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Design and Production of Collapsible Artist-Donkey for Drawing and Writing using Lines from Polynomials

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Abstract

Study showed that wooden drawing benches otherwise known as artist-donkeys or artist-horses are designed specifically for drawing and painting exercises in drawing studios. However, students of Fashion Design and Clothing Technology in Kaduna Polytechnic write theory-examinations awkwardly on the artist-donkeys due to lack of sufficient chairs and desks that were usually conveyed to the drawing studio during the examinations. Also, the artist-donkeys are stiff, heavy and block movement in the drawing studio. The purpose of the study is to use lines obtained from 3rd degree polynomials to design and produce an artist-donkey that will serve for drawing as well as seat and desk for writing during lectures or examinations in the drawing studio. It will be collapsible and packable to allow free movement in the drawing studio. The objectives of the study are to determine: the generation of numbers from 3rd degree Polynomials; the conversion of the numbers to lines; the 2D working drawing of the collapsible artist-donkeys using the lines obtained; the 3D graphic design of the collapsible artist-donkeys; the production of the artist-donkey using 2″ x 2″ black square-pipe. It is hoped that the collapsible artist-donkeys will serve dual purpose of drawing and writing, ease the constraints of seats for students during lectures or examinations and serve as space-saving for proper studio arrangement.

Keywords: Artist-horses, Examination, Drawing board, 3rd degree polynomials

Introduction

Background of the study

Mathematics is a powerful social entity that plays a key role in shaping how individual deals with the various spheres of private, social and civil lives. Mathematics does not only empower people with the capacity to control their lives, but also provide science, a firm

foundation for effective theories and concepts. It also guarantees society a vigorous economy (Kajuru and Papoola 2010).

The application of differentiation on the 3rd degree polynomials leads to the discovery of family of numbers which were converted to lines and eventually to a 2D composition of shapes for composing functional objects,

The traditional artist donkey is a drawing facility designed to hold board/drawing pad at an angle, while student sits astride the bench. However, the artist-donkey need to be redesigned to serve for drawing and writing for which the study is intended using lines obtained from 3rd degree polynomials.

It was observed that comfortable seat contributes positively to students' academic performance during lectures and examinations. However, students of Fashion Design and Clothing Technology in Kaduna Polytechnic write written-examinations uncomfortably on Artist-donkeys that are designed for drawing exercises. Also, Artist-donkeys congest studios making movements difficult therein. These inconveniences affect the teaching and learning environment and the academic performance of the students especially in drawing class. To bridge this gap, a collapsible artist-donkeys will be introduced to serve for drawing and writing during lectures or examinations. Also, it can be folded and packed to acquire space for other activities in the studio.

Mathematics deals with numbers and there is a need to transform these numbers to various shapes and forms to benefit the society. This study intends to transform these numbers to lines, which will be used to design the collapsible Artist-donkey that will be produced with 2″ x 2″ black iron square-pipe.

The aim of this study is to use lines obtained from 3rd degree polynomials to design and produce a collapsible Artist-donkey for drawing and writing. The objectives of the study are to determine the:

(1) The Generation of numbers from 3rd degree Polynomials
(2) Conversion of the numbers to lines;
(3) 2D working drawing of collapsible using the lines obtained;
(4) 3D graphic design of the collapsible Artist-donkey;
(5) Production of the collapsible Artist-donkey using 2″ x 2″ black iron square-pipe.

The study will review some related literatures under the following headings:

1. Differential calculus
2. Polynomials/Pascal triangle
3. Importance of seat in teaching and learning.

i. Differential Calculus:

In mathematics, differential calculus is a subfield of calculus that studies the rate at which quantities change. The derivative of a function at a chosen input value describes the rate of change of the function near that input value; the process of finding the derivative is called differentiation (Abadin &

Atangama, 2016). Differential calculus is basically divided into two namely, differentiation and integration. This study basically uses the application of differentiation on the 3rd degree (3!) Polynomial and the coefficient of the 3rd degree Polynomial from the Pascal's triangle (1331).

ii. Polynomials/Pascal Triangle:

Pascal was a French mathematician in the 17th centuries but the triangle now named as Pascal triangle was studied long before Pascal. The pattern was used around 10th centuries in Persia, India and China (Wikipedia, 2021). The polynomial triangles are derived from the following number patterns:

1
1 1
1 2 1
1 3 3 1
1 4 6 4 1
1 5 10 10 5 1

Fig 1: Pascal's triangle

According to Gambo, Mukailu, & Abdul (2020), the differentiation of the 3rd degree Polynomials can be combined with coefficient of 3rd degree Polynomials from Pascal's triangle (1331) to get a pattern of numbers. Example:

1 3 3 1
2 0 4

Fig 2: Number patterns

Adding 6 to both sides separated by 0 the following number patterns are obtained:

…14, 8, 2, 0, 4, 10, 16…

Fig 3: Number patterns

The number patterns above show that the sum of any two numbers on the left gives a corresponding value on the right as indicated below:

2, 8, 10
2, 14, 16

… … …

Fig 4: Number patterns

According to them, each member of the family of the numbers generated above can be converted to a line by subjecting the numbers to a test using cosine rule to fine out the angle created by each of them. The number 2, 8 create an angle 0 degree each while the number 10 create an angle of 180 degrees. Therefore, the sum of the angles created by the 3 numbers is 180 degrees. This suggests that it is a line of length 10 units. Similarly, 2, 14, 16 is a line of 16 units.

