DEVELOPMENT OF PATTERNS FOR MASS PRODUCTION OF SUITS FOR ADOLESCENTS IN BENUE STATE, NIGERIA

BY

Edache AJUNWA

DEPARTMENT OF VOCATIONAL AND TECHNICAL EDUCATION, AHMADU BELLO UNIVERSITY, ZARIA, NIGERIA

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DECLARATION

I, Mr. Ajunwa Edache declare that the work in this thesis titled "Development of Patterns for Mass Production of Suits for Adolescents in Benue State, Nigeria" was a new research area conducted by me in the Department of Vocational and Technical Education, Faculty of Education, Ahmadu Bello University, Zaria, Nigeria. Information derived from literature has been duly acknowledged in the text and a list of reference provided. The work in this thesis has not been submitted in part or whole of any Diploma or Degree of this or any other university.

Edache AJUNWA	_____	_____
Name of Student	Signature	Date

CERTIFICATION

This thesis titled "**Development of Patterns for Mass Production of Suits for Adolescents in Benue State, Nigeria**" by Edache Ajunwa meets the regulations governing the award of the degree of Doctor of Philosophy of Ahmadu Bello University, Zaria and approved for its contribution to knowledge and literary presentation.

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_____	_____	_____
Prof. T.O. Ojo (Member Supervisory Committee)	Signature	Date
_____	_____	_____
Prof. P.E. Onuigbo (Member Supervisory Committee)	Signature	Date
_____	_____	_____
Prof. A.A. Udoh (Head of Department)	Signature	Date
_____	_____	_____
Prof. K. Bala (Dean, School of Postgraduate Studies)	Signature	Date

DEDICATION

This research work is dedicated to my wife, Mrs. Juliana Ajunwa and my children, Faith Ehi Edache, Ochanya Victoria Edache, John (Pastor) Edache and Joy Onyoche Edache.

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ABSTRACT

This study focused on the development of basic patterns for mass production of suits for adolescents in Benue State, Nigeria. Specifically, the study sought to identity and classify the body characteristics of adolescents, establish average body measurements of adolescents in three size categories of small, medium and large, draft basic suit blocks to fit male adolescents, construct three (3) suits for three (3) size categories, determine the appropriateness of the suits through testing for fit, ease, mobility, acceptability and aesthetics by the adolescents models and the judges, and compare the ratings of the users and the judges. Seven research questions were asked and two null hypothesis were formulated to guide the study. A preliminary survey of 740 adolescents from institutions in Benue State was conducted for classifying them into 3 categories of small, medium and large. Body measurements of 140 adolescents were taken and their average body measurements established. The research and development design was utilized for the study. Four instruments: a questionnaire, a measurement chart, assessment chart for adolescents models and assessment chart for judges were developed by the researcher were face-validated by 3 experts and were used for data collection. Reliability was ascertained through trial testing of the instruments. The questionnaire was used to answer research questions 1-3. Average body measurements were established by measuring 140 adolescents and was used to draft pattern pieces for adolescents in three size categories of small, medium and large. Three prototype garments namely shirt, jacket and trousers were constructed for the three size categories of the 3 models. Judges knowledgeable in clothing and textiles and the adolescent models rated the constructed suits using assessment criteria charts for clothing fit, wearing ease, mobility, aesthetics and acceptability. Data derived from the study were analysed using frequency and percentages to answer research question one. Means were used to answer research questions 2-6. Analysis of Variance (ANOVA) was used for testing the null hypothesis at 0.05 level of significance. Major findings from the study include the identification of body characteristics of adolescents, average body measurements of adolescents and design specifications required for the construction of suits. Three different patterns segregated according to relevant body parts were produced. The models were satisfied with the fit conditions of the prototype suits although alterations or modifications were made in a few areas. The null hypothesis which stated that there is no significant difference in the mean responses of small, medium and large categories of adolescents for acceptability of the suits was retained and the null hypothesis of no significant difference in the mean responses by adolescents and the judges on clothing fit of the suits on adolescents was also retained. It was concluded that the developed patterns and the constructed suits meets the increasing demand for corporate dressing. It was recommended that the developed patterns should be used for mass production of suits for adolescents in Benue State, Nigeria. Lecturers in higher institutions of clothing and textile could use the drafted patterns to help them teach students in a more practical method.

TABLE OF CONTENTS

Title page- - - - - - - - - - i

Declaration- - - - - - - - - - ii

Certification- - - - - - - - - - iii

Dedication- - - - - - - - - - iv

Acknowledgement- - - - - - - - - - v

Abstract- - - - - - - - - - vii

Table of contents- - - - - - - - - - viii

List of tables - - - - - - - - - - ix

List of figures-- - - - - - - - - - iii

List of plates - - - - - - - - - - xv

List of Appendices - - - - - - - - - xvi

Operational Definition of terms- - - - - - - - xvii

CHAPTER ONE: INTRODUCTION

1.1 Background of the study- - - - - - - - 1

1.2 Statement of the Problem- - - - - - - - 6

1.3 Objectives of the Study- - - - - - - - 9

1.4 Research Questions- - - - - - - - - 9

1.5 Research Hypotheses-- - - - - - - - 10

1.6 Significance of the study - - - - - - - - 10

1.7 Scope of the Study- - - - - - - - - 12

1.8 Basic Assumption of the Study- - - - - - - 13

CHAPTER TWO: REVIEW OF RELATED LITERATURE

2.1 Theoretical Framework - - - - - - - 14

2.2.1 Research and Development Cycle - - - - - - 16

2.2.2 Body Characteristics of Adolescents - - - - - - 19

2.2.3 Garment Development in Nigeria - - - - - - 22

2.2.4 Development of Clothes by Foreign Countries. - - - - 23

2.2.5 Evolution of Simple Garment Forms - - - - - - 24

2.2.6 Origin of Modern Garment Terms - - - - - - 25

2.2.7 Origin of Fitted Garments - - - - - - - 26

2.3. Drafting of Basic Block Patterns - - - - - 25
2.4. Clothing Construction from Adapted Patterns - - - - 31
2.4.1. Drafting the Blocks - - - - - - - - - 36
2.4.2. Taking Measurements - - - - - - - - - 38
2.5 Garments construction - - - - - - - - 57
2.5.1 Cutting Fabric Accurately - - - - - - - - 59
2.5.2 Sewing - - - - - - - - - 61
2.6 Clothing Fit - - - - - - - - - 64
2.6.1 Standards for well-fitted coat - - - - - - - - 65
2.6.2 Principles of Clothing Fit - - - - - - - - 67
2.7 Mass Production - - - - - - - - 68
2.8 Strategies that Improve Mass Production of Garments in Nigeria. - - 74
2.9 Empirical Study - - - - - - - - 76
2.10 Summary of Literature Reviewed - - - - - - 82

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 The Design of the Study- - - - - - - - 84
3.2 Population of the Study- - - - - - - - 86
3.3 Sample Size and Sampling Procedure- - - - - - 87
3.4 Instrument for Data Collection- - - - - - - 89
3.4.1 Validation of the Instrument- - - - - - - - 89
3.4.2 Pilot Study- - - - - - - - - 89
3.4.3 Reliability of the Instrument- - - - - - - - 90
3.5 Procedure for Data Collection- - - - - - - 90
3.6 Procedure for Data Analysis- - - - - - - - 114

CHAPTER FOUR: PRESENTATION OF ANALYSIS AND DISCUSSION OF RESULTS

4.1 Presentation of Bio-data variables- - - - - - - 116
4.2 Answer to Research Questions- - - - - - - 117
4.3 Testing Research Hypothesis-- - - - - - - 142
4.4 Summary of Major Findings- - - - - - - - 145
4.5 Discussion of Findings- - - - - - - - 146

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1	Summary- - - - - - - - - -	150
5.2	Conclusion- - - - - - - - - -	151
5.3	Recommendations- - - - - - - - - -	152
5.4	Limitations of the Study- - - - - - - - -	153
5.5	Implications of the Study- - - - - - - - -	153
5.6	Suggestion for Further Studies- - - - - - - -	154
	References- - - - - - - - - -	155
	Appendices - - - - - - - - - -	163

LIST OF TABLES

Table 2.1:	The Factory Boutique Shima Production Concept - - -	72
Table 2.2:	Steps in manual production. - - - - - -	73
Table 3.1:	Population for the Study - - - - - -	87
Table 3.2:	Selection of Sample - - - - - - -	88
Table 4.1:	Perception of respondents on body characteristics of adolescents -	117
Table 4.2:	Categories of adolescents body measurement based on small, medium and large (Height 130 – 150cm). - - - - -	118
Table 4.3:	Average body measurement of small-sized adolescents (N = 40). -	119
Table 4.4:	Average body measurement of medium-sized adolescents (N = 40).	121
Table 4.5:	Average body measurement of large-sized adolescents (N = 40). -	122
Table 4.6	Assessment of wearing fit by small size adolescents models - -	128
Table 4.7	Assessment of wearing comfort by small size adolescents models -	129
Table 4.8	Assessment of wearing ease and mobility by small size adolescents models - - - - - - - - -	130
Table 4.9	Assessment of Acceptability and Aesthetics by small-sized adolescents - - - - - - - - -	131
Table 4.10	Assessment of wearing fit by medium-sized adolescents models -	132
Table 4.11:	Assessment of wearing comfort by medium-sized adolescents -	133
Table 4.12	Assessment of wearing ease and mobility by medium size adolescents models - - - - - - - - -	134
Table 4.13	Overall Assessment of Acceptability of suits by medium-sized models	135
Table 4.14	Assessment of wearing fit by large-sized adolescents models -	136
Table 4.15:	Assessment of wearing fit by large-sized adolescents - -	137
Table 4.16	Assessment of wearing ease and mobility by large size adolescents models - - - - - - - - -	138
Table 4.17	Overall Assessment of Acceptability of Suits by Large-Sized Models	139
Table 4.18	Judges mean scores on clothing fit, mobility, ease and aesthetics -	140
Table 4.19	Percentage analysis of scores for overall clothing fit by the three categories of adolescents and judges - - - - -	141

Table 4.20: Assessment of mean responses of adolescents models for acceptability of suits in three size categories of small, medium and large. - - 142
Table 4.21: Two-way ANOVA for difference in the mean response of adolescents 142
Table 4.22: Comparison of Clothing Fit by Three Size Categories of Models - 144
Table 4.23: Two-way ANOVA for difference in the mean response of judges - 144

LIST OF FIGURES

Fig 1: Map of Benue state showing the Local Government Areas- - - - 12

Fig 2: Three size categories of small, medium and large adolescents - - 18

Fig 3: Pattern for bodice front and back- - - - - - - - 35

Fig 4: Matching of armhole and neckline- - - - - - - - 37

Fig 5: Areas of body measurement (back)- - - - - - - - 41

Fig 6: Areas of body measurement (front)- - - - - - - - 43

Fig 7: Crotch measurement -- - - - - - - - 45

Fig 8: Sleeve pattern- - - - - - - - - 50

Fig 9: Front and back shirt- - - - - - - - - 53

Fig 10: Front and back trouser pattern- - - - - - - 57

Fig 11: Pattern layout-- - - - - - - - - 58

Fig 12: Pattern placed according to grain line- - - - - - 59

Fig 13: Pinning pattern- - - - - - - - - 60

Fig 14: Cutting of fabric- - - - - - - - - 60

Fig 15: Back Shirt Draft - - - - - - - - 92

Fig 16 Front Shirt Draft - - - - - - - - 93

Fig 17: Sleeve Draft - - - - - - - - - 94

Fig 18: Jacket Front and Back Draft - - - - - - - 95

Fig 19: Classic Jacket Front and Back Draft - - - - - - 96

Fig 20: Front Body and Slide Panel Draft - - - - - - 97

Fig 21: Finished Panel Draft - - - - - - - - 98

Fig 22: Seam Allowances for Jacket - - - - - - - 99

Fig 23: Front lining Draft - - - - - - - - 100

Fig 24: Side and Backlining - - - - - - - - 101

Fig 25: Sleeve Lining - - - - - - - - - 102

Fig 26: Completed Jacket - - - - - - - - 103

Fig 27: Specific Parts of Trouser - - - - - - - 104

Fig 28: Front Trouser Draft - - - - - - - - 105

Fig 29: Inseam and Outseam of Trouser - - - - - - 106

Fig 30: Front Crotch and Waist Line - - - - - - - 107

Fig 31: Back Trouser Draft - - - - - - - - 108

Fig 32: Back Crotch - - - - - - - - - 109

Fig 33: Back Waist - - - - - - - - - 110

Fig 34: Back Dart - - - - - - - - - 111

Fig 35: Waist Band Draft - - - - - - - - 112

Fig 36: Seam Allowances for Trousers - - - - - - 113

Fig 37: Drafted patterns for front and back shirt. - - - - - 173

Fig 38: Drafted pattern of long sleeve - - - - - - 174

Fig 39: Drafted pattern of front and back coat - - - - - 175

Fig 40: Drafted pattern for two piece coat sleeves - - - - - 176

Fig 41: Drafted patterns of trouser front and back - - - - - 177

LIST OF PLATES

Plate 1: Chest measurement - - - - - - - - 166

Plate 2: Across front measurement - - - - - - - 166

Plate 3: Across back measurement - - - - - - - 167

Plate 4: Waist measurement - - - - - - - - 167

Plate 5: Hip Measurement - - - - - - - - 168

Plate 6: Center Back Measurement - - - - - - - 168

Plate 7: Shoulder length measurement - - - - - - 169

Plate 8: Neck measurement - - - - - - - - 169

Plate 9: Long sleeve measurement - - - - - - - 170

Plate 10: Arm circumstance measurement - - - - - - 170

Plate 11: Wrist measurement - - - - - - - - 171

Plate 12: Trouser length measurement - - - - - - 171

Plate 13: Ankle measurement - - - - - - - - 172

Plate 14: Crotch length measurement - - - - - - - 172

Plate 15: Pattern laying and cutting of shirt fabric by the researcher - - - 178

Plate 16: Pattern laying and cutting of coat fabric by the researcher - - - 178

Plate 17: Pattern laying and cutting of trouser fabric by the researcher - - 179

Plate 18: Sewing of shirt by the researcher - - - - - - 180

Plate 19: Sewing of coat by the researcher - - - - - - 180

Plate 20: Sewing of trouser by the researcher - - - - - - 181

Plate 21: Fitted suits on small-sized adolescents (front and back view) - - 182

Plate 22: Fitted suits on medium-sized adolescents (front and back view) - - 183

Plate 23: Fitted suits on Large-sized adolescent (front and back view) - - 184

LIST OF APPENDICES

Appendix A: Introductory letters - - - - - - 163

Appendix B: Body characteristics of adolescents - - - - - 165

Appendix C: Procedure for body measurement - - - - - 166

Appendix D: Body measurement chart guide - - - - - 173

Appendix E: Drafted patterns for established average body measurement - - 175

Appendix F: Pattern Laying and Cutting - - - - - - 180

Appendix G: Construction of Prototype Suits - - - - - 182

Appendix H: Fitted suits on different size categories of small, medium and large adolescents - - - - - - - - 184

Appendix I: Assessment criteria chart for adolescents on wearing fit, ease, mobility and aesthetics by small, medium and large adolescents - - 187

Appendix J: Assessment criteria chart for judges on wearing fit, ease, mobility and aesthetics - - - - - - - - 188

Appendix K: Pilot study - - - - - - - - 189

Appendix L: Graphic Design Version of the Patterns for Small, Medium and Large Adolescents - - - - - - - - 191

OPERATIONAL DEFINITION OF TERMS

Applied Design: These are design techniques mostly found on the fabric like embroidery which can be made by hand or machine, dye, pigment and printing on clothes.

Babbanriga: A large flowing robe or gown worn as an outer garment by males.

Basting Stitch: These are temporary stitches on garments which are removed after sewing

Balance: Refers to the relationship between the figure and clothing and between the various sections of the clothing. A garment is said to be balanced when the vertical grain lines on the bodice front and back, the sleeves are perpendicular to the floor.

Block: This term refers to foundation pattern or master plan. It is made up five different patterns.

Breaches: These are types of detergents used for the removal of stains and other dirt from clothes.

Buba: Blouse with loose three-quarter sleeve.

Commercial patterns: These are the paper that have been developed by experienced pattern makers which was obtained through draping with muslin cloth or tissue paper before it was cut into paper. Seam allowances are left, the exact amount is stated on the pattern. The straight grain is clearly marked by a thick straight line with arrow shown at each end. Balanced marks are indicated by a v-shaped symbol. This is called the notch and it is illustrated at the edge of patterns on the two corresponding sections. This shows where the two notches should match together.

Drafting: This is an engineering approach to producing patterns using a set of measurements obtained from a figure by following some instructions or rules. The instructions are interpreted into drawings of shapes on paper or fabrics. The accuracy of the drafted pattern

depends on the accuracy of the body measurements, drafting instructions and skill of the pattern maker.

Fabric: A fabric is a finished product of textile in the process of clothe manufacturing.

Fiber: A fiber is a hair-like structure which is a building block of fabrics.

Figure types: Refers to the categories of the human built; tall and thin, tall and plump, short and thin, short and plump,

Fit: Refers to the sufficient ease in a garment to permit freedom of movement, to provide physical comfort when sitting, bending walking and it gives attractive outlook.

Girth: This is the measurement around body parts, especially the arms, waist, wrist, chest, thigh, knee and so on.

Iro: Cloth wrap round the waist usually worn with Buba by females.

Jackets: These are upper body garments worn over other clothes.

Kaftan: Shirt worn outside the trousers to knee level

Mass production: It is the production of garments of the same type in large quantity so that every customer could have it.

Pattern marking: These are symbols representing information about pattern in form of notches, broken lines, double lines, solid lines, and small circles.

Pattern: A pattern is a piece of paper drafted and cut to size and shape, used for cutting out fabric pieces for making garments. This may be commercial pattern or drafted pattern.

Stock sizes: Drafting of sizes with related body shapes

Slopper: A garment with few design details that extend from the top to kneel level.

Structural Design: Refers to different types of yarns introduced to weaving such as thick yarns and coloured yarns in a fabric.

Trueing: Changes or designs added to the foundation pattern including balance marks, seam allowance and dart manipulation to fit an individual according to current fashion.

Tricel: It is a synthetic fiber.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Adolescent is a young male or female between the ages of 12-17 years, (United Nations Department of Public Information, UNDPI 1997). Adolescents body type is the relationship of the human body shape to body size. Every physical characteristics in a person is a factor determining his or her body-type, whether it is height, weight or lower to upper-body ratio as well as body weight appearance such as broad shoulders, chest and abdomen, (Myoungok and Injoo, 2014). The authors pointed out that as the body types classifies a body shape of adolescents in general, it is not the same according to different characteristics of adolescents, men and women. It was also noted that males are generally taller, have wider shoulders, narrow hips than females. Additionally, the form of muscle and bone is more prominent because males typically have less body fat than females (Myoungok and Injoo, 2014). Body sizes and shapes can vary drastically among adolescents, race and ethnicity as well. However, because of the diversity with each having a respective standard body shape, it is not easy to select one standard body type. It is necessary to have a unique body measurement charts that fits the self-concept of individuals. Size charts have been developed for sizes of small, medium and large in three categories based on height, that is short, regular and tall for adolescents, (Anikweze, 2013).

Adolescents form the largest number of any nation including Benue State. The period of adolescents begins with onset of puberty and ends with the stage of becoming adults. During this period, adolescents undergo several mental, biological, social, psychological and physical changes. Physical changes occur in height, weight and body shape. At this point,

clothing becomes very important to adolescents because they use clothes to protect, adorn and modify the body (Aldrich, 1999).

The fitted garments of modern time marked a definite departure from earlier forms of dress used by individuals. The foreign influence through Christianity and Islam played a significance role in the transformation of Nigerian garments. This brought about the introduction of variety of fabrics which gradually replaced the wearing of animal skin and leaves. The making of these garments needed just a few body measurements. For example, neck, chest, and length. Hands and fingers were used to estimate yardage and body measurements before the invention of measuring tools. Increase in population brought about the need for ready- made clothes and mass production of garments that suits the need of individuals. The making of garments involve the generation of data from body measurement of individuals. These should be translated into paper patterns by drawing while following a set of rules and techniques before actual garment construction for fitting, (Choi and Powell, 2005).

Development of patterns is one of the techniques use in forming styles in garment making. The data generated from body measurement are used to develop paper patterns for the various parts of the body. Paper patterns are obtained through the accurate measurement of body dimension. Each measurement is repeated for three consecutive times and average is taken. The average value is called optimized sizing. The federal government banning of importation of ready-to-wear garments in the late eighties, brought about difficulty on the part of parents buying clothes for their children. The main objective of this ban is economic self- reliance. This has made Nigerians to make use of local manufacturing companies in the provision of garments for the population (Akubue, 2004).

Shailong and Igbo (2009) stated that local manufacturing companies make use of free-hand cutting techniques, and further stressed that this method of garment construction is time consuming as the tailors will just measure an individual, cut and sew without making use of patterns. The free-hand cutting method makes it difficult to meet with the demand for large scale production of garments for the populace. There is also the tendency of making improper garments that does not fit the figure type using free-hand cutting, (Anyakoha and Iloeje, 2003).

