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DEVELOPMENT OF A TRAINING MANUAL FOR LEARNING COMPUTER GRAPHICS (COREL DRAW) AMONG FINE AND APPLIED ARTS STUDENTS IN ABIA STATE COLLEGES OF EDUCATION (TECHNICAL) AROCHUKWU NIGERIA

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Abstract

This paper presents thedevelopment of a training manual for learning computer graphics (CorelDraw) among fine and applied arts students in Abia State Colleges of education (Technical) Arochukwu. The paper adopted research and development design and was carried out in Umuahia, Abia State. The population of the study comprised of 15 computer graphics experts from computer business centres in Umuahia, Abia State.The instrument for data collection was 82-item validated questionnaire designed to collect information from respondents on objectives,contents, instructional materials, teaching strategies and evaluation criteria to be used to develop the training manual. The data collected from the questionnaire were then analysed. The findings from the data analysis revealed the items to be used in developing the training material. Based on these findings, the training manual would be developed.

Keywords: Self-instructional Manual, Computer Graphics, Fine and Applied Arts.

Introduction

In the past, pictures and images are either created using camera or manually using paper, pencil and other materials. However, the advent of computer graphic provided means of creating pictures and images. In this sense, Shirley (2005) stated that computer graphics describes the use of computer to create or manipulate images. Computer graphics is used mostly in the creation of an image that looks like a photograph from a real life, but portrays something that could not actually be taken as a picture (Falohun, Omidiora, One, Ajala & Ismaila, 2012). Computer graphics have wide range of applications. In engineering and architecture, computer graphics soft wares are used in designing of building, aircraft, automobile, machines. For data visualization and fine arts, computer graphics provide means of creating bar chart, pie chart, cartoons, painting and logo. In entertainment, advertisement and games, computer graphics play important role in designing movies, TV advertisement and video games Pellacini, 2009). In education and training, computer graphics provide means producing instructions for teaching concepts as well as producing training simulators among others. The number of the applications will continue to increase with advancement in technology.

Computer graphics have a number of advantages when compared with the traditional methods of producing images. In computer graphics, one can make changes and *undo* them without tampering with the whole design. It is also possible to view a model from different angles by rotating it along various axes. One can also perfect on minute details of a design by magnifying it to see them clearly. Presenting images in three dimensions enables designers to illustrate inner parts of structures they design, bringing clarity on the structures they intend to build (Benjamin, 2009). Furthermore, design using computer graphic packages takes shorter time when compared with the traditional methods. However, despite these laudable advantages, computer graphics have some disadvantages. Some of the graphics applications are so complex that they need an expert to install and customize the settings. In addition, like all other computerized systems, graphical system lack the intelligence of understanding real world conditions and principles like the purpose of the structure it is designing (Benjamin, 2009).

There are different approaches to producing computer graphics on microcomputers. Rieber (2000) identified three approaches to producing computer graphics on microcomputer, namely, 1) command-based approach; 2) GUI-based approach and 3) use of "second-hand" graphics (clip art, scanned/digitized images, etc.).Rieber (2000) further stated thatthe command-based approach involves algorithmic processes for

defining a graphic, such as the writing of programming code using special graphics commands particular to the programming language (e.g., PASCAL, C, BASIC, LOGO). The GUI-based approach is based on the graphical user interface and involves graphic tools such as "pencils," "brushes," "fill buckets," "box makers," etc. GUI-based approaches most commonly use input devices such as a mouse, light pens, and graphic tablets, although some of the earliest GUI-based approaches used the keyboard. In second hand approach, second-hand graphics are copied, not created, and include clip art and all of the scanning and digitizing technology (both hardware and software). For example, graphics can be drawn on paper, converted into digital form with a scanner, and then "imported" into one of many computer applications. This approach also includes the electronic "capture" of video and photographic images

There are two main types of GUI-based graphics packages used for creating and manipulating images. This includes painting and drawing packages or programs. In a painting program, the image is represented as a grid of pixels, and the user creates an image by assigning colors to pixels. This might be done by using a "drawing tool" that acts like a painter's brush, or even by tools that draw geometric shapes such as lines or rectangles. But the point in a painting program is to color the individual pixels, and it is only the pixel colors that are saved. In a drawing program, the user creates an image by adding geometric shapes, A practical program for image creation and editing might combine elements of painting and drawing, although one or the other is usually dominant. Two well-known graphics programs are Adobe Photoshop and Adobe Illustrator. Photoshop is in the category of painting programs, while Illustrator is more of a drawing program (Eck, 2018).