Fig 5: Lines obtained from number patterns 2, 8, 10 & 2, 14, 16 respectively as follows:

10 units (10 inches) **16 units (16 inches)** **16 x 2 = 32 units (32 inches)**

These lines of 10, 16 and 32 units are used to represent inches in the design of collapsible Artist-donkey for drawing and writing during lectures or examinations.

iii. Importance of seats in Teaching and Learning

Education whether formal or informal is an essential need in every society as it equips a person with communication skills which include reading, writing, speaking and listening. However, seat is one of the essential needs for conducive teaching and learning environment. Bethany (2018) maintained that students' seats can have a positive impact on student behaviour, academic performance and class participation. Awanda (2019) added that Benefits of seating arrangements include: Safe and accessible classroom environment. He maintained that flexible seating has become a new evolution in education; that there are different types of seats that look different from desks facing towards the front or table with chairs that are typically accustomed to.

Artist-donkey or Art-horse is a prime important seat for effective teaching and learning in drawing class.

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Fig. 6: A student is drawing comfortably on an Artist-donkey

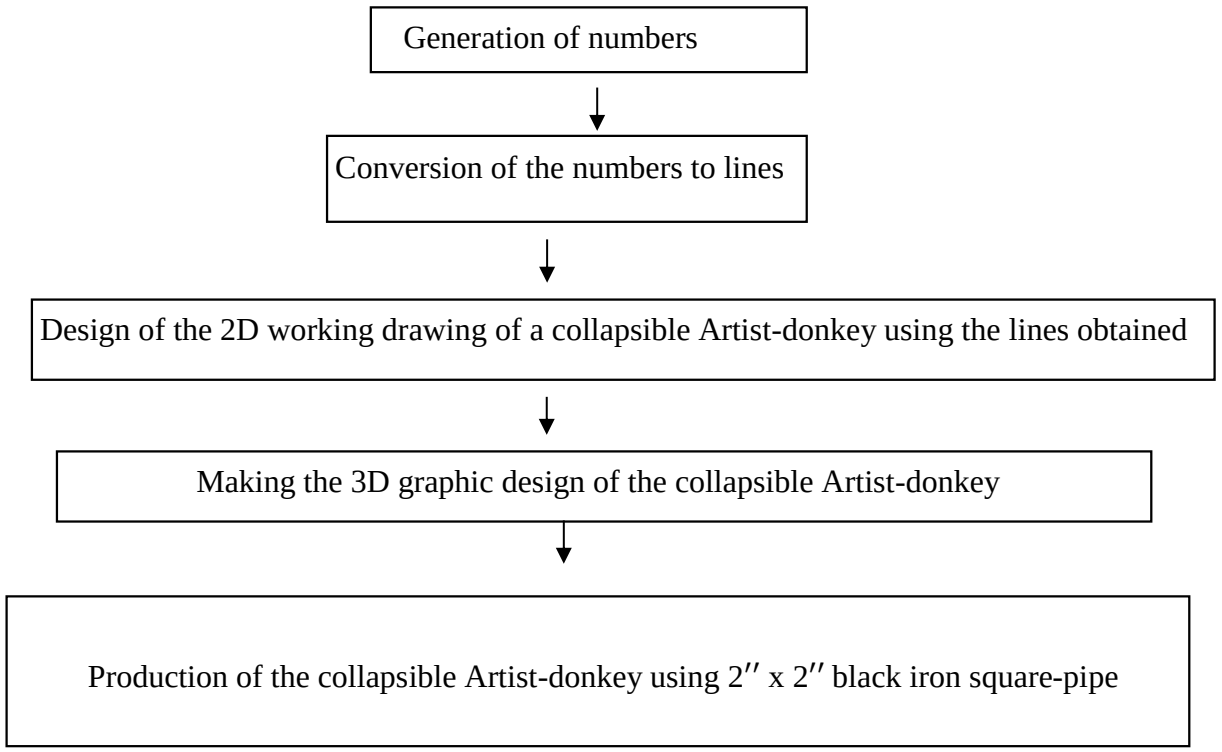
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Methodology

The study intends to design and produce collapsible Artist-donkey using lines obtained from 3rd degree polynomials for drawing and writing in the Main Campus of Kaduna Polytechnic. The study adopts empirical applications which consist of 5 steps as follows:

1. Generation of numbers from 3rd degree polynomials;
2. Conversion of the numbers to lines;
3. Design of the 2D working drawing of a collapsible Artist-donkey using the lines obtained;
4. Making of the 3D graphic design of the collapsible Artist-donkey;
5. Production of the collapsible Artist-donkey using 2″ x 2″ black iron square-pipe;

Fig. 7: Research Design Chart of the collapsible Artist-donkey



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