The commercial patterns that are used for effective clothing construction were not available for the garment production industries as pointed out by Akubue (2004), because they had been prohibited from importation into the country by the federal government in order to protect foreign exchange. Kaka (1990) commented that garments made by free-hand cutting do not fit perfectly because of apparent differences in body structure and postural alignments of Africans which differs from those of Europeans. These problems influence the need to construct garments for the various categories of people including adolescent males (Olga and Adam 2006).

The body measured values is used to draft patterns on paper in order to construct clothes that fit the body. This body measurements is graded and recorded in a table known as sizing system or chart for optimized usage in mass production of garments (Piller, 2004). The mass production system adopts the concept of serving a large market with low cost products created through mass production of new technology that facilitates manufacturer responses to consumers drives for customized garments (Pine, 1993).

Clothing has been important in human history and reflects the material available to civilization as well as the technologies that has been mastered (Khalid and Helander, 2009).

Macfoy (1992) noted that the most common uses of clothing are apparel and home furnishing. Besides this uses, clothing are indispensable to industry, agriculture, transportation, space exploration, health services and other areas (Margil, 2007). Clothing in the form of garments is among the three basic needs of man after food and shelter (Marshall, 2008). Clothing is anything that an individual puts on the body in order to protect or beautify them as noted by (Igbo, 2001). Anyakoha (1997), explained that garments such as gowns, shirts, blouses, skirts, coats and trousers that people generally put on can be called clothes.

Iloeje (1995) stated that clothing serves as protection of human beings from the hazards of the environment. It was pointed out further that clothes are worn to protect the skin from hot sun, rain, cold weather, agents like bacteria, fungi and virus. Others include protection from insect bites and parasites which are capable of causing skin lesions. Clothes act as a means of personal communication by expressing individual unique personalities for modesty, attraction, self- identification, social status and psychological expression. Proper wearing of garments commands respect on the part of individual (Shailong and Igbo, 2009).

Garments are worn by different categories of people as noted by (Anikweze, 2003). It was pointed out that the categories include infants, children, teenagers, adolescents and adults. At adult stage or adolescent stage, this category can make a choice of their garments. Children depends on the choice of clothes made by their parents (Aldrich, 2006).

Jeanette (1990) explained that suits comprises of shirts, jackets and trousers. Shirts are upper body garments by which the selection of an appropriate block and the sequence in which various adaptations of the basic blocks can take place. The design relies heavily on the imaginative use of the type of fabric, embroidery, decorative seams and style of pockets. Jackets are also upper body garments characterized by the degree of built-in shaping that

highlights well-tailored garment. The making of jacket is dependent on the proper use of interfacing, lining and interlining, hand stitches, tailor's padding, and other accessories. The author concluded that trousers are lower body garment characterized by the length of the legs. He further stated that accurate measurement of the waist line is used to select the correct size for trousers. Traditional wear is a tribal or customs dress which are worn by the people. Nigerians will continue to adorn themselves as their forebears did centuries ago. The Hausa people are particularly well known for their distinctive cape-like garments or kaftans, richly embroidered with designs and variations of such design known as Dagi can be found in most parts of Nigeria (Ibrahim, 2003).

It is only by drafting patterns from basic blocks, for the construction of shirt, jacket, and trouser as practical record specimen that is the focus of this work for mass production of suits for male adolescent garments. The effectiveness of pattern drafting depends on accurate body measurement that can enable the development of different size charts of small, medium, large for target population. The patterns that are produced from this research work will be able to fit 85% of male adolescents in Nigeria.

1.2 Statement of the Research Problem

Adolescents in Nigeria generally and in Benue State specifically, put on different types of apparels such as shirts, jackets, trousers and traditional attires. However, when adolescents or young men appear in suits, they are generally described as 'corporate'. This implies that they are business minded and may have no time for trifles or humour. A suit is a complete dress outfit which consists a pair of trouser, shirt and jacket. Suit is of particular importance for those who work in offices, banks, educational institutions, air ports, sea ports and hospitals in Benue State. Majority of individuals who favour the wearing of them in

Benue State belong to the Christian faith and have been used to English mode of dressing. So also their children have taken after them in this fashion. The increasing number of private and public institutions and churches in Benue State implies that 'corporate' dressing is on the increase. There is increasing need for wearing suits mostly to churches, school, social functions and so on. The air port in Benue State is not functioning to facilitate the movement of traders that deal in fashion products. The railway is not also functioning well to allow easy access to trading. There is no standardization of drafted patterns and consequently mass production of garments is almost impossible. It is only by a system of sizes and patterns that make it possible to construct garment that fit the body without resorting to custom-made clothing. This custom-made clothing which involve using free hand cutting of fabrics directly and sew is time consuming, wastes a lot of fabrics, money and energy. Since the commercial patterns imported from other countries have been banned by the Federal Government of Nigeria, we have to develop the indigenous pattern based on Nigerian body proportion and shape that fit the target population. In order to fulfill the gap created of meeting the increasing demand for corporate dressing by adolescents, the researcher focused on the development of patterns for mass production of suits for adolescents in Benue State, Nigeria.

In recent times, the production of uniforms for the armed forces, schools and hospitals, the job was awarded to contractors who were not professionally trained tailors. They used free hand for cutting materials that slows down the rate of production. Also poor utilization of materials leads to too deeply cut curved lines such as in the necklines and armholes. There may be too much waste and the grain of fabric incorrectly determined. The undesired garment may be tight, causing creases, restricts wearers movement, or too baggy

for a good fitting. The front and back bodice may be limited or over stretched while darts are likely to be placed wrongly (Shailong and Igbo, 2009).

Mass production of garments in Nigeria is associated with many problems, as noted by (Kajogbola, 1997). The author stated that Nigerian manufacturers have always been criticized for poor quality of their products. Such criticism may well be borne out of the expectation from the customers who expected that indigenous producers must produce goods comparable to multinationals. The author opined that in as much as the local producers attempt to perform within the operating environments, it has always been drawn back by one problem or the other. It is either that the market for their products was poor quality arising from crude technological process or the problem of raw materials, low innovative ability, inadequate working capital or lack of government incentives.

Garments of various types are being made in the country as Nigerians cannot depend on foreign clothes totally. Quite unfortunately, most Nigerians prefer foreign clothes to locally manufactured ones. This is the reason why Nigerians still purchase some foreign second-hand clothes in Nigerian markets, (Dike, 1993). Price is regarded as the overriding determinant of the people's choice for local garments. The high price of Nigerian clothes lead to low preference for locally made garments to the advantage of foreign ones. Another reason for choice of locally made garments is the issue of poor quality. Some locally made garments are alleged to be of poor quality. Poor quality should not lead to blatant neglect of our locally produced garments. There should be patronage so that the market grows, in this case, there will be more people entering the garment business. Then there will be competition among the garment producers so that at the long run, there will be increased quality and reduction in price.

Electricity supply is erratic. There have been unreliable services from the Power Holding Company of Nigeria. This has forced many garment making industries to buy their own generators. The running costs are high and the fuel is not always available. Since the garment making is a continuous process, the disruption cause by even a short power failure before starting the generator for operation may be great. This is particularly the case in the manufacture of synthetic fibers, while in weaving, the production can be ruined.

It is on record that most of the indigenous apparel industries do not develop and maintain an up-to-date body measurement data which is essential for mass production of garments (Uzoka, 2000).This is as a result of lack of skilled man-power in the area of modern information technology, computer aided design (CAD), three dimensional (3D) body scanners and interactive web-based application in garment production.

1.3 Objectives of the study

The main objective of this study is the development of patterns for mass production of suits for adolescents in Benue State, Nigeria. The specific objectives are to:

1. identify body characteristics of adolescents.
2. categorise adolescents based on their sizes of small, medium and large.
3. take body measurement of adolescents and establish average body measurement based on their sizes of small, medium and large.
4. draft three patterns for different size categories of adolescents.
5. construct three different suits for adolescents based on their size categories of small, medium and large.
6. assess the suits for fit, mobility, ease and aesthetic, by adolescent models
7. assess the suits for fit, mobility, ease and aesthetic by judges.

1.4 Research Questions

1. What are the body characteristics of adolescents in Benue State?
2. What are the categories of adolescents based on their sizes of small, medium and large?
3. What are the average body measurement of adolescents in the size categories of small, medium and large?
4. How can the basic block patterns be drafted to fit the three size categories of adolescents?
5. How can the block patterns be adapted using some design techniques to construct shirts for three size categories of adolescents?
6. What are the mean responses on fit, mobility, ease and aesthetics by adolescents?
7. What are the mean responses on fit, mobility, ease and aesthetic by judges?

1.5 Research Hypotheses

Null hypothesis 1: There is no significant difference between the mean responses of small, medium and large categories of adolescents on the acceptability of the suits.

Null hypothesis 2: There is no significant difference in the mean responses of the adolescents and judges on the clothing fit of the suits.

1.6 Significance of the Study

The findings of this study would be of great significance to several stakeholders in Home Economics education. These include lecturers in clothing and textiles, fashion designers, tailors and dress makers, dealers in fabric trades, curriculum planners and policy makers in education. Most importantly the adolescents and youths who are always eager to follow some fashion trends of their time.

This study will be significant in stimulating reduction of dependency on foreign garments, discourage artificial scarcity, protect local industries and reduce foreign exchange rate to the barest minimum. The work is of educationally and aesthetically significant in stimulating creativity and originality in the design, style and comfort among male adolescents in Nigeria.

The findings of this study will be of economic benefit to the large scale garment manufacturers who are engaged in mass production practices. This is because the study would provide market information regarding what the consumers prefer as individual. It would also socially provide information on the problems and prospects facing the demand and supply of mass production of male adolescent garments. This will help the producers of customized garments to identify appropriate market target and strategies to maximize profit.

This work will improve our local garment industries. In as much as consumers want immediate and personalized service delivery, more customers will patronize the market. The garment making industries selected by the National Directorate of Employment,(NDE) for skill training of youths will be provided with government incentives that will improve the standard and quality of the products. This is in line with the nation's aspiration to provide jobs for the youths in order to reduce unemployment. It also aimed at discouraging importation of foreign garments and clothing in a bid to stop dumping. With the improvement of local industries, there is hope to attain self-sufficiency in the provision of essential goods for the people.

If the recommendations of this study are properly implemented, majority of jobless youths will be employed into the growing number of garment producing industries in Nigeria. Due to the wake of information super high way, the quality and the acceptability of

our local garment and apparel products will be enhanced. Local apparel and garment materials like traditional wears will be found in the international market in the long – term. Since the world is becoming one global village, patterns of production that will be standardized will be of great significant.

The acquisition of knowledge and skills in the use of pattern drafting for mass customization will enhance efficiency in application of advanced technology. It will reduce wastage of resources in a well-designed clothing. It will also motivate creativity in pattern making among the clothing industry.

1.7 Scope of the Study

The study was delimited to Nigerian male adolescents in Benue State. The work was also delimited to only the body measurements that are relevant to this study. These include chest measurement, across back, across front, waist, hip, center front, center back, shoulder, sleeve length, biceps or arm circumference, trouser length, thigh, crotch and ankle. Weight and skin-fold thickness are not relevant for this present study, because this study was not on nutritional intake of individuals. The work will focus on the construction of suits which comprises of shirt patterns, coat and trouser as practical record specimen for mass production for male adolescents in Benue State, Nigeria.

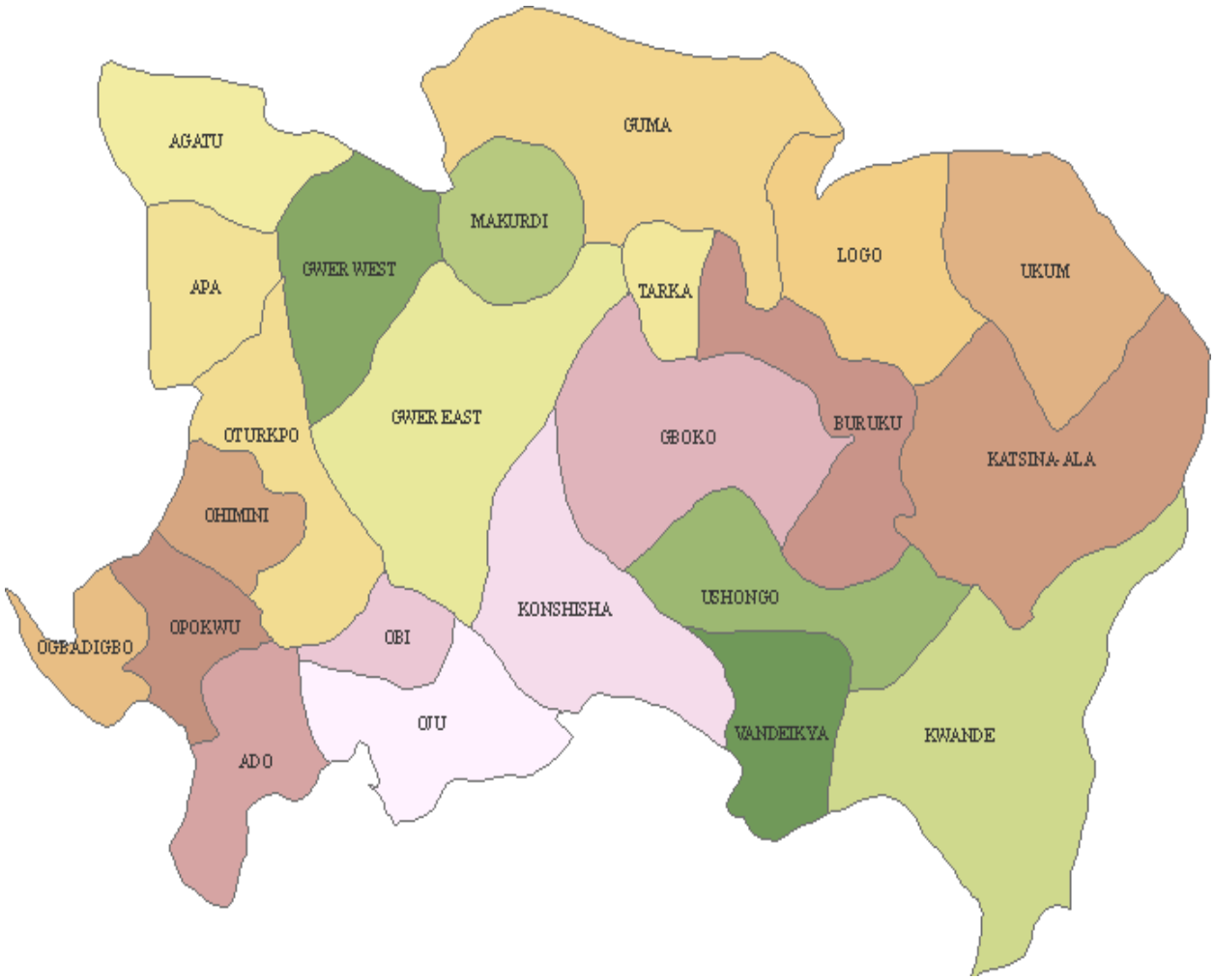


Figure 1: Map of Benue State showing the Local Government Areas.

Source: Benue State office of statistics, Makurdi, (2014).

1.8 Basic Assumptions of the study

(a). It is assumed that the garment produced in this research will be able to fit 85% of male adolescents, both in design, style and comfort in Nigeria.

(b). The sewing threads used for the garments match the colour of fabrics and size the eye of needle respectively.

(c). The type of design, style and fabric selected for the garment will be acceptable to target population based on current fashion.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

In this chapter, the literature related to this work were reviewed in the following sub-headings.

2.1 Theoretical framework

- Modesty theory
- Aesthetic theory
- Theory of cognitive dissonance

2.2 Conceptual Framework

- Research and Development Cycle
- Body Characteristics of Adolescents
- Development of Garment in Nigeria
- Development of clothes by Foreign Countries
- Evolution of Simple Garment Forms
- Origin of Modern Garment Terms
- Origin of Fitted Garments

2.3. Drafting of Basic Block Patterns

2.4. Clothing Construction from Adapted Patterns

2.5 Garments Construction

2.6 Clothing Fit

2.7 Mass Production

2.8 Strategies that Improve Mass Production of Garments in Nigeria.

2.9 Empirical Study

2.10 Summary of Literature Reviewed

2.1 Theoretical Framework

There are many theories that can be used to understand the reasons for wearing clothes. Three major theories here were used to understand the reasons why people put on clothes. These includes:

i. modesty theory

ii. aesthetic theory

iii. theory of cognitive dissonance

2.1.1 Modesty Theory

This theory was postulated by two psychologists, Ernest Crawley and Estelle Young. The authors stated that modesty is a proper way of wearing clothes. The exposure of almost every part of human anatomy has been considered immoral. The collapse of the Graeco-Roman civilization brought about western dominated culture with Christian doctrines which conceived the body as a source of man's temptation. The church inculcated strong feelings of guilt and shame in connection with body nudity. According to the proponents of this theory, conflict over the question of decency in the modern world arises when standards are established independently by different cultural or sub-cultural groups. Adolescents and children have to be encouraged to practice the good morals of decent dressing so that they will not deviate from it in future, (Roscho, 1993).

2.1.2 Aesthetic Theory

This theory states that clothings are worn for beauty sake. Schramm (2000), noted that the present day trend toward interchangeability of parts of the wardrobe to effect greater variety in the clothing originated in the nineteenth century. It was about 1900 that bodice of

skirt were joined at the waist line to a one-piece dress. The chief contribution of the twentieth century is the idea of the basic wardrobe and the basic clothes.

On the other hand, Roschco, (1993) stated that the present generation has concept of good taste and of art different from the olden days. Most young fashion leaders of today have an education based on the principles of art. The modern dress design has a philosophy of art, fashion and history, plus imagination. Art is no longer only the ability to paint a picture, the focus is also on developing the ability to choose and assemble garments, accessories and home furnishings, displaying both creativity and appreciation. Intellectual and manipulative skills developed by practice can enhance one's imaginative abilities, which can be seen in one's choice of beauty and taste.

2.1.3 Theory of Cognitive Dissonance

Festinger's theory of cognitive dissonance centers around the idea that a person will do a variety of things to achieve consistency in the psychological world. If two pieces of information do not "fit together", the individual will make certain alterations in the information which Festinger calls "dissonance-reducing changes." The person who restore consistency by (1) changing his opinion, (2) changing his behaviour, (3) changing the information he has, or (4) distorting his perception. In most cases, he will resort to mechanisms that will not require him to change his original opinion or decision. This theory is applicable to the ways we express ourselves in clothing wears, (paul,2007).

2.2 Conceptual Framework

2.2.1 Research and Development Cycle

A widely used model of educational research and development is the systems approach model designed by Dick, Carey and Carey (2005). It consists of ten steps in a cycle.

It starts with identifying instructional goals and goes through conduct of instructional analyses, analysis of learners and contexts, development of assessment instruments, instructional strategies and materials and stretches into design and conduct of formative and summative evaluation. Such a model is better suited for instructional design and instructional evaluation.

There is also another model of R & D known as the New Product Development (NPD) formalised by Stone (1999). The NPD process consists of two parallel paths: one involves the idea generation, product design and detail engineering while the other involves market research and market analysis. The present study involved use of technical and vocational skills to develop patterns for clothing construction. Indeed, the R & D cycle of Gall et al (2007) was adapted in the design of prototype garments for adolescents figure. The steps in the cycle of R & D in this research are as follows:

Step I: Identification of goals for the product which included needs assessment or generation of ideas to govern pattern development.

Step 2: Identification of specific skills, procedures, and learning tasks involved in reaching the goals.

Step 3: Identification of learners' entry skills, attitudes and characteristics of the instructional and environmental settings for the new knowledge and skills.

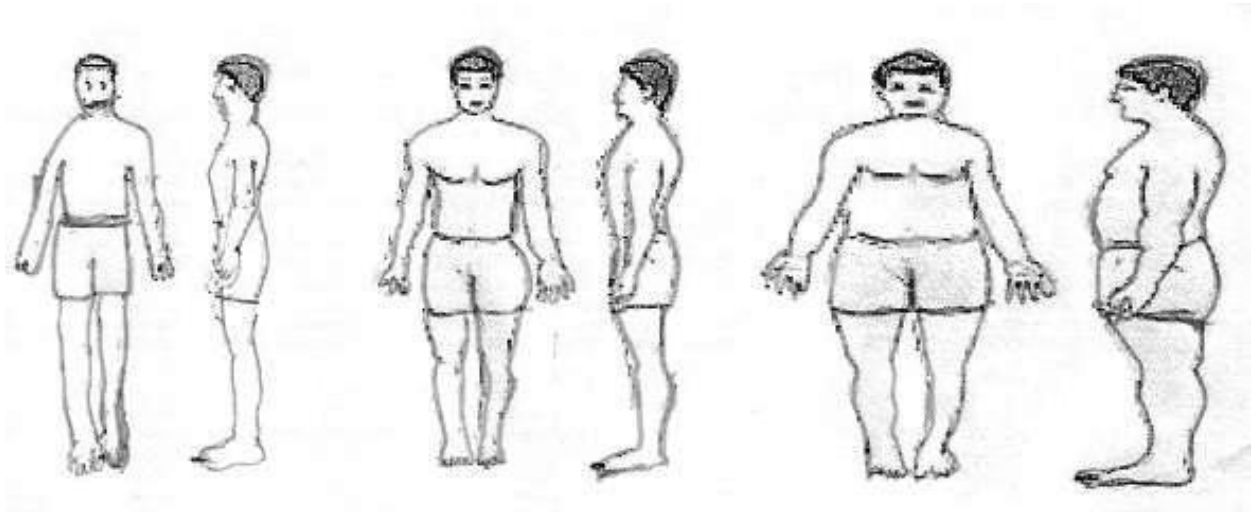
Step 4: Translating the needs and goals into specific performance objectives that provide a basis for planning assessment instruments, instructional strategies and instructional materials.

