course are:
- Adu, Gyamfi, S. and Osei, Agyedu, G. (2008) Essentials of Information Technology, Willas Press Ltd Kumasi, Ghana.
- Burke, S. Fashion (2006) Computering - Design and Techniques and CAD.
- Center, M. and Vereker, F. (2008) Fashion Designer's Handbook for adobe Illustrator.
- Fashion catalogs.
- Garf, J. L. – Perfect Pixel, advance Photoshop.
- Kogent Solution Inc., Creating I T skills (Photoshop), Dreamtech Press, New Delhi 2009.
- McKelvey, K. Fashion Source Book, Blackwell Science Ltd, 1996.
- Now Advance Photoshop – the magazine for Adobe, Photoshop professionals.
- Photoshop creative – Monthly Adobe Photoshop dedicated magazine.
- Photoshop and Illustrator tutorials.
- The magazine for Adobe Photoshop professional.

Purchase of the books and subscription of the magazines was made possible by the budget of the project.

b. Instructor
   There is one (1) lecturer in charge of teaching CAD in the department. This lecturer is a trained fashion designer who is dedicated to Fashion Application through formal and informal computer training over the past eight (8) years, knowledgeable in Photoshop, Illustrator, AutoCAD, CorelDraw, PhotoDraw and the Microsoft office package.

c. Softwares:
   The available softwares for the department are Photoshop, Illustrator, and Microsoft office however AutoCAD would be introduced later. This is because AutoCAD is utilized by other systems, and it is also versatile or adaptable and used in different areas as against the other softwares that are confined to only one area. In the different areas of fashion AutoCAD can be used as following:

Garment construction:	Marker making
Pattern drafting:	Drafting patterns
Illustration:	Human figure, drawing garments and its features
Textiles:	Motifs for fabric development

4.5 General Advantages of CAD
- With CAD, there is a possibility to save a silhouette or figure to files so as to concentrate on designing and adding detail to drawing or designs rather than starting from scratch each time; this allows fashion students to be more efficient with their time.

- Most of the current systems have reached a level of sophistication that include a colour palette, fabric pattern and texture library which allows for less thinking and formation of designs. Colour, texture and fabric suggestions to design work can be added without great difficulty to the designing process.
- CAD also allows drawing techniques and the possibility of scaling to a degree of accuracy that would never have been possible through manual drawing.
- Using the computer helps to present ideas clearly and professionally with accuracy and less human errors.
- CAD is valuable to students who find presentation difficult, as it opens up a whole new area to explore and experiment with giving user confidence and the necessary skills to develop and work on various ideas.
- Drawing can be printed to any scale other than making up several drawings for different uses and then the saved part can be redrawn to different scales.
- As said by Leach (2002), it may be faster to create a 'rough' drawing such as a sketch by hand (pencil and paper) than using Computer Aided-Design (CAD) but for larger and more complex drawings which involve similar shapes or repetitive operations CAD method is very efficient.

Disadvantages

- It may be faster to create a simple sketch with a pencil and paper in hand than using CAD.
- The capital required to purchase a computer and its accessories is high although it is worth it.
- The total cost of running and maintaining the CAD system is high.

5. Conclusion

Fashion Design has gone through phases from traditional to computerization. Transformation of Fashion Design Education in the country is not that drastic but with time and training in computer education there will be a great improvement. Consequently, it should start seriously with making fashion students computer literate. Although some students complained of high costs in procuring a computer, they seem to be making efforts to purchase and have found the study of CAD interesting. It is hoped that in the near future the manual or traditional designing would be replaced by computer designing. Some of the things that needs to be put in place are, well equipped computer center and a number of trained instructors. Although there were limitations in the use of CAD the advantages far outweigh the disadvantages and so all efforts should be put into it promote its use.

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