In graphic arts, graphic packages are used in designing letter head paper, birthday cards, wedding cards, complimentary cards, invitation cards, logos, banners, cartoons, brochure, website and business cards among a host of others (Redfield,2016;Soffar,2019). In the absence of lecturers to teach how to design and produce the above listed art works and more, there is the need for self-instructional manual that will enable students in fine and applied department to learn how to create images using computer graphics. Hence,the researchers set out to design and develop a training manual that will enable students to learn computer graphics.

Problem Statement

Computer graphics course has already been integrated into the curriculum of NCE (Nigeria Certificate in Education) programme in department of Fine and Applied Arts of Abia State College of Education (Technical). Students are expected to register the course and pass it before graduation. But unfortunately, lecturers in the department do not have indepth knowledge and skills of teaching such course. The existing textbooks in the College library on computer graphics do not cover most of the course contents of the computer graphics course in the department. Furthermore, some of the textbooks on computer graphics are not designed for layman usage. Therefore, the researchers deem it necessary to design and develop training manual that will help students to learn the computer graphics course at ease.

Objectives of the Study

The major objective of this study is to develop a training manual for learning computer graphics.
Specifically, the study sought to:
The objectives of the study are to:

1. Determine the instructional objectives of the modules within the training manual
2. Determine the contents of the modules within the training manual
3. Determine the instructional materials to be used in the training manual
4. Determine the instructional strategies to be used in the trainingmanual.
5. Determine the assessment criteria for assessing students' performance..
6. Develop the computer graphics training manual.

Research Questions

The following research questions were formulated to guide the study:

1. What are the objectives of the training manual to be developed?
2. What are the contents of the trainingmanual tobe developed?

3. What are the instructional materials to be used in the teaching of computer graphics?
4. What are the instructional strategies to be used in the training manual to be developed?
5. What are the evaluation criteria for assessing students' performance?

Self-instructional Manual

A self-instructional manual according to Slleigh (1997) in Alpha (2013) is a training or instructional guide that allows learner's active participation in learning on their own by using the manual as a guide.

Several approaches, methods and techniques are used in teaching concepts in computer graphics. This part reviewed some materials that illustrates the approaches and methods used teaching and learning of computer graphics. It also reviewed some materials on difficulties faced by students learning computer graphics. It also reviewed some materials

Seron, Cerezo and Baldassarri (2008) authored a paper which focuses on the use of new tools in order to improve the learning of Computer Graphics, in particular of some aspects that have been detected as specially difficult by the students. According to the students' opinion, the most difficult concepts to understand are usually (reasons included):

- In CG: Geometric Projections and 3D Viewing Systems. Problems are due to the complexity of array treatment of transformations and projections.
- In GM: Basic concepts of Differential Geometry. Mathematical treatment is totally novel. Geometric Modeling of Euclid Objects (Curves and Surfaces), problems are located in the comprehension of parametric representations.
- In VMA: Global shading. Direct and inverse kinematics. Virtual humans. Facial animation. Behaviour. In all the cases the major difficulty lies in the technical complexity of its implementation.

A problem common to all these subjects consists in the evident initial difficulty for the student to visualise certain concepts. In order to solve most of the student's doubts and problems the use of the Problem Based-Learning (PBL) methodology and Interactive Embodied Pedagogical Agents (IEPAs) are introduced in the courses. PBL and the use of IEPAs for education and training tasks. By combining these ideas, the authors obtain an interactive learning environment created to improve student's learning capabilities.