Step 5: Assessment instruments developed in relation to the performance objectives,

Step 6: Instructional strategy developed for assisting learners achieve the performance objectives.

Step 7: Development of instructional materials which might include print materials such as textbooks and teacher training manuals.

The present study involved investigative activities aimed at the development of a new product which would improve the fashion desires of male adolescents. In terms of somatotype, Kennard (2006) states that the shape of every adolescent's body will fall into any of three categories: ectomorph, mesomorph and endomorph. Hence, there should be at least three basic sizes of adolescent's garment of small, medium and large to correspond with ectomorph, mesomorph and endomorph respectively as shown in the figure below.



a. Ectomorph b. Mesomorph c. Endomorph

Figure 2: Three size categories of small, medium and large adolescents
Source: Kennard (2006) – http://menshealth.about.com/cs/gayhealth/a/body_shape.htm

A person with an ectomorph frame does not have enough fat or muscle and has a tough time building muscle or gaining weight. Someone with an endomorph body type is considered to be carrying around too much fat and tends to have trouble losing weight. A

mesomorph is perhaps the ideal body type with a well-formed body. Whatever body proportion an individual has, Billett (2010) insists that one should dress for one's body type.

2.2.2 Body Characteristics of Adolescents

According to Cameron, (2000), the rapid growth and changing shape of the child from birth to age one means that close increments in size of their clothes have to be made. This should be done usually in three-month intervals. It is at this stage that weigh and the age of the child are the predominant description for garment selection. Hence height becomes the critical sizing division once a child begins to walk.

Adolescence is a period of growing up or growing towards adulthood. It is a transitional stage from childhood to adulthood and covers nearly a decade with no clearly defined beginning and end. During this Period, there may be a lot of body variations. Body variations are the changes in size of the different parts of the body. Although each child is unique, certain characteristics and behaviours are typical of children of the same ages. This period is divided into two, early adolescence, which is from 12-14 years and late adolescence, from 15-17 years. Most early adolescents grow and change with amazing speed. In this period a child undergoes several developmental changes such as mental, biological, social, psychological and physical changes. Among the most noticed physical changes in adolescenct boys are increase in height, weight and sexual maturation. The commencement of rapid growth in adolescents is not very certain.

The first thing to realize about adolescent development in boys is that the average boy begins two years later than the average girl. That is, he may start at twelve years in contrast to ten years. The earlier developers among boys begin as early as ten years while slow developers start at fourteen years of age and there are a few who wait longer. Physically they

become taller and heavier, their appetites increase and their faces and bodies become matured. Secondary sexual characteristics appear. Many early adolescents become concerned or even embarrassed about their changing bodies and bodily functions (Kureave, 2006).

During adolescence, the leg length grows faster than trunk length but during the period of peak growth, the trunk grows faster than the limbs. The rate of growth of the shoulders is at a maximum and the rate of growth of the head accelerates slightly. Pubic hairs begin to grow. Later comes the hair in the armpits and on the face. The voice cracks and deepens (Michigan State University 1999). Size, physic and athletic ability count a lot at this age. The texture of the skin changes. The pores enlarge and secret more oil and sweat. The child starts to develop an adult figure. At this time also, adolescents believe that others are as interested in them as they are in themselves. They develop a sense of personal uniqueness and invulnerability. The adolescents doubt themselves and feel insecure, moody and very emotional and have frequent eruptions of anger. Adolescents are also argumentative, defensive, careless and loud. They neither listen to other peoples' point of view nor admit their own fault. Since the increasing length of adolescence period brings about more changes that are difficult to define and since adolescents are self-conscious and worry about any defect on their appearance, good clothing is particularly needed by adolescents to camouflage their bad points and enhance the good ones (Kureave, 2006).

Manufacturers have decided to accept a 6cm height interval as a base for a coding scheme for children. This is an approximation of the average growth per year over a period. However, it must be noted that the range of heights in children in any particular age group is longer than the amount of growth that occur in any one year, therefore, a child’s age is only a very crude guide or ‘designation’ of his sleeve header expected stature. It is better to link

other body measurements to height than age. One must recognize that age on clothing labels is only a secondary descriptive value as variations in height linked to heredity are further distorted by the variability of the onset of puberty and growth spurt (Marshall 2008).

The most apparent characteristics of a small child's shape is the size of the head: by the age of three years, the child's head has almost completed its growth. A small child has a head one fifth of its height while the adult's head is only one eight of its height. The size of the head of a child must be taken into account when designing openings on bodice for the head to pass through it. From the age of two, the average child loses fat until about the age of eight years. This slimming down process is very apparent and it is generally spoken of in terms of the child 'losing baby fat' (Marshall 2008).

Boys are often a little thinner than girls at this age group, but as differences in measurements are small, a common size chart can be used. The most significant difference occurs on the hip/seat measurement and some garment makers of boys wear take account of this when making them, (Cameron 2000).

Adolescent is a young person who is developing from child into adult. This stage is known as puberty, (Cameron, 2000). The stage at which the child grows decreases steadily from birth onwards until puberty when the rate of growth accelerates. This acceleration is called adolescent spurt or growth spurt. Until the growth spurt occurs, there appears to be little difference between boys and girls in the speed at which they grows, (Aldrich, 2006), She commented that in early childhood, there is little difference between the sexes. Significant difference begin to appear at about seven years which means by this age, it is necessary to offer a size chart for each sex. Puberty brings dramatic difference between boys and girls, (Aldrich, 2006).

According to British Standard Institution, (1997), girls begin to grow quickly at about age of eleven or twelve, however their growth is shorter in duration than that of boys and proceed at a slower rate. It was further documented that because girls enter puberty earlier, eleven to thirteen-year old girl are taller than boys of the same age. The bust development of a girl is the dramatic change in her shape as stated by (Beazley, l990). In his findings, he noted that the early stages of development result in little bust prominence and it is only when the bust begins to develop a structural shape that a girl will require to have blocks which have bust darts.

The average boy starts his growth spurt at about the age of thirteen and grows rapidly until the age of fifteen, then more slowly until he is seventeen. Because of the variation in growth spurts, height and age has little correlation at this time. Age was said to have little relevance on size at this stage. Boys often become thinner during this growth spurt but begin to gain muscle. Boys have two more years to grow behind the girls and therefore attain a greater final height as observed by (Aldrich, 2006).

2.2.3 Garment Development in Nigeria

Before the development of modern garments in Nigeria, the people usesd leaves and animal skins to cover their private parts and protect the body from harsh weather. The people harnessed the leaves functionally around their waist. The leaves covers the front private part and behind. The men used strings to hold the leaves around their waist while the females used beads (Ahuwan 1996).The author noted that the women also used animal skin to carry babies on their back. It was stressed that later on, men used some kind of cloth to cover their private parts both front and back. The women used single wrap of cloth round their waist. It was also documented that the making Buba and Babanriga are typical idea of the fusion

between Nigerian traditional garment and foreign influences. The wrapper took a natural step further from the animal skin used by women for wrapping babies on their backs. At this time, Iro(wrap round cloth),was originally used by both male and female. Males tied the end of the cloth across the left shoulder while the females tied it around their waist with heavy layers of beads 0n their necks. After Iro, a little blouse known as Buba was added, then came the Kaftan, which is the lengthening of Buba to a knee length. Kaftan and Buba evolved as a result of adaptations from European garments (Ahuwan 1996).

The foreign influence through advent of Christianity and Islam played a significant role in the transformation of Nigerian garment. These two religions came with the sole objective of transforming the society into educated and civilized citizenry while at the same time spreading their religion. This brought the introduction of woven clothes from cotton which gradually replaced the animal skin and leaves (Ogunduyile 2008).

2.2.4 Development of Clothes by Foreign Countries.

Long before spinning and weaving came into being, primitive man discovered the adaptation of a covering for legs and a Jacket for body by scraping hides with flint knives to remove the hair and by cutting out sections for garments with the same knives. After chewing the hides to soften them, thongs or narrow strips of hide was used to hold the garment pieces together. These garments were more comfortable and more functional than animal skins. The softened hides become stiff when expose to the rain. Men continue to search for the method to keep hides soft and preserve them. It was probably during the Mesolithic period(about 8000 B.C) that man discovered how to make hides pliable by robbing with fat or marrow from bones, (Flugel 2000).

Mesolithic man also learned that dung and urine preserved the hides indefinitely. True tanning with vegetable substances containing tannic acid develop later among civilizations of Aisa and Europe,(Flugel 2000).

Felting technique was developed by Asia Mongols. The hair were criss-crossed on woven grass mats. Fibres are moistened, roll up and pounded in a mat form until the fibres become felted. Except for hides, felt was the first suitable material for garments.

In the south pacific, where clothing was used more for decoration than protection, the Polynesians discovered that the fig and paper mulberry trees produced a spongy fiber which, when pounded, provided cloth. Nonwoven cloth was made by stripping off the bark of the tree in thin layers, placing, three layers together at right angles over a smooth rock and then pounding the substance with stones,(Adamson, 2004).

Man has used crude flint knives, crude needles and coloured yarns to fashion and decorate his clothing since very early times. Archeologistics have uncovered eyed needles made of mammoth Ivory and Walrus Tusks, crude buttons and toggles, and dozens of coloured dyes stored in hollow bones, dating from the later part of the old stone age (Magdalenian age, about 1400-8000BC.),Rouge, combs, hair ornaments and cosmetic boxes date from the earliest civilization along the rivers of Asia, Egypt, China and India,(Havold, Pomeroy, 1992).

2.2.5 Evolution of Simple Garment Forms

Adamson (2004), noted that Sumerians, whose civilization somewhat paralleled the old kingdom of Egypt, were the earliest inhabitants of Mesopotamia. The Egyptians of the old kingdom, during which period, the pyramids were built. The people lived a peaceful life along the Nile. Natural protection was afforded by the sea and mountains and the threat of

invasion was not evident. The simple tunic and loin-cloth were the principal garments; ventilated wigs were worn to protect the wearer from intense heat of the sun. The wearing of wide jeweled collars, armlets, bracelets and anklets dates from the old kingdom and indicates that personal adornment was emphasized at this early stage of development. Draped rectangle cloth was in use to resemble anoff-shoulder chemise. The right arm was free and the left arm could be used to pick up the open end and wrap it around the body. Egyptian dress had reached its zenith of complexity by the time the youthful king, Tutankhamen and his queen, daughter of Nefertiti, inherited the throne. This period in Egyptian history is sometimes referred to as Egypt's rococo period,(James 2004).

2.2.6 Origin of Modern Garment Terms

Many of the names for fabrics and garments popular today originated centuries ago in various parts of the world. In India, has come calico, a name for the sea-port of calicut where it was first made. Madras was named after the city of madras. Cotton was called "Quten" by the Arabs who first saw the fuzzy plant in India. Cashmere takes its name of the state of Kashmir, where the long silky hair of the Kashmir goat has been used to produce fine woolen shawls. Chintz, a printed cotton fabric which often has glazed surface, is derived from the Hindi word "Chint", Meaning "Colour" Nainsook, a lightweight muslin comes from the Hindi terms "Nanisukh", which means a "delight to the eye". Jodhpurs, named for the city of Jodhpur, originally referred to the close-filing clothes worn by the wealthy Maharajas of Rajput. The word dungareesstems from the Hindi word "Dungri" the coarse fabric used by the poorer classes of India. The Hindi language has given the word Khaki, meaning dust-coloured, (Flugel, 2000).

A fine silk, crepe means "silk of China". Gingham is said to have stemmed from the Mallay word "Gingan", meaning "Striped". The Near East has its own terms as afqhan, named after Afghanistan where it was first made, damask, named for the city of Damascus and Muslin derived from Mosul, the Mesopotamian city where the cotton industry flourished. Persia also contributed to fabric and garment vocabulary, percale, from Pargalah, meaning, a fine printed Muslin, Taffeta, from "Taftah" a woven silk fabric; Sea-sucker, from "Shir-o-Shakar", meaning "milk and sugar" and Pajamas from "Paejamah", a leg garment,(Jenny, 2006).

Many fabric and garment terms originate from Europe. Gabardine is from the Spanish word "Gabadina", a coarse frock. Jersey is named for the Island off English coast where it was first produced. Cardigan is named for the Earl of Cardigan who wore the knitted coat-like sweater. Paisley comes from the city of the same name in Scotland where a soft, colourful woolen cloth was first woven in imitation of the cashmereshawls. Corduroy is said to have originated as "corded u roi", a luxurious silk pile fabric reserved for royalty. Voile, meaning veil, originated during the gothic period when fine veils were worn,(Jenny, 2006).

2.2.7 Origin of Fitted Garments

The fitted garments of the late middle ages marked a definite departure from the earlier forms of dress. This marked the first time in history when men and women became definitely identified by their dress. A number of factor influenced medieval dress. The designing of hair nets for the head-tie and body fitted armour of the knight is believed to have led to the development of the fitted garment, (James 2004). According to Jenny (2006), embroidery work advanced in Europe during this period. Ladies embellished emblems on the garments of their knights and nuns in convents created designs for the elaborate vestment of

the clergy. The production of fine steel needless in Asia made the beautiful embroidery stitches possible. The first steel needles to be produced in Europe were made in Germany (about 1370). During the middle Ages, each decorative motif on garment had a secret meaning and the symbolism in garment developed into its highest degree. White became symbolic of purity, red is of the blood shedby Jesus and black symbolized death. Ann of Britany, wife of Louis XII, (1498-1515) of France, was the first bride to be married in white, breaking the tradition of red as the colour of the bridal garment. The bridal veil dates from the Asiatic custom of veiling the face of the bride until after the wedding ceremony to indicate her humble status. The wedding ring originated when Pope Innocent III ruled that a ceremonial band must be presented before the wedding ceremony could be performed,(Jenny, 2006).Tradition and symbolism prevail today in marriage customs. The wearing of white as a symbol of virginity (white is never worn for the second wedding) and a veil as a symbol of submissiveness. Furthermore, to assure happiness and good fortune, a bride may wear something old, something new, something borrowed. In 1790, Thomas saint, an Englishman discovered the first sewing machine. In 1830, a Frenchman, Thimonier, made a sewing machine which was used for making soldier's uniforms. However a mob of angry workmen wrecked Thimonier's machines because the machine put many people out of work,(Adamson, 2004).

The development of military uniforms and the invention of paper garment pattern in the nineteenth century marked the production method of clothing. Ready-made clothes were used in Paris about 17^{th} century, but the highest development in quantity and variety of output was reached by the Americans. This was the time concerted efforts were made at

developing a standard sizing systems for mass production of garments. This was because of high demand for clothing (Ralph and Harry, 2010).

2.3. Drafting of Basic Block Patterns

The three major methods of garment construction include, draping, drafting and flat pattern making. It is a method of obtaining patterns by working from the measurements of the figure according to a set of instructions and drawing a shape on paper or card. The alternative is to work directly on a dress stand, either using a cheap fabric such as calico or muslin which is then used as a pattern to cut the fabric, or using the fabric itself. This system is known as 'modeling' and although it is the only suitable method for draped styles (as it enables the exact position and amount of fullness to be controlled), it would be very expensive and time-consuming to make every pattern by modeling (Ahuwan 1996).

According to Igbo (2003),there are two stages in pattern drafting: the making of a set of five basic patterns known as 'block patterns' or 'blocks', and secondly the adaptation of the blocks to the style required. The five blocks are-front and back bodice, sleeve, front and back skirt. The advantage of cutting from blocks is that the blocks provide a permanent record of the correct fit while dart movements, additional seams, fullness, etc., are planned on them. Cutting from blocks has the added advantage of being quicker than any other system. The method of using the same set of blocks to adapt to any style shows that all styles, no matter how different they may appear, must be related since they are all developed from the same basic shape and will thus fit the same figure.

It therefore follows that unless the fit of the blocks is perfect, no pattern cut from them will fit well, and it is worth spending time on making up your set of blocks in calico to check the fit. Any adjustments needed must first be made in the fabric and then transferred to

the blocks. From then on, the cutter may have complete confidence in adapting the revised blocks to any style, knowing that any pattern developed from the blocks will have the same good fit, (Laska, 2009).

Having checked the fit of the blocks, it is advisable to make a set of blocks in cardboard as they may then be outlined quickly and will be better able to stand up to frequent use. Plastic coated card is preferable as it does not wear at the edges. Blocks are always made without seam allowances as they are then very much easier to adapt and the seam allowances may be added to the final pattern, if required. All the patterns shown in the diagrams are without seam allowances for the sake of simplicity,(Gale 1998).

According to Gale (1998), the back bodice block has two darts-one at the waist and one at the shoulder (to provide room for the shoulder blades). The front bodice block has only one dart, at the waist. Many blocks have a shoulder dart instead, or a shoulder and a waist dart, but the single waist dart most clearly illustrates the reason why a dart is needed in the front bodice, i.e. because the dart is formed of the difference between the bust and waist measurement s. This difference is known as the 'waist suppression'. It also clearly shows that the greater the difference, the wider the dart needs to be, (Keith, 2001).

It was documented that the waist suppression must be distributed around the figure to avoid creasing caused by over-shaping in one area and a loose fit in another area. The side seam can only take a small amount of suppression before it begins to crease but a further amount may be taken at the back, below the shoulder blades, thus the back block has a dart in that position. However it is obvious that, for the female figure, most of the suppression needs to be at the front, hence the large dart in the front bodice block.

The reason underlying the shape of the bodice blocks can further be demonstrated by making a plain bodice by modeling fabric directly on a dress stand. It will be found that the fabric cannot be fitted over the front of the stand without fullness appearing somewhere around the edge of the fabric. If it is first pinned along the center front and over the shoulder area, and then smoothed along the under arm seam, the fullness will be concentrated at the waist and will fall under the bust point. This is the position in which it is shown on the block. Pinning a piece of fabric over the back of the stand will produce similar results, with the fullness concentrated beneath the shoulder blades. This shows that the results produced by an accurate system of pattern drafting are identical to those produced by modeling (Sharon 1997).

The sleeve block is completely straight at the sides and this shape was chosen because it is much easier to adapt than a block which tapers at the sides.

The skirt blocks are very slightly flared at the sides, but this is the minimum recommended hem width since a skirt which is completely straight at the sides will appear to taper inwards (Iloeje 1995).

According to Jenny (2006),blocks are not intended to be used as patterns, i.e. for cutting out fabric, without being adapted and are not suitable for use without adaptation for several reasons. For instance, the front dart on the bodice block extends to the bust point (to ensure that a dart drawn in any position will always point towards the bust point) but the bust darts on a pattern must always be shortened l"-2" (2.5cm-5.0cm). Also the dart in the front bodice block is very wide since it contains most of the waist suppression, but it would not be practical to make a dress with such a large dart as it would badly distort the grain of the fabric. Two smaller darts give a much better fit when a tightly fitted bodice is required.

2.4. Clothing Construction from Adapted Patterns

Bodice Blocks

Draw a rectangle measuring half of bust measurement plus 1" (2.5cm), by back waist measurement .The left hand edge will be the centre back line and the right hand edge the centre front line. The lower line will be referred to as the waist line for the moment, although the true waist line will be curved. Letter the rectangle A-B-C-D as shown. From A measure down half of back waist length plus 1" (2.5cm) and mark point E. Square across and mark point I7 on the centre front line. (In sizes 16 and 18 add 1'4" (3.1cm) instead of 1" (2.5cm), and in size 20 and larger add 1½" (3.8cm).) Calculate one-quarter of the back waist length and draw a line this distance below the top line(G-H). This is the back width and front width line. Draw a vertical line mid-way between the center back and the center front, then draw a line parallel to this and ½" (13mm) towards the center back (J-K). The first line represents the true side of the figure; the second is the side seam line, (Anikweze 2003).

Back

Neckline

Measure one-sixth of back width measurement along the top line from A. Square up ½" (13mm) and mark the neck point (L). (In sizes 16 and 18, square up $\frac{5}{8}$ " (16mm) and in size 20 and larger square up $\frac{3}{4}$" (19mm).) Curve the neckline from L to A as shown (page 38). Shoulder-Measure half of the back width measurement plus $\frac{1}{4}$" (6mm) along the back width line from G and mark point M. Square up half of A-G plus $\frac{1}{4}$" (6mm) from M and mark point N, Extend the line N-M approx. 2" (5.0cm) below M as a guide for drawing the arm hole curve.

Join L-N for the shoulder line, extending it 1" (2.5cm)'beyond N. Add 1" (2.5cm). to the shoulder measurement of the figure and measure this amount from L to mark the shoulder point (P). (The 1" (2.5cm) is made up by $\frac{1}{4}$" (6mm) ease and $\frac{3}{4}$" (19mm) allowance for the shoulder dart.)