Ivanovaand Ivanov (2011) use of low-cost interactive marker augmented reality (AR) technology during presentation of the course computer graphics. The preliminary exploration of AR technology adoption for teaching support and learning enhancement is done and several benefits are identified, summarized and analyzed via a model. Two learning scenarios are designed based on human-computer interaction principles to present important concepts virtually in interactive and engaging way. The students' opinion is gathered and the results describe AR as promising and effective technology that allows better understanding of theory and facts and that supports creative thinking and development of more realistic 3D models and scenes.

Suselo, Wünsche, and Luxton-Reilly, (2017) conducted a systematic literature review identifying reported challenges, methodologies, and approaches for teaching computer graphics. They found that problems related to teaching and learning of computer graphics can be categorised into four key issues. The first issue is insufficient background, especially inadequate skills in mathematics and programming. Solution-Top-down: learn the foundation and the structure of computer graphics knowledge whilst practising the tools. The second issue is difficulties in understanding geometric concepts such as transformations, projections and 3D modelling.Solution-Top-down Implement interactive 3D demos to show concepts and techniques in computer graphics.The third issue is difficulties in solving logical problems and making the connection between theory, programming, application and final visual effects. Solution- Top-down: Using a teaching platform with a set of compact applications to demonstrate computer graphics techniques and algorithms The fourth issue is that many students are passive learners and don't interact much with peers and teachers . Solution –Top-down: Pay attention to the relationship between theory and application, and use practical applications to promote communication between students and teacher. Another suggestion addressing this issue is to use a top-down approach involving group projects. This resulted in increased attention to learning activities, more autonomous learning, and improved teamwork and communication skills.

On the issue of teaching approach and methodology, the authors three common approaches of teaching computer graphics, namely, top-down approach, hybrid approach, bottom-up approach. The

bottom-up approach is regarded as most traditional and seems to be favoured in text books for teaching computer graphics and is also most popular based on our personal teaching experience. The approach presents first foundations such as transformations and rendering of simple objects, before more complex topics are introduced. The top-down approach starts with a moderately complex problem or case study, e.g. a simple game, and then breaks it down into simpler problems (functional modules).This can help students absorbing the foundations and structure of graphics applications while practising (visible rather than mathematical based) application-level understanding and skills. The top-down approach often involves using high-level tools and can promote self-learning and increase students' motivation and knowledge of fundamental computer graphics concepts. Using high-level development tools, such as game engines, can enable students with insufficient mathematics skills to understand computer graphics concepts and produce attractive results. Several researchers have combined the top-down and bottom-up approach into a hybrid approach. The motivation is to support the learning of practical skills while simultaneously improving the knowledge base. Teachers can combine theory with graphics programming and use of graphics software to foster students' abilities in solving practical problems (Suselo, Winches, &Luxton-Reilly, 2017).

Materials and Method

This study adopted research and development design. The research was carried out in Umuahia, Abia State.The total population of the study comprised of 15 computer graphics experts from various computer graphics business centers in Umuahia,Abia State. There was no sample and sampling technique as the population of the study was manageable. The instrument for data collection was Computer Graphics Training Manual Questionnaire (CGTMQ). CGTMQ was validated by three experts in computer graphics (CorelDraw).CGTMQ contained six sections; A, B, C, D, E and F. Section A solicits information on the personal data of the respondents. Section B contains items seeking information on the objectives of the training manual on five-point scale. Section C comprises items eliciting information about contents of the training manual to be developed. Section D contains items seeking to find the instructional materials to be used in the training manual. Section E comprises of items focusing on the teaching strategies to be used. Section F on the other hand contains items soliciting information on the evaluation criteria to be used in assessing students' after instruction. The data collected using CGSMQ was analyzed using mean and standard deviation respectively.

Findings

Research Question 1

What are the objectives of the training manual to be developed?