The shoulder point (P) must always be at least $\frac{1}{4}$" (6mm) beyond N to give a slight curve to the top of the armhole, but figures vary so much in their proportion of shoulder width to back width that this may not always occur; if necessary make the dart wider, although not wider than 1" (2.5cm).If this is still insufficient, make two darts and transfer one to the neckline (sec page 43), although if the measurement vary a great deal from average it would be advisable to re-measure the figure ,(Sharon, 1997).

Shoulder dart

Mark point Q mid-way between L and P and join it to the centre point of the back width line (G-M). Make the dart 3" (7.6cm) long and $\frac{3}{4}$" (19mm) wide by measuring from Q towards the centre back. Raise point Q ½" (13mm) and join to P. Make the other side of the dart the same length and join to L. (Raising point Q ½" (13mm) ensures that the shoulder seam will be a straight line after the dart has been sewn, (James 2004).

Draw the arm- hole curve P-M-J, although the curve may only be provisional until the front block has been drafted. Then the entire curve may be drawn, thus ensuring that the back and front arm-hole curves will join smoothly.

Side seam

Measure $\frac{3}{4}$" (19mm) from K towards the centre back line and mark point R. Join R-J with a slightly curved line (to avoid reducing the width of the block at bust level.) Extend, the line slightly below the waist line.

Waist line

Measure ½" (13mm) down from R and curve to B for the true waist line.

Waist dart

From B, measure half of G-M along the waist line and square up to the under arm line. Measure½"(13mm) each side of this line to form the dart, as shown.

(The measurement of the waist line of the block, less the dart, should equal one-quarter of the waist measurement of the figure. If necessary, adjust the width of the dart.), (Jenny 2006).

Front Neckline

The width of the front neckline is the same as that of the back neckline-one-sixth of the back width measurement measured along the top line from D (point S). Measure the same amount plus ½" (13mm) down from D and mark point T. Curve the neckline provisionally S-T as shown.

Shoulder

Draw a short construction line 1½" (3.8cm) below the top line, as shown. Measure the' shoulder measurement of the figure from S onto this line and mark the shoulder point (U). Join S-U for the shoulder line. Also drawn the centralized shoulder line as a guide: measure 3/4" (19mm) below U and ½" (13mm) below S and join with a broken line.

Armhole

Measure half of the front width, measurement of the figure along the front width line from H and mark point V. Curve the arm hoe U-V-J ensuring that it joins smoothly to the back arm hoe curve. (Note that the lowest point of the arm hoe curve is on the broken line, not the side seam, since that is the true side of the figure.)

Side seam

Extend the line J-K ½" (13mm) below K and mark point W.

Waist line

Measure the front waist length of the figure down from T along the cf and mark point X. Curve from W to X for the true waist line,

Bust point and bust line

Draw the dart line parallel to the center front and approx. 4" (10.2cm) from it (half the distance between the bust points.) Extend the line from the waist line (point Y) up to the under arm line. From Y, measure the bust point length of the figure along the dart line and mark the bust point (point Z). Draw the bust line on front and back blocks passing through the bust point and parallel to the under arm line (Anikweze 2003).

Waist dart

The waist line of the front block, less the dart, should equal one-quarter of the waist measurement of the figure, plus 1/2" (13mm). Calculate this amount and subtract it from the line W-X. The remainder forms the dart. Measure half the width of the dart each side of Y and join to Z. As with the shoulder dart, one side of the waist dart will be shorter than the

other. Extend the shorter side to match the longer and re-draw the waist line curve, (Susan and Janice 1998).

Cutting out the blocks

Cut all straight lines first-shoulder, side seams, center back and center front. Place shoulder seams together to check that the neck and arm- hole curves are continuous and place side seams together to check that arm-hole and waist ; curves are continuous. Correct if necessary before cutting along the curves. Make balance marks on the shoulder seam by matching first the neckline curves, then the arm-hole curves to make a balance mark each side of the dart, (Gale1998)

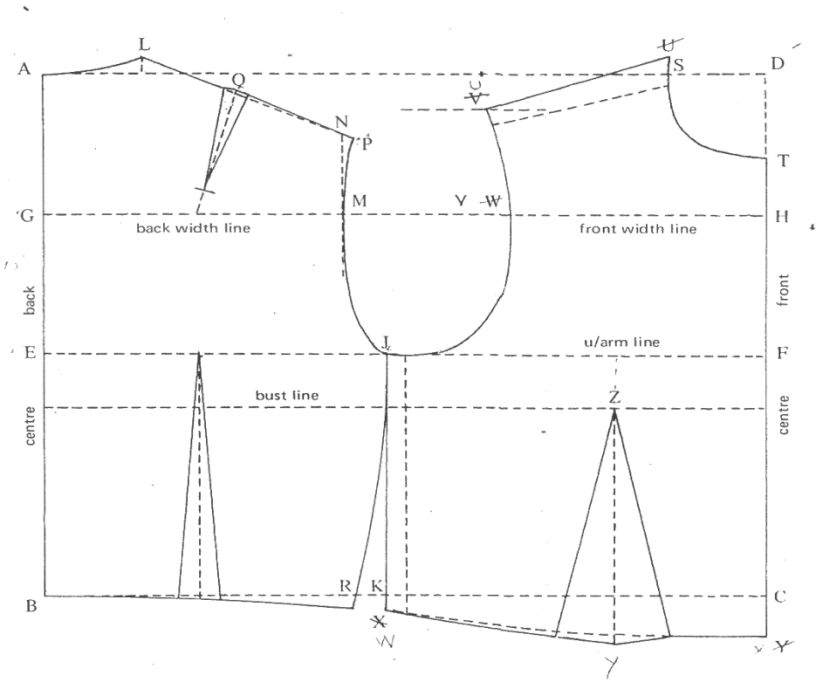


Figure 3: Pattern for bodice front and back.

Source: Campbell (2001), Designing Patterns.

2.4.1. Drafting the Blocks

All bust, waist and hip measurements referred to are 'net', i.e. without ease. All horizontal construction lines must be parallel to each other and at right angles to all vertical lines.

Bodice and skirt blocks are always drafted with the center back on the left hand side and the center front on the right hand side, and similarly the sleeve is drafted with the back on the left hand side of the centre line and the front on the right hand side. The complete set of blocks therefore fits the right hand side of the figure. The only reason is that the majority of blocks are set out in this way and it is therefore easier to understand other blocks and to compare them. All commercial patterns are arranged in this way as are most pattern cutting books, although the blocks in some American books may be reversed, (James 2004).

Igbo, (2003), noted that all the curves which are drawn during the drafting of the blocks should be regarded as provisional and must be corrected after the blocks have been completed by placing corresponding edges together and checking that the curves are smooth and continuous across the seams. For instance, on the bodice blocks, place the shoulder seams together to check the curves of neckline and arm hoe, place the side seams together to check the curves of arm hoe and waist. On the skirt blocks place the side seams together, first at the. waist to check the curve of the waistline, then at the hem to check the hemline curve. Place the sleeve seams together to check the curves of sleeve head and wrist.

Since the blocks represent only half of the front or back, all lines which join to the center front or center back must join at right angles to ensure that the line is continuous when the complete section is opened out. Figure 2 shows a badly shaped neckline resulting in a point at the center front. The broken line shows the correct shape. The armhole has also been

badly shaped resulting in a point at the shoulder instead of a continuous curve. The broken line shows the correct line,(Gale 1998).

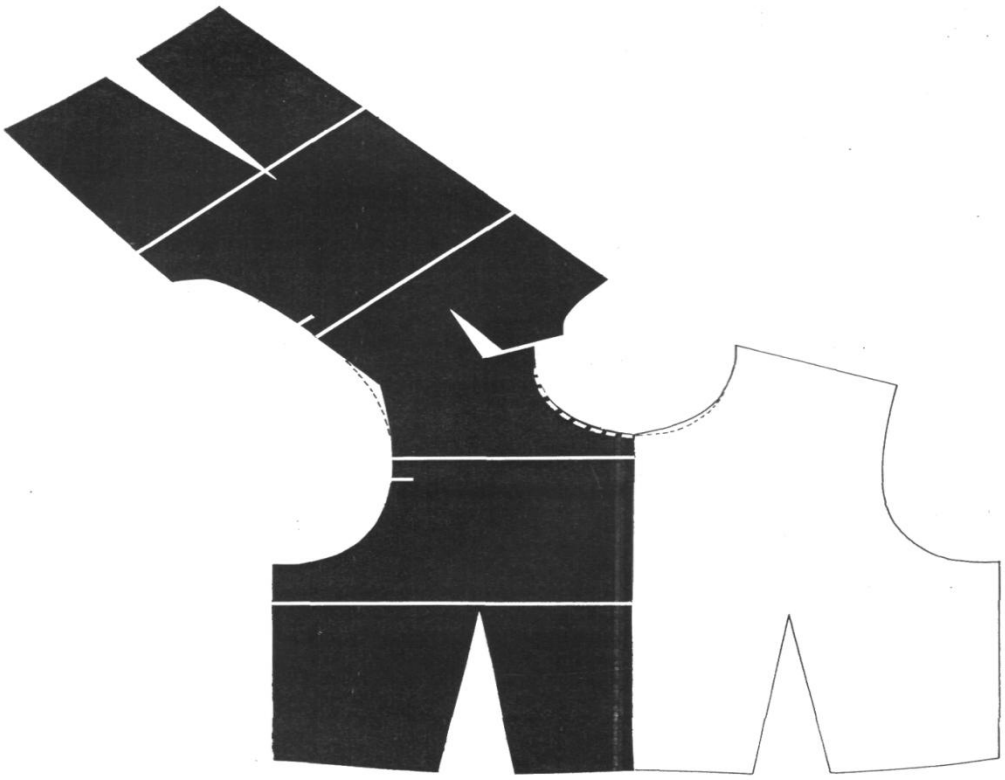


Figure 4: Matching of armhole and neckline.

Source: Henry (1994). Basic Tailoring.

According to Susan and Janice (1998),before drafting blocks to your own measurements, practice drafting them in stock sizes so that the shape and proportions may be compared with the diagrams. This provides a valuable lesson in the appreciation of line and proportion, which is so important in good pattern cutting. Also practice drawing smoothly curved lines as it is vital that the curved lines on a pattern are drawn smoothly with gradual, never abrupt, changes of direction, and that curves are joined very smoothly into straight

lines. Patterns may be drafted using tailor's chalk instead of pencil and many people find it easier to draw a good line with the edge of a piece of chalk. There is no need to try to memorize the draft of the blocks as it will be memorized naturally with practice.

2.4.2. Taking Measurements

It is essential that measurements are taken accurately; that is, in the correct positions and with an equal amount of tension on the tape, as inaccurate measurements will cause an unnecessary amount of fitting and re-cutting after the garment is tacked together. There arc two reasons for taking measurements to ascertain the size of the figure, and to determine the proportions of the various parts of the figure. Skill in taking measurement accurately will be attained with practice and it may be found helpful to practice on a dress stand to gain confidence in correct positioning of the tape,(Igbo2003).

Make a general observation of the shape of the figure before taking measurements and note any variations from normal, such as unusually sloping or square shoulders, and note the posture of the figure, whether normal, erect or stooping. Study the side view in addition to the front and back views as this gives a better indication of the posture and proportion, (Iloeje1995).

Akubue,(2004) pointed out that before beginning to take measurement, tie a piece of tape around the waist of the figure to define the exact location of the waist, so that accurate measurement may be taken to and from the tape. (This is very important as it is otherwise difficult to assess the position of the waist accurately, especially at the back.)

Measurements may be taken over a dress if it is close fitting, or over underclothes. Always take measurements in the same order each time to avoid omitting any, and do not allow ease when measuring as this is allowed later when drafting the pattern,(Gale 1998).

Dress

1. **Bust**

According to James, (2004), this measurement is usually taken first as it gives an indication of the other measurements to expect if the figure is in proportion. The tape should be slightly raised at the back to cover the shoulder blades. This is important as, if the tape is allowed to slip down, the measurement may be too small by 1" or 2" (2.5cm to 5.0cm).

2. **High Bust**

If the bust of the figure is prominent in relation to the remainder of the figure, it is advisable to take a high bust measurement above the usual bust measurement just under the arms. This measurement should be checked against the measurement of the bodice blocks along the under arm lines.

3. **Waist**

Always take this measurement even if it is not absolutely necessary, (as in the case of loose fitting clothes) as it gives an indication of the proportions of the figure. Measure closely but not tightly.

4. **Hip**

This measurement is taken over the widest part of the hips which may be anywhere between 7" and 11" (17.8cm-27.9cm) below the waist, but is usually 8"-9" (20.3cm-22.9cm) below. Always stand at the side of the figure when taking the hip measurement as the correct level for the tape can then be clearly seen. Most people tend to take this measurement too high. When the hip measurement is found to be large in relation to the bust and waist, note the position of the excess-whether at the back (large seat) or at the side (prominent hips),(Sharon 1997).

5. **Hip Depth**

The distance between the waist and the level at which the hip is measured is known as the hip depth and, as already stated, is usually 8"-9" (20.3cm-22.9cm). Still holding the hip measurement tape in position, use the other end of the tape to measure from the waist to the tape measure at hip level.

6. **Upper Hip**

If the figure is large or if the proportions of hips and waist differ considerably from normal, take the upper hip measurement approx. 4" (10.2cm) below the waist. This is also helpful when drawing the curve of the side seam of a skirt between hips and waist. The upper hip line should then be drawn on the skirt block and the measurement checked.

7. **Back Waist Length**

Measured from the small prominent bone at the back of the neck to the tape at the waist. When measuring for a one-piece dress, jacket or coat (i.e. one without a seam at the waist) also take the total length measurement at this stage.

8. **Front Waist Length**

Measured from the base of the neck at the centre front to the tape at the waist. The back waist length should be approximately 1½ (3.8cm) longer than the front waist length.

9. **Bust Point Length**

This measurement is essential as it determines the angle and position of the bust dart. Figures may vary considerably in this measurement, which is taken from the tape at the waist up to the bust point,(Sharon 1997).

10. **Back Width**

James, (2004), noted that this is measured across the back from armhole to arm-hole, approximately 4" (10.2cm) below the back of the neck. (If the person being measured is not wearing a garment with an armhole seam, the correct position of the seam must be estimated.)

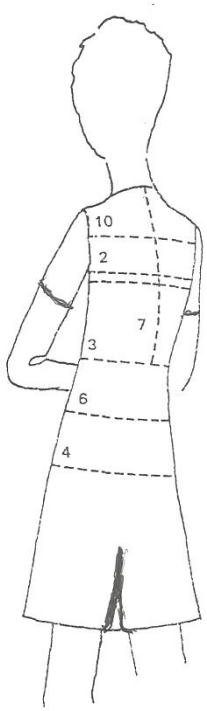


Figure 5: Areas of body measurement (back).

Source: Henry (1994). Basic Tailoring

11. **Front Width**

Measured at the same level as the back width: approximately 1½" (3.8cm) below the base of the neck at the centre front.

(Various other terms are used to Ascribe these two measurement s.)

12. **Shoulders**

Measured from the side of the neck to the end of the shoulder bone,

The shape and position of the armhole seam, which contributes a great deal to the finished appearance of the garment, is dependent on the accuracy of the last three measurements, although some practice is needed to take them accurately.

13. **Top arm girth**

This measurement is taken around the widest part of the arm, approx. 6" (15.2cm) below the shoulder point.

When taking the following 3 measurement, the end of the tape should be held so that it rests on the top of the shoulder bone. Continue to hold the tape in the same position while taking all three.

14. **Depth of sleeve head**

To take this measurement, place a ruler as high as possible under the arm of the person being measured and measure from the shoulder bone to the upper edge of the ruler.

15 **Elbow point length**

Measured from the shoulder bone to the point of the elbow with the arm bent,(Igbo 2003).

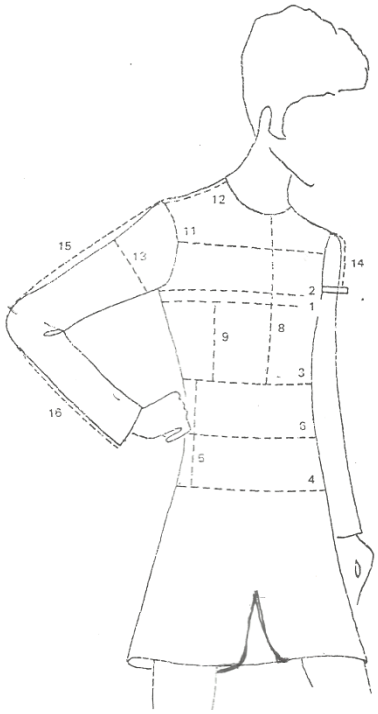


Figure 6: Areas of body measurement(Front).

Source: Henry (1994). Basic Tailoring.

16 **Sleeve Length**

Continue holding the tape measure in the same position as for the above measurement and measure to just below the small bone on the outside of the wrist, with the arm straight.

Skirt

Waist, hip and hip depth measurement s are taken as for a dress.

17. **Front Length**

Measured from the tape at the center front waist to the ground, noting the length of skirt required. Allow the tape to hang naturally-do not stretch it. Deduct the length of

skirt required from the ground length, and that amount is then deducted from the back and side ground lengths to find the skirt lengths at those points,(Igbo 2003).

18. **Back length**

Measured from the tape at the center back waist to the ground.

19. **Side length**

Measured from the tape at the side of the waist, over the prominence of the hip, to the ground.(Should be used as a check measurement if the figure has prominent hips.)

Trousers

Waist, hip and hip depth measurements are taken as for a dress and skirt.

All the following measurements are taken standing at the side of the figure:

20. **Crotch depth**

This measurement is taken with the person sitting on a firm chair or the edge of a table, from the tape at the side of the waist over the hip prominence to the surface of the chair.

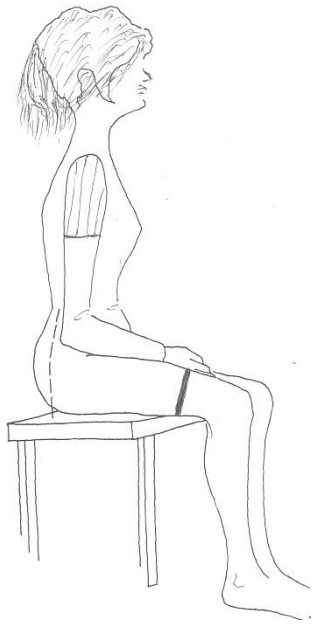


Figure 7: Crotch measurement.

Source: Henry (1994), Basic Tailoring

21 **Outside leg length**

Measured from the tape at the side of the waist to the length required, which is usually just below the ankle bone. Remember to allow for the heel height which will be worn.

22 **Knee level**

Measured from the tape at the side of the waist to the side of the knee. The widths of trousers at knee and ankle bear so little relation to body measurements that there is no need to measure them,(Gale 1998).

Ease

According to James (2004), the amounts of ease shown on the measurement chart are the average amounts used at the moment for a dress in a material of average thickness. A coat or jacket would need approximately twice these amounts. All circumference measurement s must have ease added as a garment made exactly to the measurement s of the figure would be very uncomfortable to wear. The only length measurement s which have ease added are: depth of sleeve head, to allow room for the arm to move, sleeve length, to allow for the elbow to bend, and crotch depth, to allow ease of movement in trousers.

½" (13mm) is added to the back width line, although not to the front width line. This is because arm movements are usually forward and upwards, but rarely back. The 1" (2.5cm) ease allowed at the waist is the usual amount allowed on a skirt or trousers, or for a close-fitting dress with a waist seam. Most dresses without waist seams have considerably more ease than this: 6"-8" (15.2cm-20.3cm) is the usual amount for a loose fitting blouse or dress.

Measurement Charts

Dress Measurement	Body Measure	Ease	Total	Half Total
1. Bust		2"/5.0cm		
2. High bust		2"/5.0cm		
3. Waist		1"/2.5cm (skirt)		
4. Hip		2"/5.0cm		
5. Upper Hip		2"/5.0cm		
6. Hip depth				
7. Back waist length				
8. Front waist length				
9. Bust point				
10. Back width		½"/13mm		
11. Front width				
12. Shoulder				
Sleeve Measurements				
13. Top arm		2"/5.0cm		
14. Depth of sleeve head		½"/13mm		
15. Sleeve length		½"/13mm		
16. Elbow point length				
Skirt Measurements				
17. Front length				
18. back length				
19. Side length				
Trouser Measurement				
20. Crotch depth				
21. Outside length				

Source: Gale 1998, Inside Fashion Design.

Sleeve Block

Construction lines

Draw a rectangle measuring top arm girth plus 2"(5.0cm) by sleeve length.

Divide the rectangle vertically into 4 equal sections (folding the paper to make crease lines is the simplest method).

Name and letter the lines as follows: line AB is the centre line, line CD is the back arm line and line EF is the front arm line. The lower line will be referred to as the wrist line, although the true wrist line will be curved.

Measure the depth of sleeve head plus ½" (13mm) down from A and square across for the underarm line (GH). Measure the elbow point length from -A on to the back arm line and mark the elbow point (J). Square across for the elbow line(KL), (Shailong and Igbo 2009).

Sleeve head

From E, measure down half the distance between top line and underarm line (M).

From C, measure down the same amount less ½" (13mm) (N). The sleeve head is curved between the five points G-N-A-M-H but guide lines are necessary to draw a good curve. Join G-N, N-A, A-M, and M-H. Mark the centre of each line and square out the following amounts: between G and N - ½" (13mm), between N and A - ½" (13mm), between A and M -1" (2.5cm) and between M and H - $\frac{3}{4}$ (19rnm). There are now nine points to guide the curve of the sleeve head. Note that the curves of the front sleeve head are more pronounced than those of the back: the upper curve to allow ease over the shoulder bone and the lower to allow the arm to be moved forward easily,(Aldrich 2006).

Wrist line

Measure down ½" (13mm) from D and up ½"(13mm) up from F. Curve the true wrist line as shown.

Cutting out

Cut out the block along the side seams, then fold the paper along the lines C-D and E-F so that the side seams are together. Check that the curves of sleeve head and wrist are continuous across the seam and correct them if necessary.

Balance points

According to Aldrich (2006), the balance points, which show how the sleeve head joins to the arm- hole, are the points M and N on the sleeve head. After cutting out the bodice and sleeve blocks, place the back sleeve head face downwards against the back arm hoe with curves together and the sleeve seam ½" (13mm) beyond the bodice side seam (i.e. level with the true side of the bodice). Move the sleeve head around the arm hoe, keeping the curves together, until the balance point (N) is reached. Mark the corresponding point on the arm-hole.

Repeat the procedure with the front block, placing the sleeve to the broken line at the side of the bodice block (i.e. to the true side of the bodice) and mark the front balance point. Each balance point should be approx. 1" (2.5cm) below the back width or front width line. It is very important that balance points are marked on the blocks and transferred to all patterns made from the blocks. They must then be transferred to the fabric after cutting, (Sharon 1997).

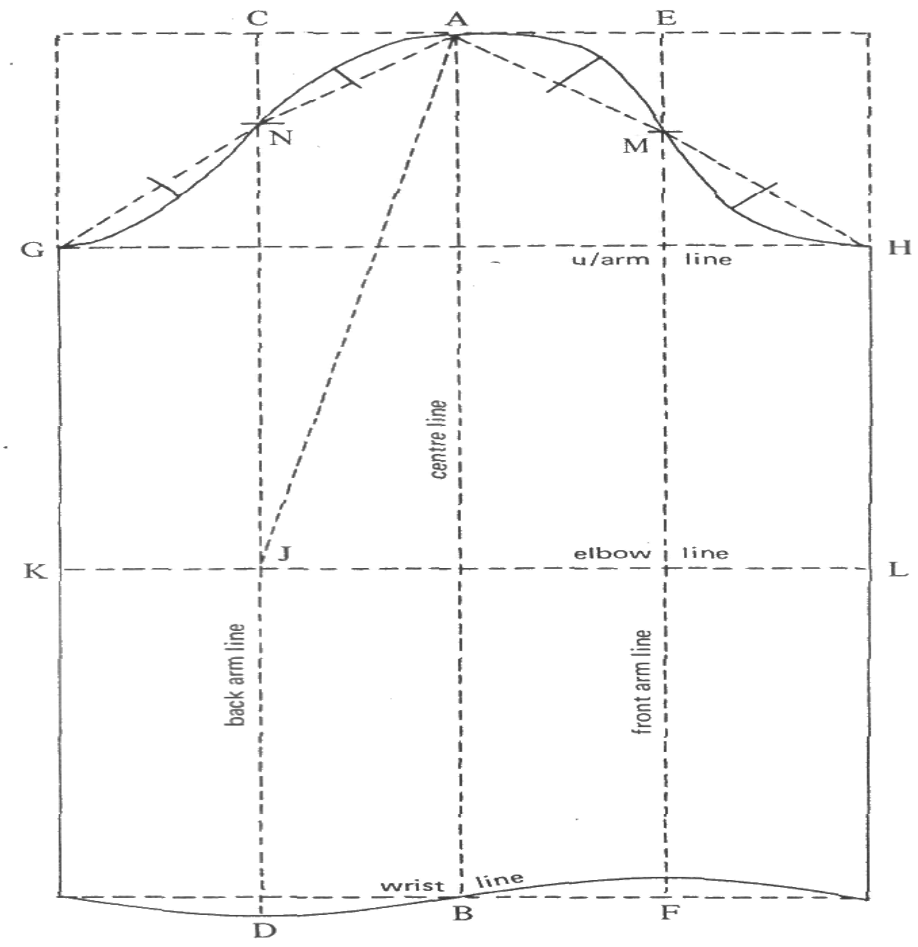


Figure 8: Sleeve pattern.

Source: Campbell (2001). Designing Patterns.

Skirt Blocks

Draw a rectangle measuring half of hip measurement plus 2" (5.0cm), by front skirt length.(As on the bodice blocks, the left hand edge of the rectangle will be the center back and the right hand edge will be the center front.)

Draw the hip line by measuring the hip depth less ½ (13mm) down from the top line and squaring across. Name the hip line.

Back Skirt

Waist line

Measure one-quarter of waist measurement plus 1"(2.5cm) from A along the top line (B). Square up ½" (13mm) from B (C). Curve from A to C for the waist line.

Waist dart

The best position for the waist dart in the back of a skirt is approx. 3" (7.6cm) from the center back, although it may be slightly further in larger sizes. Darts which are further apart than this will not be pointing towards the fullest part of the seat. Measure 3" (7.6cm) from the center back along the waistline (D) and square down 5" (12.7cm) from the curve (E). Measure W (13mm) each side of D and join to E, (Aldrich 2006).

Side seam

Measure one-quarter of hip measurement from the center back along the hip line (F). Square down from F to the hem line (G).Measure out ½" (13mm) from G (H) and join H-F. Continue the line above F for approx 4" (10.2cm) to serve as a guide for drawing the upper part of the side seam, between F and C. The curve should follow the straight line for 2"-3" (5.0cm-7.6cm) and then curve to C, thus allowing sufficient room for the curve of the hip bones.

Hemline

According to Anikweze (2003), it is measured up $\frac{1}{8}$" (3mm) from H and measure down ½" (13mm) from the center back, or as required, according to back skirt length. Curve the hemline as shown (page 44).

Front skirt waistline

Measure one-quarter of waist measurement plus $1\frac{1}{4}$ (3.1cm) from J along the top line from the center front line (K). Square up ½" (13mm) (L) and measure down I½" (13mm) from J (M). Curve from L to M for the waistline.

Waist dart

The front waist dart should be approx. 5" (12.7cm) from the center front (not less as its purpose is to provide shaping for the hip bones and many blocks place this dart too close to the center front). Like the back dart, it should be at right angles to the waist curve but considerably shorter, approx. 3" (7.6cm).Measure 5" (12.7cm) along the waistline from the center front (N). Square down 3" (7.6cm) from the curve and mark the base of the dart (P). Measure $\frac{3}{8}$" (9mm) each side of N and join to P, (Shailong and Igbo 2009).

Side seam

Measure one-quarter of hip measurement plus 1" (2.55cm) along the hip line from the center front (Q). Square down from Q to the hemline (R). Measure out ½" (13mm) from R (point H, as on the back block), and join Q-H for the side seam. Continue the line above the hip line, as on. the back, and curve from Q to L,(Igbo 2003).

Hemline

Measure up $\frac{1}{8}$" (3mm) at H and curve to the center front. This block has ½"(13mm) added to the side seam on back and front (i.e. the total hem width is 2" (5.0cm) greater than the hip measurement). This is the minimum hem width for any skirt, even if it is intended to appear completely straight, as otherwise it will appear to taper inwards.

James (2004), noted that, if a slightly flared skirt is required, some fullness may be added at the side seams (and the line joined to just above the hip line to ensure a good line) but no more than 1½" (3.8cm) should be added at each seam as a larger amount would cause die fullness to hang in folds at the sides instead of being evenly distributed around the skirt. This is a very serious fault in skirt cutting. If greater fullness is required, the block must be cut and spread apart as shown in page 44.

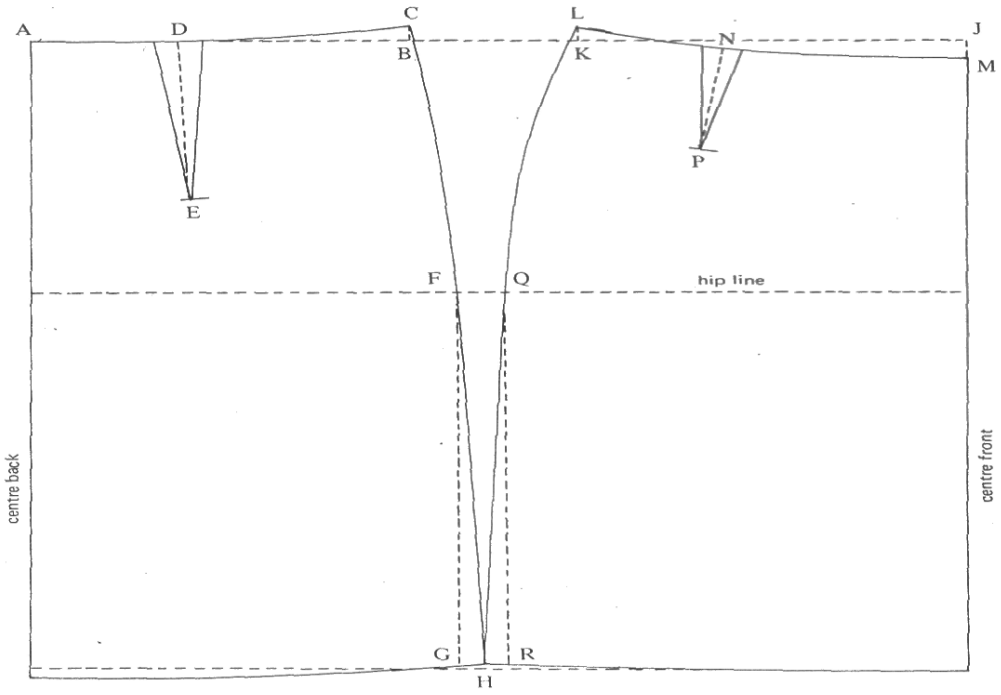


Figure 9: Front and back skirt.

Source: Campbell (2001). Designing Pattern

Trouser Blocks

According to Gale (1998),the trousers produced by these instructions are close fitting over the hips and thighs and fall straight from thigh to ankle with a hem width of half hip measurement plus 1" (2.5cm). This shape has been chosen as being the easiest to adapt to the

shape required by adding or subtracting width at the knee and ankle. The blocks are constructed by drafting the front block, tracing it on to a new sheet of paper and using it as a basis for drafting the back block. It is very important that the crease lines are marked clearly as they control the balance of the trousers.

Construction lines

Draw a rectangle measuring one-quarter of hip measurement, plus ½" (13mm), by trouser length required (the right hand edge is the center front line and should be at least 3" (7.6cm) from the edge of the paper).Draw the hip line by measuring the hip depth down from the top line and squaring across. Draw the crotch line by measuring the crotch depth plus ½" (13mm) down from the top line and squaring across. Draw the thigh line 3" (7.6cm) below the crotch line. Draw the knee line according to the knee length measurement. Name all the lines, (Sharon 1997).

Front Trouser

Waistline

Measure down ½" (13mm) from the top line and mark point A. Measure one-quarter of waist measurement plus 1" (2.5cm) along the top line (B) and curve from B to A. Draw the waist dart - 5" (12.7cm) from the center front, 3" (7.6cm) long, $\frac{3}{4}$"(19mm) wide and at right angles to the waist line, (Jenny 2006).

Centre front seam

Mark point C at the junction of the center front line and the crotch .line and extend the crotch line beyond the center front line. Extend the hip, thigh and knee lines. Measure one-twelfth of hip measurement less $\frac{3}{4}$" (19mm) from C and mark point D. Draw a short construction line from C at 45° to C-D as shown and measure half of C-D plus V£" (13mm)

(point E). Curve the center front seam A-E-D keeping it on the line A-C for 3 "-4" (7.6cm-10.2cm).

Inside leg seam

Mark point F where the center front line crosses the knee line and measure out half of C-D (point G).Mark point H where the center front lien crosses the ankle line and measure out half of C-D (point J).Join J-G and continue the line above G for 4"-5" (10.2cm-12.7cm) as a guide, then curve to D, (Jenny 2006).

Outside leg seam

Mark point K where the hip line meets the side line. Calculate half of hip measurement plus 1" (2.5cm). Measure half of that amount along the knee line from G (point L). Measure the same amount along the ankle line from J (point M). Join M-L and continue the line above L for approx. 3"-4" (7.6cm-10.2cm) as a guide. Curve to K and B.

(This curve, and that of the inside leg seam between G and D, may be adjusted slightly according to the width desired on thigh and crotch lines but it must always curve smoothly.), (Akubue 2004).

Crease line

Mark the centre point of the ankle and knee lines, join and continue to the waist.

Hem line

Measure$\frac{1}{4}$" (6mm) above the ankle line on the crease line and curve to M and J,Cut out the front trouser block, place it face downwards on a new sheet of paper and trace, allowing a margin of 3" (7.6cm) all round. Re-draw all the construction lines and name them and letter all points as on the front block. The lower part of the back pattern, below the knee line, is the same as the front, except for the curve of the hemline, (Igbo 2003).

Back Trouser

Center back seam

Measure out $\frac{1}{4}$" (6mm) from D along the crotch line and mark point N.Mark point P where the crease line meets the front waist line. Measure 1" (2.5cm) from P towards A and mark point Q. Square up 1½" (3.8cm) from Q (point R). Join R-C as a guide line. Measure half of crotch depth from R and mark point S. The center back seam is curved R-S-E-N. It should be hollowed slightly between R and S and should pass through or just below point E.

Waistline

Measure one-quarter waist plus 1" (2.5cm) from R on to the top line (T) and curve as shown, (page 48).

Waist dart

Draw the waist dart - 3" (7.6cm) from the center back, 5" (12.7cm) long, at right angles to the waist line and 3/4" (19mm) wide.

Outside leg seam

Measure out $\frac{3}{4}$" (19mm) from K (point U). Curve from L to U and join to T. (T-U will be almost a straight line.), (Gale 1998).

Inside leg seam

Curve from G to N as shown.

Hemline

Measure down ½" (13mm) from the ankle line along the crease line and curve to M and J. Place the blocks together at the top of the inside leg seam to check that the center seam is a continuous curve and place them together at the top of the outside leg seam to check the waistline curve. Place each of the seams together at the hem to check hem curve.

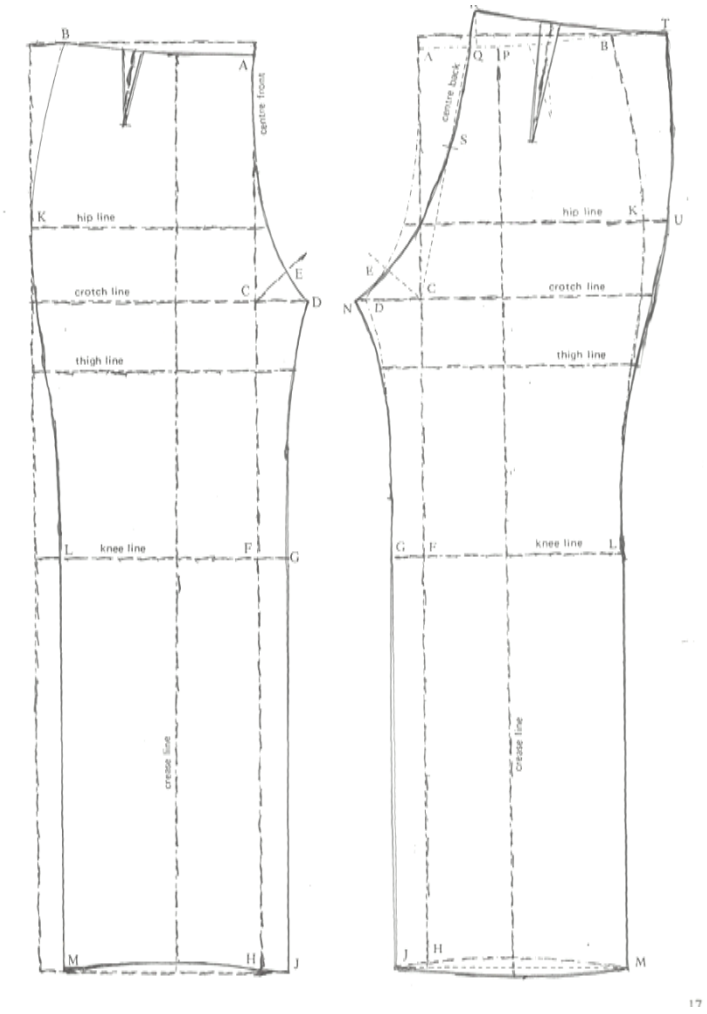


Figure 10: Front and back trouser pattern

Source: Campbell (2001). Designing Patterns

2.5 Garments Construction.

Before sewing, the pattern and fabric should be correctly layout, pin and cut. A line, referred as the grain line, is drawn on each pattern piece to indicate the direction in which the pattern should line up with the fabric. The most common grain line is a vertical line running from the top to the bottom of the pattern piece. This line indicates that the pattern should be placed on the lengthwise. grain of the fabric, which is parallel to the selvage edges. Another

popular grain line that is often marked on commercial patterns is the *foldline.* This is also the lengthwise grain of the fabric, (Nkeonye, (2009).

Always plan the layout on the wrong side of the folded fabric with sides together. This makes markings easy to transfer and protects the fabric from soil as the fabric is being handled. Fold the fabric on die lengthwise grain, and align the selvages. For many fabrics, the correct side is obvious because of the nap or print. However, the correct side of the fabric may be difficult to select. In this instance, fold back one corner and compare the two surfaces, (Ogla and Adam, 2006).

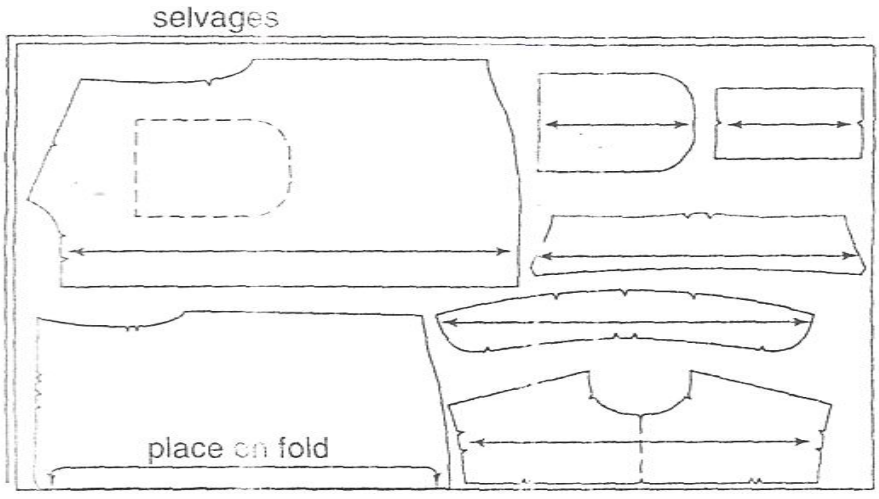


Figure11: Pattern layout

Source: Igbo, (2003) Pattern Drafting.

The correct side may have a bright print or a shinier surface. If you can't decide which is intended to be the correct side, select the side you like the best, and be sure to use the same side throughout the finished garment. Mark the wrong side with chalk to help identify the layers.

Helpful Sewing Tip: To prevent the fabric from dipping as you cut, lay the fabric over a layer of paper, such as shelf paper,(Tanner et al,2007).

2.5.1 Cutting Fabric Accurately

Stabilizing your fabric with brown craft paper, shelf paper, butcher paper, or unprinted newsprint insures that the fabric will not slip or move during cutting. This is especially vital when cutting any lightweight fabrics such as rayons, linings, chiffons, silks, crepes, knits, or velvets. Cutting with a paper support also helps achieve a clean, more accurate cut and it will not dull fabric scissors or rotary cutters any more than normal use.(Igbo, 2003).

Lay out the fabric, matching selvage to selvage, along one paper edge. (Fabric is folded selvage to selvage to keep the lengthwise grain "on fold".) On the paper, draw a cross grain line perfectly perpendicular to the paper/selvage edge. This insures perfect lengthwise and crosswise grain.