Table 1

Mean and Standard Deviation of Responses of CorelDraw Experts on the Objectives of the Training Manual to be developed

N=15

S/N	Objectives	$\overline{X}$	SD	Remark
1	To acquire knowledge on the various uses of the Coreldraw	4.87	0.52	Needed
2	To acquire knowledge and skills of using pick tool	4.80	0.56	Needed
3	To acquire knowledge and skills of using freehand	4.27	1.03	Needed
4	To acquire knowledge and skills of using free transform shape tool	4.53	0.45	Needed
5	To acquire knowledge and skills of using smooth tool	4.40	0.91	Needed
6	To acquire knowledge and skills of using smear tool	4.00	1.36	Needed
7	To acquire knowledge and skills of using twirl tool	4.20	1.21	Needed
8	To acquire knowledge and skills of using smudge tool	4.20	1.52	Needed
9	To acquire knowledge and skills of using crop tool	4.40	0.83	Needed
10	To acquire knowledge and skills of using knife tool	4.40	1.05	Needed
11	To acquire knowledge and skills of zoom tool	4.67	1.16	Needed
12	To acquire knowledge and skills of using parallel dimension tool	3.67	1.35	Needed
13	To acquire knowledge and skills of using text tool	4.73	0.56	Needed
14	To acquire knowledge and skills of using callout shapes tool	4.00	1.13	Needed
15	To acquire knowledge and skills of using Baner shapes tool	4.80	1.22	Needed
16	To acquire knowledge and skills of using basic shapes tool	4.00	1.25	Needed
17	To acquire knowledge and skills of using spiral tool	3.80	1.37	Needed
18	To acquire knowledge and skills of using star tool	4.20	1.32	Needed
19	To acquire knowledge and skills of using rectangle tool	4.67	1.13	Needed
20	To acquire knowledge and skills of using artistic media tool	4.00	1.19	Needed
21	To acquire knowledge and skills of using 3-point cut tool	4.13	1.06	Needed
22	To acquire knowledge and skills of using polyline tool	3.87	1.09	Needed
23	To acquire knowledge and skills of using B-spline tool	3.67	1.29	Needed
24	To acquire knowledge and skills of using pen tool	4.40	0.83	Needed
25	To acquire knowledge and skills of using bezier tool	4.13	1.06	Needed
26	To acquire knowledge and skills of using 2-point line tool	4.40	0.41	Needed
27	To carry out several projects using Coreldraw package	5.00	0.00	Needed

Table 1 shows the data for answering research question 1. The table revealed that all the items had mean values greater than the cut-off point of 3.50. This implies that all the respondents agreed that all the items represents the objectives of the training manual to be developed. Table 1 also shows the standard deviations against each item.The smaller values of the standard deviations indicated the closeness of the responses of the respondents for the items.

Research Question 2
What are the contents of the trainingmanual to be developed?
Table 2
Mean and Standard Deviation of Responses ofCorelDraw Experts on the contents of the Training Manual to be developed

N=15

S/N	Contents	$\overline{X}$	SD	Remark
28	An overview of Coreldraw	5.00	0.00	Needed
29	The use of pick tool to select, size and rotate objects	4.73	0.26	Needed
30	The use of freehand to select objects by using a freehand selection marquee	4.27	1.25	Needed
31	The use of free transform shape tool to transform an object using the free rotation,free angle reflection,free scale and free skew tools	4.53	1.13	Needed
32	The use of smooth tool to smooth curved objects to remove jagged edges and to reduce the number of nodes	4.13	0.92	Needed
33	The use of smear tool to shape an object by pulling extensions or making indents along its outline	3.82	1.13	Needed
34	The use of twirl tool to creates twirl effects by dragging along the edge of objects	4.00	1.25	Needed
35	The use of smudge tool to distorts a vector object by dragging along its outline	4.07	1.22	Needed
36	The use of crop tool to remove unwanted areas in objects	4.27	0.70	Needed
37	The use of knife tool to slice objects,group of objects and bitmaps along any path you specify	4.07	1.22	Needed
38	The use of zoom tool to change the magnification level in a drawing window	4.47	0.99	Needed
39	The use of eraser tool to remove areas of drawing	4.47	1.13	Needed
40	The use of parallel dimension tool to slanted dimension lines	4.40	0.99	Needed
41	The use of text tool to type words directly on the screen as artistic or paragraph text	4.53	1.09	Needed
42	The use of callout shapes tool to draw callouts and labels	3.20	1.22	Needed
43	The use of Baner shapes tool to ribbon objects and explosion shapes	3.93	0.80	Needed
44	The use of arrow shapes tool to draw arrow of various shape,direction and the number of heads	4.33	1.23	Needed
45	The use of basic shapes tool to choose from a full set of shapes, including hexagram, a smily face, and a right-angle triangle	4.13	1.06	Needed
46	The use of spiral tool use to draw symmetrical, logarithmic and spirals	3.80	1.26	Needed
47	The use of star tool use to draw perfect stars	4.27	1.16	Needed
48	The use of rectangle tool to draw rectangles and squares	4.73	0.80	Needed
49	The use of artistic media tool to provides access to the preset, brush and sprayer	4.27	1.16	Needed
50	The iveSketch tool use to sketch naturally with intelligent stroke adjustments	3.80	1.21	Needed
51	The use of 3-point curve tool to draw curve by defining the start, end center points	3.67	1.29	Needed
52	The use of polyline tool to draw lines and curves in preview mode	3.46	1.21	Needed
53	The use of B-spline tool to draw curved lines by setting control points that shape the curve without breaking it into segments	3.80	0.77	Needed
54	The use of pen tool to draw curves:one segment at a time	4.33	1.05	Needed
55	The use of bezier tool to draw curves:one at a time	4.20	1.15	Needed
56	The use of 2-point line tool to draw a straight line segment and curves	3.93	1.23	Needed
57	The use of pan tool to control which part of the drawing is a visible in the drawing window	4.47	1.49	Needed
58	Students Projects using Coreldraw package	4.93	0.82	Needed

The table 2 revealedthat 29 items had mean values greater than the cut-off point of 3.50.The items according to the respondents represents the contents of the training manual to be developed.The remaining two items on the other hand had mean values of less than 3.50, implying they are not to be part of the contents of the training material to be developed. Furthermore, the values of the standard deviations from the table indicated that the responses of the respondents were close.

Research Question 3
What are the instructional materials to be used in the teaching of Computer Graphics?
Table 3
Mean and Standard Deviation of Responses of CorelDraw Experts on the Instructional Materials to be used in the Training Manual to be developed.
N=15

S/N	Instructional Materials	$\overline{X}$	SD	Remark
59	Short Video Clips	4.40	1.30	Needed
60	Short Audio Clips	3.67	1.45	Needed
61	Chalk and Chalkboards	4.47	1.13	Needed
62	Drawings	4.73	0.70	Needed
63	PowerPoint software	4.40	1.12	Needed
64	Computers	5.00	0.00	Needed
65	Projectors	4.67	0.44	Needed
66	Screens	4.80	0.94	Needed
67	Coreldraw software	4.93	0.26	Needed

In table 3, all the items had mean values greater than the cut-off of 3.50. This implies that these items represents the instructional materials to be used in developing the training manual. The table also contains the standard deviations of the items. The values of the standard deviations for the items were small, indicating that the respondents do not differ much on the instructional materials to be used.

Research Question 4
What are the Teaching Strategies to be used in the training manual to be developed?
Table 4
Mean and Standard Deviation of Responses ofCorelDraw Experts on the Teaching Strategies to be used in the training manual
N=15

S/N	Teaching Strategies	$\overline{X}$	SD	Remark
68	Demonstration method	3.60	1.03	**Needed**
69	Lecture method	4.93	0.26	**Needed**
70	Project method	5.00	0.00	**Needed**
71	Discussion method	4.33	0.82	**Needed**
72	Problem Practice method	4.40	0.83	**Needed**
73	Field Trip method	4.53	0.92	**Needed**
74	Case study method	4.33	0.80	**Needed**
75	Brainstorming technique	4.13	0.83	**Needed**
76	Use of examples technique	4.20	1.30	**Needed**
77	Questioning technique	4.07	1.22	Needed
78	Stimulus variation technique	3.87	1.06	Needed
79	Set induction technique	4.00	1.00	Needed

The table 4 shows that all the 12 items seeking to determine the instructionalstrategies had mean values of more than 3.50.Thess indicated that the items constitute the instructional strategies to be used in developing the training manual. Furthermore, such items had values of standard deviations ranged from 0.00 to 1.30 which, are less than 1.96, meaning respondents vary very little on the items under the study.