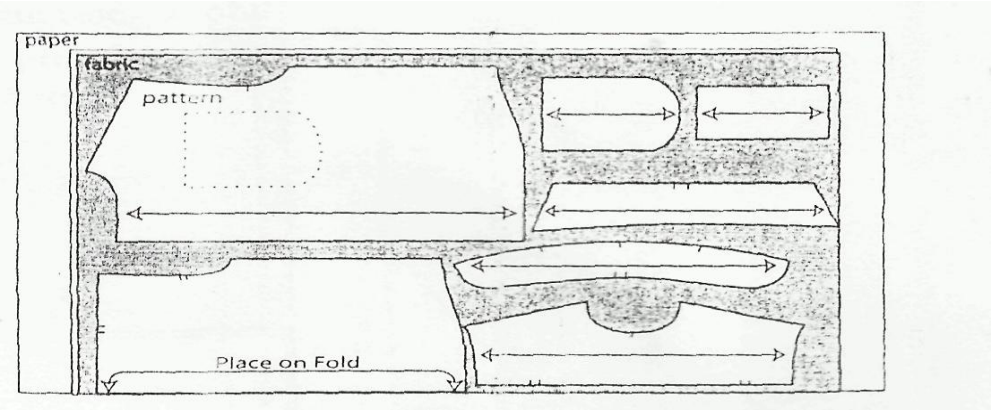


Figure 12: Pattern placed according to grain line

Source: Ogla and Adam, (2006). Designing patterns

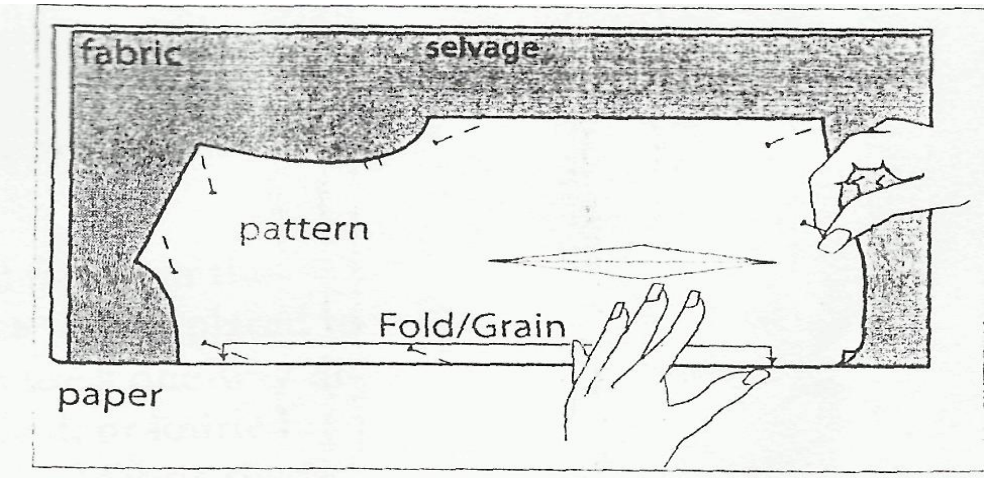


Figure 13: Pinning Pattern.

Source: Igbo, (2003) Pattern drafting.

Keeping the fabric flat and smooth, align pin the fabric to the paper edge and cross grain line. The entire length of fabric can be pinned in place. If you run out of table space, gently fold up the pinned sections until the entire piece is pinned in place. Press the pattern pieces with a dry iron to remove any creases. Lay pieces, aligning grain lines first, until the entire layout is complete. Pin the remaining fabric and paper support.

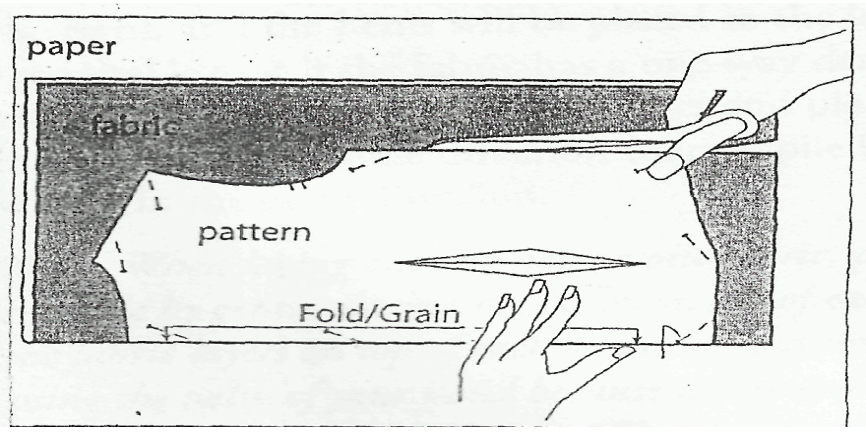


Figure 14: Cutting of Fabric

Source: Igbo, 2003 Designing Patterns

Cut the paper, fabric, and pattern all at the same time. Use long, continuous strokes to eliminate jagged edges. Do not make short, "choppy" cuts. Notice how the fabric does not move as the scissors cut. The pinned fabric piece can also be moved and adjusted closer to the cutter without distorting the fabric.

2.5.2 Sewing

From the early times, the technique of joining pieces of fabrics, leather, skin, etc. by threading fibre or leather strips through holes punched in the material, has been known. This 'sewing' process developed through the ages into a decorative art as well as becoming the most important means of fashioning clothing and furnishing fabrics, (Nkeonye,2009).

Sewing Threads and Their Selection

A wide range of sewing threads in a range of fast colours covering most customer requirements is now available in the market. They consist of cotton, synthetic and synthetic-cellulose fibre materials. There are three types of cotton threads: soft, mercerised and 'polished' or 'glace'. They are all made from good quality long fine cotton fibres. The soft cotton thread is widely used in the clothing industry; it is capable of being very effectively lubricated by thread manufacturers to reduce the coefficient of friction. Mercerised cotton thread is widely used for domestic sewing, and in the clothing industry; its chief characteristics are good lustre and increased strength. Glace or polished thread have applications in the sewing of leather and fur due to their improved strength and resistance to abrasion, (Nkeonye, 1990).

Among the synthetic fibres, nylon and polyester offered the best prospects for sewing thread manufacture, but the former did not become firmly established due to their excessively high stretch. Spun polyester thread has many outstanding properties and is being increasingly

used in this country. Sewing threads in which cotton fibre surrounds a filament polyester core occupy an important place in selling ranges. Here the polyester core provides high strength and resistance to abrasion while the cotton sheath carries the lubricant and provides the sewability,

Ogunbiyi, (2006), noted that the quality of the sewing thread affects the strength and durability of the garment. Thread selection includes strength selection and colour selection to match the garment being made up. The shades of the fabric and the thread should be exactly right, or much painstaking work will be ruined. It is advisable to buy a thread a tone darker than the fabric. In commercial production, it has been found that lubrication of the sewing thread gives improved performance. Lubrication reduces friction and so aids the running of the thread through the needle.

As the sewing thread runs through the needle at high speed, friction is generated and this produces heat. This heat can melt thermo-plastic (synthetic) fibre threads. Friction is also generated as the needle is pushed in and out of the fabric at high speed, and the heat liberated can cause fibre fusion. An additional source of fibre damage is the cutting of the yarns in a fabric by a damaged needle. However, the use of thermo-plastic fibre threads is unlikely to create these problems when using domestic sewing machines, as the sewing speeds are much slower.

Needles

Having selected the right thread in a matching colour, it is now necessary to find the right needle for the work in hand. The smallest, finest size of needle, consistent with the size of thread and the material to be sewn, should be used. A general recommendation for home-dressmaking with the lighter-weight dress fabrics would be a 10 -12 needle, with sizes 14 -16

being suitable for heavier fabrics (Singer sizes are quoted here). If too fine a needle is used to stitch a heavy fabric, seams will split and ugly holes will be introduced in the fabric.

Tension and Its Adjustment

In order to avoid unsightly puckering at the seams, machine tension should be kept as low as possible to ensure a balanced stitch of acceptable appearance. There are two tensions on the sewing machine: the upper and lower tensions. The upper tension controls the thread from the needle, while the lower one controls the thread from the spool or bobbin. The spool or bobbin must always be wound evenly for the best stitching results. With a good tension, the formation of the stitch is similar on both sides and the stitches are evenly embedded in the fabric.

One good method of adjusting to a good sewing tension is to suspend the bobbin and bobbin case by the thread and then adjust the spring tension until the bobbin falls under its own weight. The bobbin is then replaced in the machine and a sample seam stitched. The tension of the needle thread is then adjusted to give a balanced stitch. The pressure on the foot should also be as light as possible, being just enough to permit positive feed of the fabric through the machine, (Nkeonye,2009).

Stitch Length

The length of the stitch, i.e. number of stitches per centimetre/inch, depends on the weight of the fabric used. If the stitch length is too small, the needle makes too many punctures too close together, and the weave or body of the fabric is damaged. Again, if the stitch length is too large, the seam is hot held together securely and it will split.

The sewing machine, therefore, should be set for the correct stitch length before sewing is commenced. In the average, a stitch length of 12 - 14 per inch (5-6 per cm) is used

This may increase to 16 per inch (6.3 per cm) when handling very fine fabrics, e.g. lawns and georgettes.

Pressing and Finishing

For best results in the finished garment, each seam should be pressed as it is made, before proceeding to the next step. This facilitates the final pressing of the garment and improves the overall appearance. The heat of the iron should be in accordance with the nature of the material. Synthetic fabrics require only mild conditions, a light steaming followed by pressing with it cool iron. Severe conditions can cause glazing and pressure marks on materials such as triacetates and acrylics. Acrylic fabrics should be ironed dry or with a very little steam, but steam irons are recommended for garments containing tricel. All pressing should be done on the reverse (wrong) side wherever possible. Ironing-boards with resilient claddling are preferred, (Nkeonye, 2009).

2.6 Clothing Fit

Clothing fit means using the knowledge of line, proportion and balance to look our best. While the flat pattern adjustments allow one to make the pattern statistically accurate for fitting needs, they cannot accommodate figure flaws due to posture, excess weight or bone structure individuals. These significant personal alterations must be worked out in fitting muslin. The problems of an excessively large or small garment must be eliminated in muslin. The same or other changes should be made in every garment we sew, (Susan and Janice 1998).

The perfect solution to these and other tricky fitting problems is the use of a dress form. The dress form provides three-dimensional view which allows a person to fit and alter the garment from all angles. There a great variety of dress forms available to the one who

sews at home. The wire mesh variety is adjustable but does not have a smooth contour or pinning surfaces. The classic type with fabric-covered cotton batting is realistic and smooth shaped. It takes pins and is ideal for working with very heavy fabrics or garments.

2.6.1 Standards for well-fitted coat

Neckline- it should be sharp, natural curve without seam or facing showing. Collar edge lies against coat and is not turned up, no seam or under- collar showing on outer edge. Rolled collars cover back seam at neck. Points of collar same length and placed on equal distance from center front of garment, (Cooklin,2001).

Shoulders- Smooth, no wrinkles. Thin shoulder shapes help to form a firm foundation over front hollow area and keep grain line from sagging.

Darts- Should end in a sharp point with no bulges. Bust should point towards the fullest part of bust and end 1.5cm to 2.5cm short of the point. Front shoulder darts points towards fullest part of bust, (Kunick, 2007).

Armscye- should be natural curve with no wrinkles or puckers at bottom or sides.

Chest- Crosswise yarns paralled to the floor with no wrinkles or pulling**.**

Front edge (closing)-Hangs straight down, perpendicular to floor with no swinging to either side.

Sleeves- Fullness of set-in sleeve should be eased so that sleeve cap fits smoothly with no gathers or puckers visible. Accurately fitted at shoulder line to hang smoothly with grain line accuracy. Crosswise grains parallel to floor and lengthwise grains perpendicular to floor. Full length ends 1.5cm below wrist crease. Elbow darts pressed downward and placed exactly at bend of elbow. Coat sleeves may hang straight, usually are fuller than suit sleeve (Cooklin, 2001).

Buttonholes- Each buttonhole, same length, position, width and grain line as others. End of buttonhole extends 1/4cm beyond center front to allow shank of button to rest exactly at center front. End of tailored buttonhole strong and sharp with square corners. Lips narrow, thin and of equal width that meets in the center. Back of buttonhole neatly done with no fray edges. Buttonhole should not be bulky.

Fasteners- Button sewed on with shanks so outer fabric will not wrinkle when buttoned. Length of depends upon weight and thickness of fabric. Hooks and eyes inconspicuous with no stitches or knots showing on right side of garment. Thread loops may be used in place of metal (straight) eyes in some places. Snaps the same as for hooks and eyes .may be covered with lining to be less conspicuous (Rodwell,2010).

Side Seams- Hang straight or perpendicular to floor without swinging to back or front. When arm relaxed and hand dropped to side, longest finger should fall on side seam, unless seam is designed for difference position.

Back (5cm below base of neck)-Crosswise yarns parallel to floor, smooth no wrinkles across shoulders or under collar edge, (Kunick, 2007).

Waistline- About 1.5cm below normal indication if coat or jacket is fitted (to feel more comfortable and stay in place better.

Zipper Closings (lapped method)-Be flat, smooth, even, narrow and inconspicuous. Only front (top side) row of machine or hand stitching on outer side of garment. Stitching on under section should not be seen. Outside stitching straight and parallel to seam edge. Zipper teeth completely hidden when garment is worn.

Rodwell (2010), noted that hems of sleeves, skirt, jacket, coat hems should be flat, smooth, uniform widths, inconspicuous and parallel to the floor. No hand hemming stitches or bulky areas showing.

Linings- Lining should fit smoothly into outer garment with few wrinkles. The lining should have ease at bust, sleeve and back. Hand stitches of lining to coat or jacket should be almost visible and not to show on the outside of garment. Lining and garment should be well pressed.

N:B

Balance- Horizontal grain lines parallel to floor at chest, back, cap of sleeves and hip line; vertical lines: perpendicular to floor on straight skirts. Darts, tucks, hang of garment- same amount on each side of center front. Fit each time with proper foundation garments, shoes and with shoulder shapes inserted.(Hazel, 2012).

2.6.2 Principles of Clothing Fit

There are four principles that explain the reasons behind individual clothing choices and decisions. According to Jackson and Touchie (2010), such principles include modesty, immodesty, protection and adornment principles. They explained that modesty refers to what people feel is the proper way for wearing clothes. Immodesty states that clothing is not used to cover nakedness but to attract attention to one wearing it. Protection principle views physical condition of the environment as protection from extreme cold or hot climate and other problems. Adornment principle emphasis that clothing is worn for beauty sake.

In everyday life settings, people project specific identity about self. The self is considered the centre of ones personal identity, (Michener 1994).

According to Shaffer (2008), stated that self is a person's impression of trait, motives, values and behaviours that combine to make him or her unique individual. This is equivalent to self esteem and self-concept which finds outlet in self-expression. Self-expression is about being able to say or do what one meant to say or do. Consequently, this desire for self expression may be regarded as 'individuality' or 'distinctiveness' in dress. It can also be regarded as exploratory tendency in clothing which is a medium for experimentation. A person outfit tell others a lot about his or her personality. Clayton, (2004), noted that figure type, age, sex, body complexion, colour, time of the day, activities and status in the society affects the type of clothing one selects and wear.

2.7 Mass Production

According Tseng and Jiao (2001), mass production is the technologies and systems capable of delivering products that meet individual needs with nearly the same efficiency as other production. The authors stated that one of the future directions of fashion and garment industry appears to lie in mass production process. Garments are manufactured massively using predefined size charts which allow for the reduction of production cost. It is, therefore, practically impossible to obtain a perfect fit between a piece of cloth and an individual buyer (Kotha, 1995; Pine, 1993). Owing to their low cost, prét-a-porter garments are dominating the modern markets, while partial individualization is achieved using sizing systems with normalized dimensions. Under this way, absolute individualization is sacrificed to the benefit of production economy (Fralix, 2001; Walter, 2006).

The concept of mass production is devised to serve the individualized, needs of consumers and increase their satisfaction percentage (Anderson et al, 1999). This term implies a strategy for producing customized garment with maximum differentiation through a

low-cost production process (Davis, 1997). Nowadays, this manufacturing model is enabled by modem information technologies, computer-aided design and manufacture systems, three-dimensional (3D) body scanners, interactive web-based applications, etc. (Ashdown and Delong, 1995;Salusso-Deonier, 1989; Gazzuolo et al, 1992). From the manufacturers' point of view, there is an apparent trend on producing individualized garments with the greatest possible differentiation without affecting the production cost (DeLong et al. 1993).

However, the relation between the size charts and body dimensions is not constant because of the changes that occur in the human population. Recent body surveys in Germany proved that a garment sizing system for a certain body type does not cover more than the 25 per cent of the population in which it is addressed (Lanenegger and van Osch, 2002; Walter, 2002) Hence, body measurements should be updated regularly in order to provide current information on essential sizes and their geographical distribution in the population (Istook et al., 2003).

Consequently, for a successful garment mass production model, the development and maintenance of up-to-date anthropometric databases of the target market population, is essential (Salusso-Deonier, 1992; LaBat and Delong, 1990), or man, 1991; Goldsberry et al, 1996; Ashdown, 1998). Such an approach necessitates the existence of a proper methodology for producing sizing systems (which are not proportionally graded) with respect to a target population and the corresponding garments type(s). These sizing systems should satisfy the majority of the target population and at the same time should imply a cost-effective and affordable production process by the garment manufacture (Fralix, 2001; Walter, 2006)

Whether mass customization can be successfully employed in the knitted fashion product industry remains a contested question. Pine extended Davis's definition of mass customization to include variety and individualized opinions that would allow almost everyone to find what they wanted at prices comparable to mass-produced items. The term "mass customization" has evolved from the familiar "mass production" which continues to signify the manufacture of large quantities of standardized products by the use of assembly line techniques. Mass customization, however, has been variously interpreted, and there is no precise definition of term at present.

Banks (2000) opined that some modern business concepts for fashion products, shoes and other items have combined contemporary manufacturing technologies with mass customization. An example of this is the Finnish left(r) foot company, where a customer's feet are scanned by sales personnel. The information obtained is then used to manufacture perfectly lilting shoes that are delivered to the customer's home within three weeks. Another example of mass customization of fashion products is the Internet-based German company spread shirt that sells T-shirts whose graphics are individually designed by customers. Spread shirt applies these unique designs to a selection of standard Tshirts using modern digital printing technology. Other knitted fashion products can be customized in a similar manner.

Fiore, Lee and Kunz (2001) cited the two essential elements in mass production of apparel: co-design for a unique product and body scanning for a better fit. In co-design, the customer, generally with the aid of CAD technology or professional assistance, assembles an individualized product from a company's offerings by choosing style, fabric, colour palette, pattern and size. Body scanning may be employed to obtain or verify measurements if a perfect f it are required. The disadvantages of body scanning are three-told: (a) it requires an

investment in specialized equipment, (b) not all people wish to be scanned and (c) certain types of clothing require taking a customer's measurements manually. The latter procedure enables a dialogue between the purchaser and the sales person regarding the fit of a garment, an aspect often overlooked in promoting body scanning. On the negative side, taking measurements manually can be more time consuming and may raise issues of personal privacy. One of the bottlenecks in the mass customization concept for flat knitted products via complete garment technology has been the co-design process itself. Until now, it has involved manual interaction between the customer and the shop assistant throughout the customization of the garment. A new system that could make the co-design process more efficient and profitable would be welcome (Banks 2000).

In 1995 the Japanese manufacturer Shima Seiki introduced the first knitting machine capable of producing a complete ready-made flat knitted garment. The company called their complete garment concept WholeGannent(r). In the same year WajimaKohsan Ltd. opened the first Factory Boutique Shima, a retail store specializing in on-demand production of customized knitted garments, in Wakayama, Japan. The company added a second Factory Boutique Shima in the same city in 2008. The two shops and their associated manufacturing unit employ about fifty people. Factory Boutique Shirna is a business concept that combines knitting technology and mass customization on the retail level. It enables a client to enter the showroom, design and customize a flat knitted garment, and then have it manufactured promptly in a nearby production facility. The boutique provides customers the opportunity of examining fashion magazines, swatches of fabric, colour charts and sample garments for ideas in custom designing their own garment. A selection of garments in various sizes may also assure a perfect fit.

In the process of creating the customized item, the dent's measurements are taken by a shop assistant skilled in clothing design. The Factory Boutique Shima product includes a variety of items made by the cut-and-sew, fully-fashioned or complete garment manufacturing methods, with customization options corresponding to each technology. The sequence from the retail shop entrance to the point where the custom designed garment is delivered is shown in Table 2.1.

Table 2.1: The Factory Boutique Shima Production Concept

The Factory Boutique Shima concept
Customer enters store
Customer browses through catalogues and examines merchandise
Design and production of garment
Order placed and purchase pre-paid
Manufacturing of customized item
Delivery of finished garment

Source: Textile Journal, Japan, March (2011).

After the production process has been completed (Table 2), a customer is still free to decide whether or not to purchase the garment. If an affirmative answer is given, an order is generated and sent to the shop's production unit. This "manually customized" WhoteGarmenl(r) product is then made without cutting or sewing. that is, the entire garment is created in one continuous operation en the knitting machine. Such a manufacturing process will result in a seamless product with a more perfect fit and drape than is possible to achieve in the case of conventionally sewn products.

Table 2.2: Steps in manual production.

Manual WholeGarment production in Factory Boutique Shima
Item and style
Choice of material
Neck type
Sleeve length
Size (input of body measurements)
Choice of colour
Attachments
Production completed

Source: Textile Journal, Japan, March (2011).

When a garment has been finalized and pre-paid, it is manufactured as expeditiously as possible, generally the same day. Yarn and other stock components such as buttons and labels are kept on hand. By reducing the number of processes involved, complete garment manufacturing makes it possible to produce a customized garment in less time than conventional methods. In Japan, delivery is generally made by parcel post, but if faster service is required (for example, on orders from abroad), express shipment is used. If shipping is expedited, a customized garment could reach a customer in 3 to 10 days alter being ordered, depending on the production schedule and the destination.