Research Question 5

What are the evaluation criteria for assessing Students' Performance?

Mean and Standard Deviation of Responses of CorelDraw Experts on the Evaluation Criteria for Assessing Students Performance

Table 5

N=15

S/N	Evaluation Criteria	$\overline{X}$	SD	Remark
80	Completion of task given by a teacher within a specified time	4.93	0.26	Needed
81	Completion of task given by a teacher accurately	4.80	1.66	Needed
82	Completion of task given by a teacher with minimum of steps specified by the teacher	4.80	0.57	Needed

Table 5 revealed that all the items had mean values of more than 3.50.This implies that such items are to be used as a guide during the evaluation of student's competencies after training in CorelDraw. In addition, such items had values of standard deviations ranged from 0.26 to 1.66 which are less than 1.96, meaning respondents vary very little on the items under the study.

Conclusion

The advent of computer and itssubsequentuse in production of images and graphics provides golden opportunities to not only to those in graphics profession, but also those involved in teaching and learning graphics. This informed the integration of computer graphics in the curriculum of fine and applied arts NCE programme recently. There exit paucity of materials for teaching and learning of computer graphics in Abia State College of Education (Technical) Arochukwu. Hence, the researchers set out to develop an instructional material for teaching computer graphics.The process of the development began with the articulation of objectives and research questions.This was followed by construction of questionnaire, data collection and analysis. The data analyzedrevealed the objectives, contents, instructional materials, teaching strategies and evaluation criteria to be used in developing the instructional material for teaching computer graphics among students of fine and applied arts in Abia State College of Education (Technical) Arochukwu.

References

Alpha, A.A. (2013). *Development of Self-instructional Manual for Sand Casting Technology in the Polytechnics in North Central States of Nigeria*, Unpublished Doctoral Thesis. Department of Vocational Teacher Education, University of Nigeria, Nsukka. Enugu State Nigeria.

Benjamin, S,(2009). Disadvantages and Advantages of Computer Graphics. Retrieved on 2nd March, 2020

Branson, R.K, Raymer, G.T, Cox, J.L, Furman, J.P, King, F.J &Hannum, W.H. (1975). Interservice Procedures for instructional systems development (1-5) *TRADOC Pam 350-30.NAVEDTRA 106 A, Ft Monroe, VA U.S Army Training and Doctrine Command.*

Eck, D. J. (2018). Introduction to Computer Graphics. Version 1.2, Retrieved on 24th February, 2020 from http://math.hws.edu/graphicsbook.

Falohun, A. S, Omidiora, E. O, Oke, O. A, Ajala, F. A &Ismaila, W.O. (2012).Application of Computer Graphics Technique to Computer System Assembling.*Computer Engineering and Intelligent Systems*, 3 (7), 71-76.

Ivanova,M&Ivanov,G. (2011).Enhancement of Learning and Teaching in Computer Graphics through Marker Augmented Reality Technology. *International Journal on New Computer Architectures and Their Applications (IJNCAA)* 1(1), 176-184

Pellacini,F. (2009). Fundamentals of Computer Graphics, Retrieved on 2nd March, 2020.

Redfield,C.L. (2016). Teaching Computer Graphics by Application. Retrieved on 2nd March, 2020.

Rieber,L.P. (2000). Computers, Graphics, & Learning. Retrieved on 27th February, 2020.

Shirley, P. (2005). *Fundamentals of Computer Graphics*. Wellesely: A K Peters.

Seron, F, Cerezo, E &Baldassarri,S. (2008). Computer Graphics: Problem Based Learning and Interactive Embodied Pedagogical Agents. Eurographics. Retrieved on 2nd March, 2020.

Soffar, H. (2019).Graohis Design Types, Uses, Advantages and Disadvantages. Retrieved on 2nd March, 2020.

Suselo, T.,Wünsche, B.C. &Luxton-Reilly,A. (2017). The Journey to Improve Teaching Computer Graphics: A Systematic Review. Chen, W. et al. (Eds.) (2017). Proceedings of the 25th International Conference on Computers in Education. New Zealand: Asia-Pacific Society for Computers in Education.