In contrast to the manual procedure just described, one of the Factory Boutique Shima stores has introduced a newly- developed co-design system to make the interaction between the customer and the company more efficient. This process termed Order-made WholeGarment(r), enables the client to do more of the production independently, via a

computerized system The software tool developed by Shima Seiki is the result of many years of collaboration with WajimaKohsan Ltd. and the experience gained in selling produced garments in their retail store, Factory Boutique Shima. The Ordermade WholeGarment(r) co-design system functions as an interface between the customer and the manufacturer. Options are presented in several steps, allowing a customer to choose materials, styles, colours and such details as pockets and trims. This innovative software makes it possible to produce and design a fashion product with much less help from a shop assistant than before. The OrdermadeWholeGament(r) procedure has been used in one of the Factory Boutique Shima shops in Wakayama since 2008. The computer-assisted customer's personally designed garment is co-designed.

2.8 Strategies that Improve Mass Production of Garments in Nigeria.

Raw Material For Making Garments

The raw materials needed for garment making industry are largely by- products of Agriculture. Agriculture has since been relegated commercially as noted by (Ibrahim, 2003). This is because more attention has been given to oil sector in Nigeria. The raw materials needed by the garment making industry include cotton, silk, wool, linen and synthetic fibres. Most of these materials are imported from foreign countries (Kajogbola, 1997). To boost the availability of raw materials, the government should embark on deliberate policy that will enable commercial agricultural production. There should be large cotton plantations located in each geo-political zones in Nigeria. This is so because cotton is the chief raw material for garment production. On the other hand, modern methods for large production of silk, wool and linen raw materials should be applied. More experts should be trained to handle the increased production of synthetic fibres for garment production.

Improved Product Quality of Garments

It is an irony that inspite of the number of garment making industry in Nigeria, the production capabilities observed showed that the quality of most of its products are poor at least from consumer's point of view (Udofa, 2009). The strategy for achieving the high standard quality is through man-power recruitment and product development processes as observed by (Harold and Pomery, 2002). A policy must therefore be put in place to ensure the availability of modern machines in garment production. It should also include computer application in the area of Computer Aid Design (CAD), 3-dimesional laser scanners (3D) and interactive database applications. The garment making industry can be given a special loan at concessionary rates and willing members of the industry to purchase these modern machines and equipment. This will improve the quality of garment production thereby enhancing consumer's choice of patronizing locally made-in-Nigeria garments instead of continue to buy second-hand foreign materials from the market.

Electricity supply in the country should be improved. There was unreliable services from the Power Holding Company of Nigeria (PHCN). This has forced many garment making sector to buy their own generators for use. The running costs are high and the fuel is not always available to buy. If there is steady electricity supply, the quality of the products will improve and cost of production will be reduced. Consumers patronage of indigenous garment materials should be encouraged. In order to enhance consumers patronage of locally made garments, the producers should reduce the prices in such a way that the average consumers can effort to buy. The price will reduce if the government provide adequate water and electricity including road networks. If the producers provide their own generators, water supply and high cost of transportation, definitely the cost of selling price will be high too.

Naturally, most consumers prefer buying any product of proven quality at high price than to purchase poor quality product at low price (Ibrahim 2003). Good quality garments are associated with durability which is a major attribute looked for in any garment.

2.9 Empirical Study

Kaka, (1983), studied the anthropometric correlates of ethnic diversity. The topic was on a study towards the development of standard slopers for Nigerian school girls. The objective include 1. Determine the body dimensions of Nigerian school girls; 2. To establish comparison of body maturity with ethnic groups; and 3. To develop standard slopers for Nigerian schools girls. A total of two hundred (200) girls were selected, forty from five ethnic groups each, namely, Hausa, Fulani, Berom, Tiv and Yoruba. These girls were drawn from secondary schools. Measurements of weight as well as height, lengths and breaths of forty –four (44) parts of the body were taken using appropriate statistical tools and SPSS computer programme.

The result showed that there were notable significance variations in body dimensions within each of the ethnic groups, between ethnic groups taken in Pairs, also among the five ethnic groups taken together, and between the two age groups of the girls. Comparisons between ethnic groups showed that the 13year old Hausa girls were late matures but at about 16 years, their development was at par with other ethnic groups. On the other hand, Berom girls were early maturers, after 13 years, they progressively and rapidly development and so they had the greatest measurements in body dimensions. These include, Neck, Chest, Bust, Biceps, lower arm, wrist, waist, knee, calf and Ankle circumferences. The Fulani and the Tiv were the tallest at 16 years While the Yoruba were the shortest. Berom girls were the heaviest and the Funlani and Tiv were the highest in body weight. It was found that the

16year old Hausa girls had the longest arm bones, the deepest crotch depth, also had the widest upper thigh and buttock. The 16 year old Yoruba girls had the narrowest upper thigh, the longest waist-front companion, the highest buttock level, the longest waist arc. The Yoruba girls also had the thinnest triceps, subscapular and skin fold thinness. It was concluded that notable variations in body measurements have led to the planning of more than one set of standard basic block patterns for different size variations at all times. Invariably, there are individual styles which needs to be taken care of as an expression of self concept in clothing. Therefore, the areas for body measurement in this study serves as a guide for this present research work. This is in the right direction because of the increase in population and demand.

The survey study of anthropometric data conducted by Spurgeon and Meredith, (1999) of 405 blacks and white youths of 15 years of age in the United States of American. The objectives were to; 1. To determine the arm girth, calf girth and weight of black and white youths; 2. To determine trouser crotch, shirts and coat sleeves of black and white youths; 3. Use commercial pattern in length and girth of black and white for correct fitting. It was concluded that:

> *The two groups, measured during that time showed similar means for arm girth, calf girth and body weight; Black youths compared with their white age peers are shorter in sitting height, longer in lower limb height, narrower in width relative to lower limb height.*

Consequently, the arm and calf widths of sleeves and trousers respectively would be the same for both youths. The black youth compared with white youth would have shorter trouser crotch and longer shirt and coat sleeves. The width of the trouser at the hip would

also be much narrower. This suggests that a great deal of alterations would be made if one used commercial paper pattern in length and girth of the black youth for correct fitting garment. This study provided insight to body proportion of adolescent in this current study which help in categorizing adolescents based on the size of small, medium and large.

Vandenberg (2004), in his study of factor analysis of garment measures and development of children and young persons. The objectives include: 1. To make garments using predefined size charts; 2. Develop drafted patterns for children and young garments; 3. To determine distinct relationship between key dimensions. It was found out that there was a considerable relationship between age and stature, the older the age, the more developed stature. The author stated further that marriage and propagation of children affect girth measurement. It is noted that changes in body dimensions occur particularly in some Nigerian mothers who have two or more children. This can be seen in the case of enlargement of bust, projection of the stomach and increased width around the shoulders, waist, hips, thighs, knees, calf, ankle, arms and so on. It was also observed that some women lose weight, hence have decreased girth measurement as a result of giving birth to children. In men slight changes was observed. The age and stature of children in this study was used to understand the growth spurts in this research work.

Watson and Dako (2009) carried out the anthropometric study of 540 males and 117 females, age 20-24 years who participated in the African University games in Ghana. Objectives were to: 1. To determine the physical fitness of the athletes; 2. To determine the height, weight, skinfold thickness and mid-arm circumference; 3. To compare the body measurements with WHO standard. The subjects were all physically fit. The height, weight, skin fold thickness and mid-arm circumference were measured. The authors observed that

both sexes from the various countries were of medium physique. The subjects' body measurements compared favorably with those of the World Health Organization (WHO 2000), only the tricep skin fold thickness (40%) that was less than the standard value. The low value was attributed to the distribution of subcutaneous fat at different sites in the body.

Shailong and Igbo (2009), worked on the establishment of Average Body Measurement and Drafted Basic Block Patterns for male pre-school children in Enugu state. The purpose of the study was to: 1. Taking body measurement of male pre-school children in Enugu State; 2. Establish average body measurements for male pre-school children in Enugu State; 3. Drafting standard basic block patterns for male pre-school children in Enugu State. A sample of three hundred (300) children and 38 dress makers/tailors who are specialist in sewing children wears were selected for the survey and the experimental study. Measurements were taken from 17 parts of children's body using tailors tape. The data obtained were used to draft basic block patterns for bodice (shirt), sleeve and trouser. The patterns were trued using calico fabric and corrections were made to come out with the correct blocks.

Assessment criteria charts were developed by the researchers and it was used to judge the clothing fit on the models. Descriptive statistics was used in analyzing the data from the judge. The result was satisfactory and it was recommended that the block patterns should be used for mass production of garment for pre-school male children. This literature helped extensively in pattern drafting and construction of garment in this present study.

Maria, et al, (2009), carried out a study on A New Methodology for the Development of sizing Systems for Mass Customization of Garments. The research was conducted on anthropometric data of Greece men consisting of 12,810 of the population. The method

consists of six subsequent tasks which were applied to the target population for the development of mass customization models for male shirts, coats and trousers.

The chest girth, waist girth and height were commonly used for the construction of upper body garments. The neck girth and sleeve/arm length were commonly used for shirts. The waist girth and inside leg length were commonly used for making lower body garments. In this study, a set of body measurements (linear dimensions of height, inside leg length, sleeve length and girth dimensions of chest, neck and waist) of the target population was analyzed. The outcome produced primary and secondary sizes that correspond to the primary and secondary dimensions of the related garments respectively. The analysis includes the calculation of the minimum, maximum and the mean value as well as the standard deviation (SD)for every distinct set of body measurements.

The result has been successfully applied for the development of mass customization models for male shirts, coats and trousers with respect to Greek man between the ages of 20-30 years old. It was recommend that the methodology presented here can be applied to the development of mass customization models for other categories of garments and target population.

Michael (2011), conducted a study, titled, From mass production to mass customization. In this study, he highlighted the advent of industrial revolution era up to this present era. He commented that manufacturing moved from the craft era to the mass customization ear. Mass customization takes the best of the craft era of weaving and manual making of garments. A closer study of the changes taking place and the trends that exist in consumer behaviour reinforce the need for manufacturing companies to rethink their business strategies. These strategies should include the way supply chains are managed and products

are manufactured. Industries today is confronted by a new set of requirements. They are replaced by the next generation of manufacturing principles. It is called the era of mass production.

Seung and Chen (2012), in their study with a title, Mass-production methodology for an apparel industry with a future. The objective of the study was to know how the industries practice mass production and what dynamics of the industry were changed by the impact of mass production . The method involve the precise measurements of individual consumer that wanted to customize the apparel product. A trained sales person in the store processes the body measurements. The consumer can either be measured by hand, by laser body scanner or by video camera. Then body measurement software modifies the stored pattern prototype by using specific individual measurements.

A trained sales person takes the customer's measurements at certain body points and these measurements are then entered into the computer system, which consequently adjusts the size of matching points on the pattern prototype. Alternatively, a computer may generate a digital image using a video image of the consumer wearing a body stocking and then use pattern generation software to convert measurements from the image to a specific pattern (Goldman 2004). The most highly developed device measures the entire body three-dimensionally using a laser. The consumer is scanned while wearing his sleeve header street clothes. About a minute later, a print out of image is made. Then the measurement information is stored in a central database or on a smart card. The consumer uses this smart card to select the garment of choice and the pattern is adjusted automatically to fit the measurement made in the store (www.nait./org), (National Association of Industrial Technology, 2012).

Joel, et al, (2013), conducted a research called Mass production of flat knitted fashion products at the university of Boras, Swedish. (http//www.autexj.org/no1-2011/05-11pdf). The study was a survey design with discussion with shop personnel and company interviews. The field work was carried out at the firm of Shimaseiki, supplier of knitting production and inventor of the prototype co-design system order made whole garment. The result showed that when the customer has completed their customization process, the garment can be knitted without delay. Development of a configuration brings the process a step closer to mass production efficiency in the production of customized knitted garments. The gap missing here were that male adolescent groups were not included in the study.

2.10 Summary of Literature Reviewed

The related literature reviewed in this study, showed that before the developmental trend of garments in Nigeria, the people used leaves and animal skins to cover their private parts and to protect the body from harsh weather. The women were known for wearing beads around their waist and using animal skin to carry babies at their backs. The foreign influence through Christianity and Islam into Nigeria brought about significant transformation of Nigerian garments. This marked the introduction of woven clothes from cotton by the people which gradually replaced the use of leaves and animal skins.

Primitive man continued to discover how to fashion a covering for his body as early as 300 B.C. till the origin of modern garment development. The development of military uniforms and the intervention of paper garment pattern in the nineteenth century marked the production method of clothing. Ready-made clothes were used in paris about seventeenth century but the highest quality and variety of output was reached by the Americans. This was the period standard sizing systems for mass production of garments started.

Relevant literature was reviewed on body measurement data. It was found out that most of them were from other countries and few from Nigeria. Majority of the body measurements data compared black and white races based on their stature, weight, height and skinfold thickness. Some of the studies showed relationship between ethnic groups in Nigeria that described them as having low stature, narrow head, flat-sided crania and wide-short faces. Notable comparisons such as highest in body weight, longest arm, thinnest biceps, highest buttock level and longest waist-front of one ethnic group over the other was evident. Other body measurement variables such as bust measurement, waist, arm length, back line, front line, leg length were used for drafting basic block patterns for suit construction.

Most of the related literature on body measurements chart deals with the development of standard slopers for Nigeria school girls, pre-school age children, comparison of black and white races.It also showed relationship between ethnic groups in Nigeria. This adolescent stage is a significant area of study in the development of patterns for suits. Therefore, the gap that was filled in this research work focused on the development of patterns for mass production of suits for adolescents in Benue State, Nigeria.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

This chapter describes the following;

3.1 Design of the Study

3.2 The Population of the Study

3.3 Sample Size and Sampling Techniques

3.4 Instrument for Data Collection

3.4.1 Validation of the Instrument

3.4.2 Pilot Study

3.4.3 Reliability of the Instrument

3.5 Data Collection Techniques

3.6 Procedure for Data Analysis.

3.1 The Design of the Study

The design of the study followed the Research and Development (R & D) orientation of the Organization for Economic Cooperation and Development (OECD) which refers to R & D as a creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications (OECD, 2008), To business companies and State agencies, R & D would imply investigative activities aimed at making a discovery that can either lead to the development of new products or procedures, or to improvement of existing products or procedures. R & D research design to higher institutions is one of the means by which the horizon of knowledge can be expanded particularly by way of developing new products or processes to improve and expand the operations of vocational and technological

departments. Gall and Borg (2007) provided a 7-step model for the process of R & D which was adapted in the design of prototype garments for male adolescents.

Procedure followed was in line with R & D model of the study.

In line with the R & D model, the research was conducted in the following phases:

Phase 1: Development and validation of instruments for data collection - The following instruments were developed and validated for the study:

(i) A questionnaire to establish body characteristics of adolescents (Appendix B).

(ii) Body Measurement Chart Guide (Appendix D).

(iii) An assessment criteria chart for adolescents on wearing fit, ease, mobility and aesthetics (Appendix I).

(iv) An assessment criteria charts for judges on wearing fit, ease, mobility and aesthetics (Appendix J).

This phase lasted for 6 weeks.

Phase 2: Collection of body measurements in three categories of small, medium and large

(i) Establishment of average body measurements.

This phase lasted for 7 weeks.

Phase 3: Development of patterns for suit blocks

(i) Drafting of basic suit blocks (Appendix E).

(ii) Cutting of pattern pieces for constructing shirts, coat and trousers (Appendix F).

This phase lasted for 4 weeks.

Phase 4: Construction of prototype suits for adolescents

(i) Construction of prototype shirts, coat and trouser for small, medium and large (Appendix G).

(ii) Trueing by model (trials)

(iii) Making adjustments and alterations

This phase lasted for 5 weeks

Phase 5: Evaluation of prototype suits

(i) Assessment by adolescents using assessment charts to grade the wearing fit, ease, mobility and aesthetics.

(ii) Assessment by judges using assessment charts to grade the wearing fit, ease, mobility and aesthetics.

This phase lasted for three weeks

3.2 Population for the Study

The population for the study consisted all male adolescents in selected institutions. The total population was made up of 11, 916 male adolescents which were obtained through pre-study visit to selected institutions. The personnel officers of the institutions were contacted and upon explanation with a letter of introduction for permission to conduct the research, the lists of male adolescents were released. The other aspect of the population include five (5) teachers and lecturers and another eight (8) were tailors who served as judges that assessed the clothing fit.

Table 3.1: Population for the Study

Local Government Area	Institutions Selected	Population of Students
Ogbadibo	Government College, Otukpa	1762
Otukpo	Federal Government Science And Technical College, Otukpo	1511
Okpokwu	Government Secondary School, Okpoga	913
Makurdi	Mt. St. Gabriel Secondary School, Makurdi	2419
	University of Agriculture, Makurdi	48
Vandeikya	Government Compressive Secondary School, Vandeikya	833
Kwande	St Andrew Secondary School, Adikpo	724
Konshisha	Tilly Gyado Memorial College, Konshisha	910
Gwer	St Michael Secondary School, Aliade	1148
Gwer-west	Government Secondary School, Naka	732
Oju	Government Secondary School, Oju	600
	College of Education, Oju	316
	Total	**11,916**

Source: field survey, 2014

3.3 Sample Size and Sampling Procedure

Four types of sampling was used. Random sampling was used in form of balloting to select the number of Local Government Areas for the study. The researcher used paper balloting in which the names of the Local Government Areas was written. These papers were folded and put in a container, mixed and the drawer did not look into the container, pick one at a time, unfold the slip and record the name it contains, fold it and put it back into the container and repeat the process until the required number are drawn. This is called sampling with replacement, any name drawn once is ignored if picked on subsequent occasions. Sampling with replacement ensures that each member of the population has an equal

probability of being drawn. Convenient sampling was used to select the secondary schools. The researcher went to schools that are near to the roads for convenient.

Proportional sampling technique was used to select the male adolescents from the approved secondary schools. Sample was produced based on the proportion of male adolescents in relation to the population of each school. A total of 740 male adolescents were sampled. Purposive sampling was used to select the experienced tailors who specialize in children and adolescent garment sewing, comprising a total of 13 assessors. Purposive sample involve those that their contributions are relevant to the study (Uzoagulu, 1998).The sample was presented in table 3.2.

Table 3.2: Selection of Sample

Institutions	**Sample (4% of Population)**
Government College, Otukpa	70
Federal Government School and Technical College, Otukpo	60
Government Secondary School Okpoga	6
Mt. St. Gabriel Secondary School, Makurdi	96
University of Agriculture, Makurdi	3
Government Compressive Secondary School	334
St Andrew Secondary School, Adikpo	28
Tilly Gyado Memorial College	32
St Michael Secondary School, Aliade	46
Government Secondary School, Naka	30
Government Secondary School, Oju	36
College of Education, Oju	24

Total	**740**

Source: field survey, 2014

3.4 Instrument for Data Collection

Four different types of instrument were developed for data collection of the study based on the phases of the study. These are:

1. Questionnaire on adolescents body characteristics and classification
2. Body measurement chart for drafting pattern
3. 4-point assessment criteria chart for adolescents used as model
4. 4-point assessment citteria chart for judges.

3.4.1 Validation of the Instrument

Three experts validated the four different instrument used for data collection both in face and content validity. One expert in research method from the Department of Mathematics and two experts in Clothing and Textile in the Department of Vocational and Technical Education, at the Ahmadu Bello University, Zaria. The questionnaire on body characteristics of adolescents was appraised in relation to dress sense, clothing fit and fashion. The body measurement chart was appraised with regards to specific body measurement needed for drafting the suit pattern, shirt, jacket and trousers. The assessment chart were appraised in relation to items on clothing fit, mobility, ease and aesthetic. The experts comments and suggestions were used to make correction on the instrument.

3.4.2 Pilot Study

The sample of twenty (20) male adolescent students in five (5) Government approved secondary schools in Makurdi metropolis were selected. The schools were chosen because of easy accessibility. The researcher asked the age of students. The age was confirmed through

the school records. The standard body measurements of the students were taken following a set of rules. The data collected were analyzed using mean, standard deviations and analysis of variance (ANOVA)..

3.4.3 Reliability of the Instrument

In order to ascertain the reliability of the instrument, Cronbach Alpha formula was used. Stannley and Hopkins (1992) noted that Cronbach Alpha (∞) estimates correlation of instrument with alternative one which is composed of the same number of item. The test score is 0.75 of reliability coefficient. This figure is reliable as it is close to the standard coefficient of reliability (∞) = 1 as recommended by (Uzoagulu, 1998).

3.5. Data Collection Techniques

The procedure for the development of pattern for adolescents were planned in four phases through which data for the study were collected. The phases were as follows:

Phase 1: Distribution of questionnaire on body characteristics of adolescents

This phase was intended to generate ideas on special body characteristics of adolescents in order to construct suits that fit them. To generate the ideas, a 13 item questionnaire was administered to 300 respondents in five institutions in Benue State. Most of the items in the questionnaire sought for the respondents perception of body size and shape of adolescents, based on small, medium and large.

Phase 2: Taking body measurement of adolescents

The researcher and two trained research assistants took the body measurement of adolescents. Measurement guide was used for training the research assistants on how to identify the point of the body where these measurements will be taken and how to take each

measurements. The measurements that was taken after three consecutive times was recorded to the nearest whole number. (See appendix)

Phase 3: Pattern development procedures

The various body measurements were used to establish standard average body measurement which was used to draft three set of patterns for small, medium and large categories of adolescents. The drafted patterns include; Shirt Block Pattern – Front and Back, Sleeve Block Pattern for Shirt, Jacket Basic Block – Front and Back, Sleeve Block for Jacket – 2 piece-sleeve and Trousers Block – Front and Back (Topside and Underside).

Classic Fit Shirt Pattern

To make a classic-fit style, a designer has to increase the size of the pattern. There are two methods for increasing the ease in a pattern. The first is to enlarge the size of the basic block shirt pattern; the second option is to draft a new classic-fit shirt pattern.

Back Bodice Draft

- Trace the back block pattern.
- A = Measure in horizontally $^1/_8$" from the H.P.S. Redraw the neckline with a similar curve.
- B = Measure out horizontally $^1/_4$" from the L.P.S.
- A-B = Draw a straight line.
- C = Drop the side chest point $^1/_4$" and extend it $^1/_2$" from its original position as shown.
- B-C = Draw a curved line that is similar to the sloper armhole line. Apply notches.
- D = Extend the side hip line out $^1/_2$" .
- C-D = Draw a straight line, completing the new side seam:

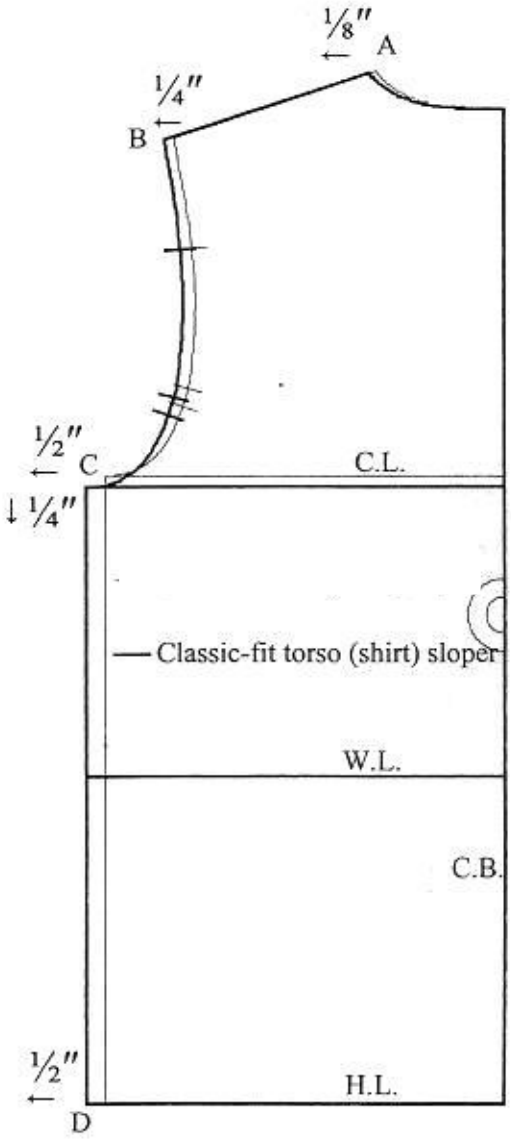


Figure 15: Back Shirt Draft

Front Draft

- Trace the front block pattern.
- E = Measure in $^{1}/_{8}$" from the H.P.S. Redraw the neckline with a similar curve.
- F = Measure out $^{1}/_{4}$" from the L.P.S,
- E-F - Draw a straight line.
- G - Drop the side chest point $^{1}/_{4}$" and extend it $^{1}/_{2}$" from the original position.
- F-G = Draw a curved line that is similar to the sloper armhole line. Apply notches.
- H = Extend out $^{1}/_{2}$" horizontally.
- G-H = Draw a straight line, completing the new side seam.

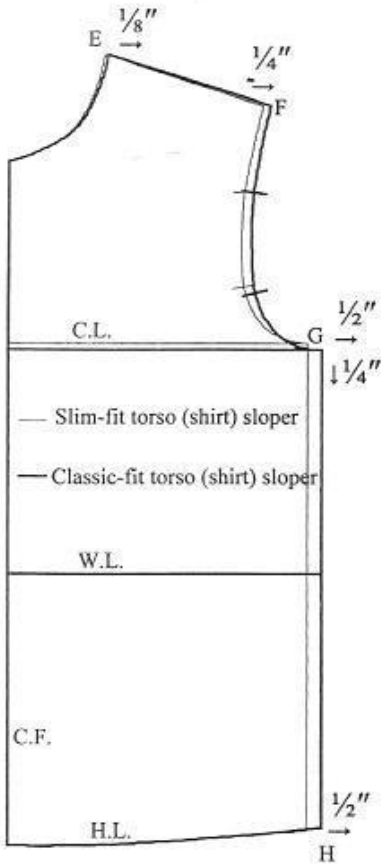


Figure 16 Front Shirt Draft

Sleeve Draft

- Trace the slim-fit sleeve sloper.
- Drop the bicep level $^{1}/_{8}$".
- B, A = Extend the bicep level $^{3}/_{8}$" on either side.
- Redraw the sleeve cap line with a similar curve.
- Check the new sleeve cap ease and apply notches.
- D, C = Extend each side of the wrist level $^{1}/_{8}$".
- B-D, A-C = Draw straight lines to complete each sleeve seam line.

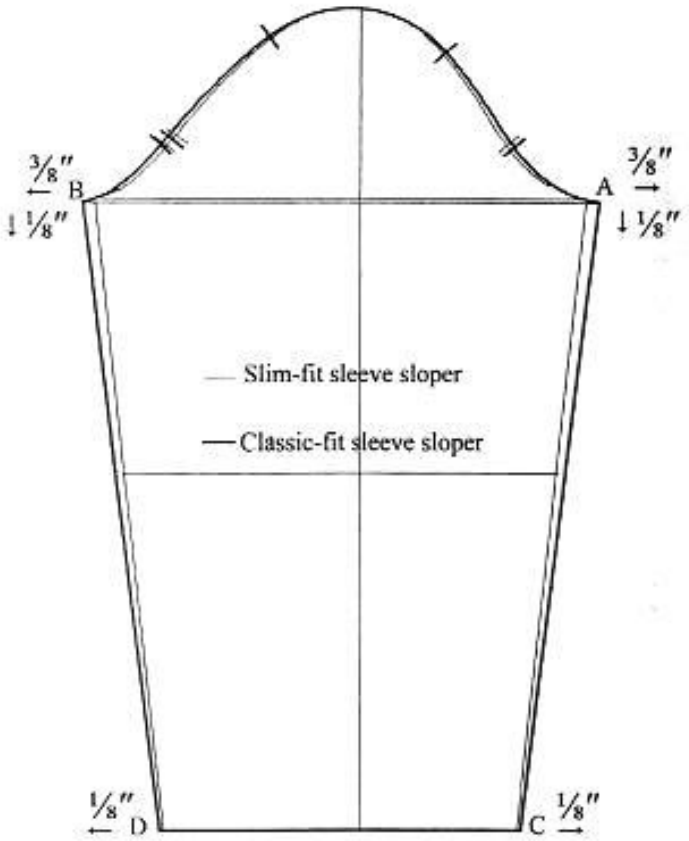


Figure 17: Sleeve Draft

Slim-Fit Six-Panel Suit Jacket Foundation

Front and Back Body Draft 1

- Trace the basic block pattern for four-panel suit jacket foundation , sides together as shown.
- A-B-Jacket length; extend 3"-4" from the hip line. The length varies depending on design.
- B-C = Draw a line parallel to the hip line.
- • A-D = Armhole depth.
- E = Waist point on the center back.
- E-F = Measure in $^{8}/_{8}$" - $1^{1}/_{8}$".
- F-G = Draw a line parallel to the center back line. G is the intersection at the bottom line.
- D-H = Measure inside $^{3}/_{8}$".
- I, J, and K = One-quarter increments of A-D.
- L = Measure in $^{1}/_{8}$" from A.
- Draw a curved line connecting L, K, J, H, and F.
- M, N, and O = Extend a line from the back interscye line to the bottom line,

M is an intersection at the chest line, N is an intersection at the waist line, and O is an intersection at the bottom line.

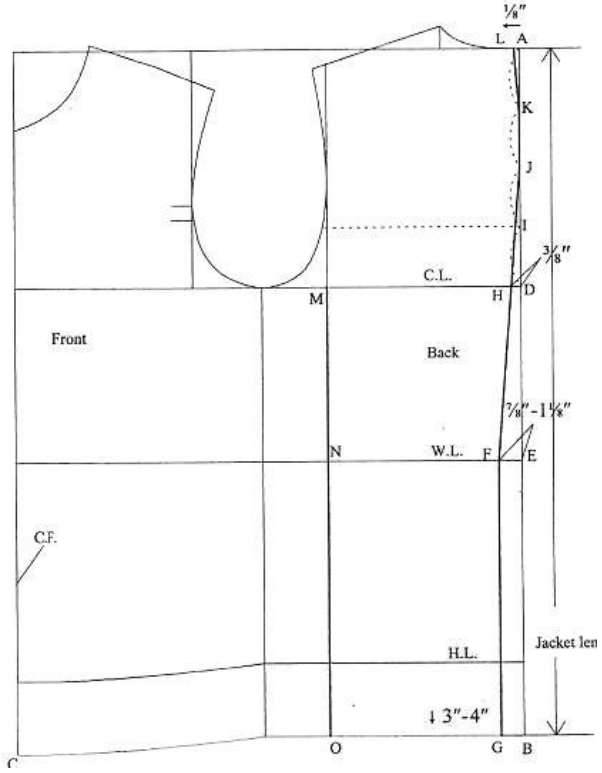


Figure 18: Jacket Front and Back Draft

Front and Back Body Draft 2

F = From I, draw a line perpendicular to the center back.
Q-N = Measure over 1"-1 1/2".
S-N = Measure over 1/4".
R-O = Measure toward the center back W-W.
T-O = Measure toward the side seam 1/8" - 1/4".

Complete each back side line by first connecting P, Q, and R, and then P, S, and T with smooth curved lines.

U = The front interscye line at chest line.
U-V - Measure toward the side seam 1 1/8".
W and X = Extend the line from V to the bottom line. W is an intersection at the waist line and X is an intersection at the bottom line.
Y = Waist point at center front line.
Z = Midpoint of W~Y.
Z-A' = Measure toward the side seam half of the dart width (ex: 1/8"-1/4").
A'-B' = Draw a vertical line that ends 2" below the chest line.
A-C' - Draw a 3 1/2" vertical line toward the bottom line.
D'-W = Measure down 3 1/4" .
C'-D' = Draw a straight line.
C'-E' = Extend 3/4" from C'.

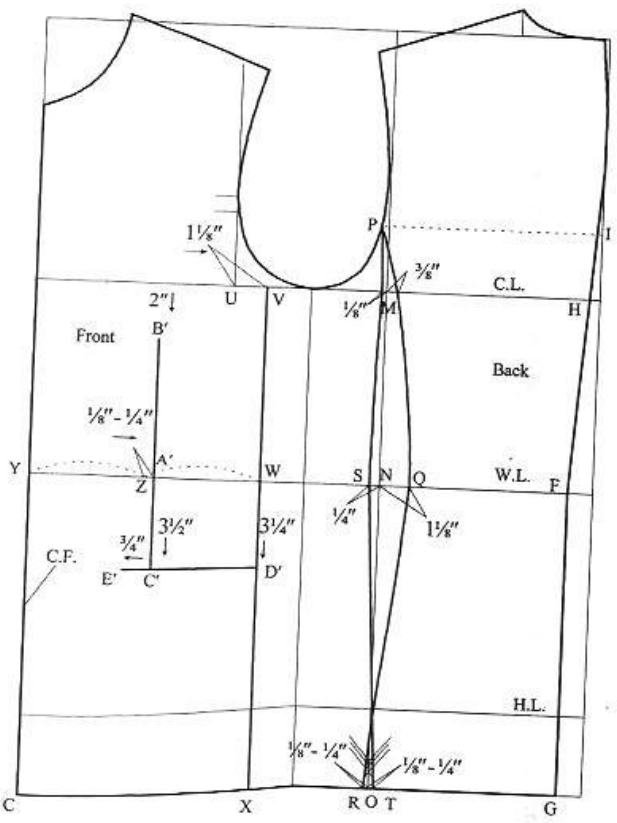


Figure 19: Classic Jacket Front and Back Draft

Front Body and Side Panel Draft

F'-V = Extend a line from V up to the armhole line.

- G', H' = From W, measure $^{3}/_{8}$" toward the center front to find G' and $^{1}/_{8}$" toward the side seam to find H'.
- I'-X = J'-X - Measure $^{1}/_{8}$" to either side.
- Draw a curved line connecting F', G', and I' and another curved line connecting F', H', and J', creating a convex dart.
- K' = Measure up $^{1}/_{4}$" from D'.
- K'-C = Draw a straight line,
- Z-A', A'-L' = Half of the dart intake (♦) = (ex: $^{1}/_{8}$"-$^{1}/_{4}$"). Measure out on either side of A'.
- M', M" = Draw vertical lines from Z and L' to line E'-C'-K'.
- Complete the front dart lines by extending straight lines to B'.

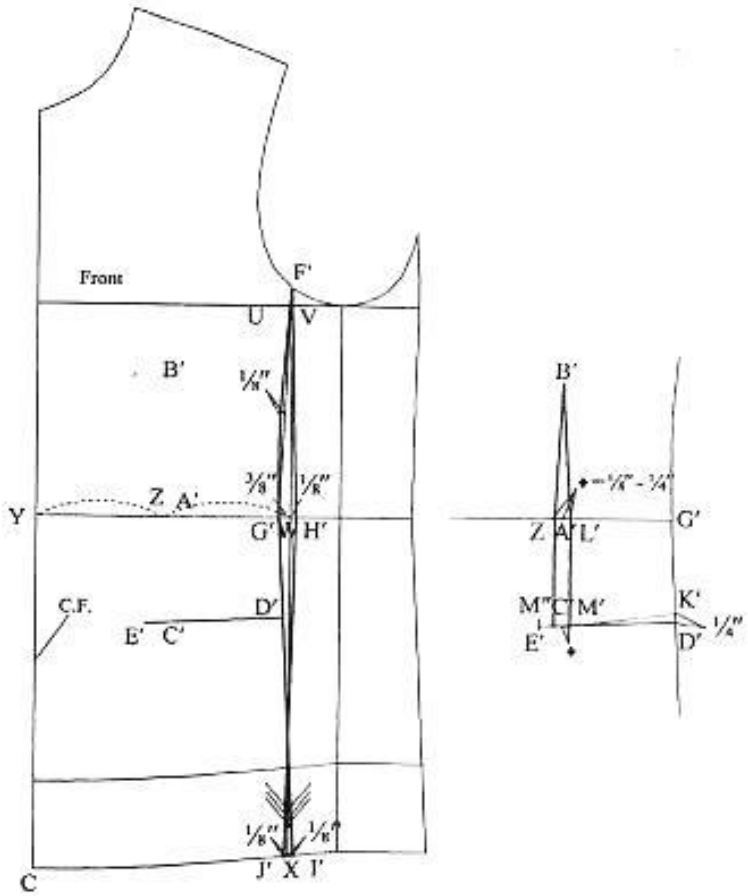


Figure 20: Front Body and Slide Panel Draft

Front Body and Side Panel Finished.

- N'-K' = From K', extend the same amount as the width of M'-C (♦), toward the outside.
- I'-I" = From the bottom, extend the same length as K'-D' (ex: $^{1}/_{4}$") to make the seam the same length as the back side seam.
- F'-C" = Draw a line parallel to I'-C.
- Draw a curved line by connecting G'-N' and O'-r.
- F'-F" and P-P" = Measure horizontally $^{3}/_{8}$" toward the back draft. And redraw a similar line to the original line.
- H'-P' = Measure down the same length as in the G'-N'.

. P'-Q' = The pocket width; total width of pocket (ex: $5^{1}/_{4}$"-$5^{3}/_{4}$") - (the width of E'-O').

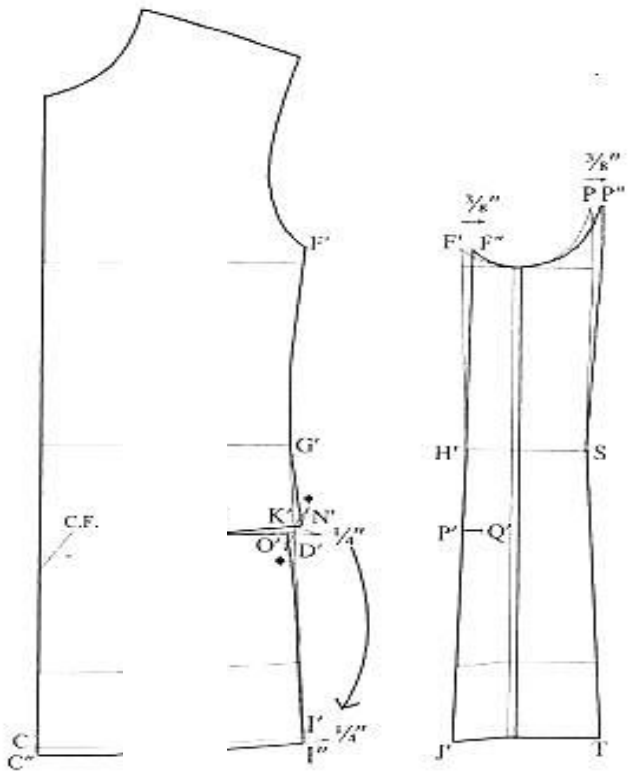


Figure 21: Finished Panel Draft

Seam Allowance for Jackets

Examples of seam allowances for jackets

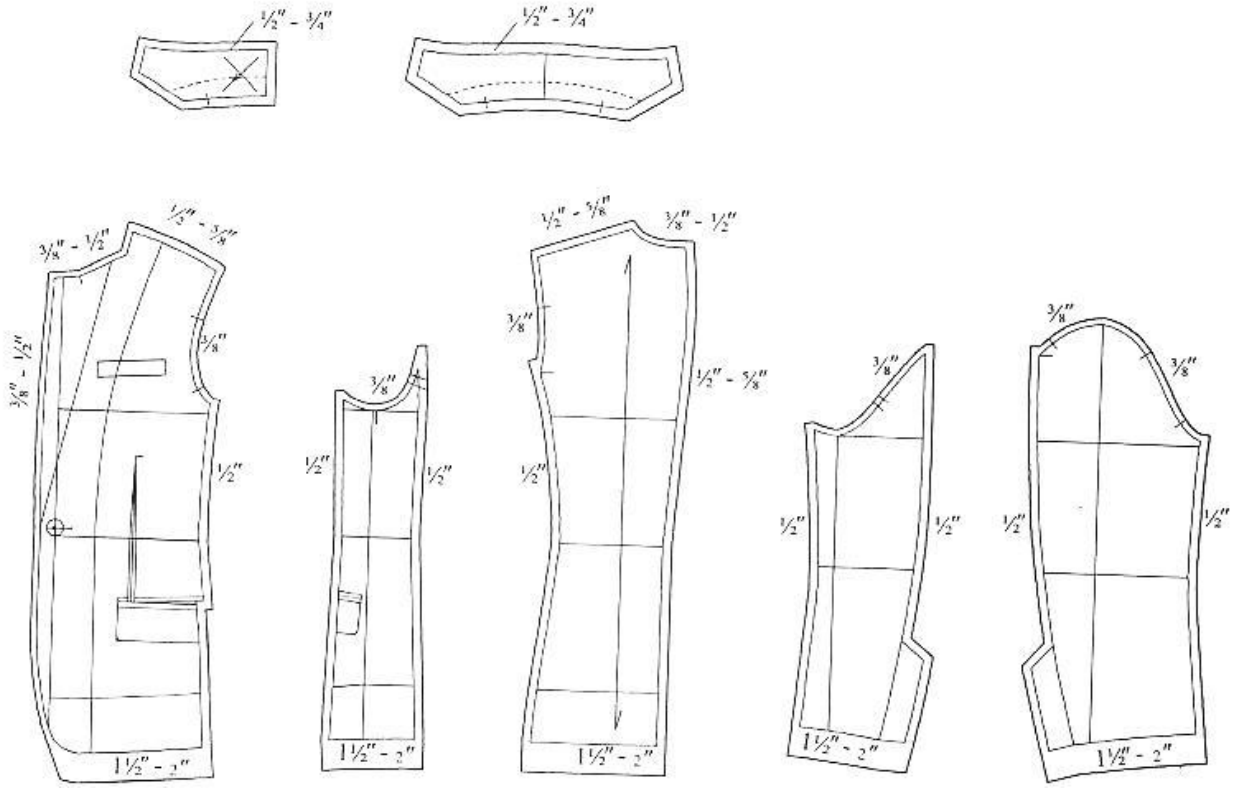


Figure 22: Seam Allowances for Jacket

SUIT JACKET LINING

The lining pattern for a suit jacket has added ease, because lining is often constructed out of a lightweight fabric and people need room for movement On the other hand, the lining pattern must be shortened from the bottom, so that the lining will not be seen from the outside. The exact amount of ease that will be added varies depending on the thickness of fabric and the sewing methods as well as the cost of manufacturing. In general, the lining pattern has an added W-\" in circumference and is shortened l"-2" in its length. The following example is for suit jackets.

Front Lining Draft

- Trace the front suit jacket pattern that has the facing line in it.
- Cut along the facing line.

» Because the front pattern has the dart on it, reduce half of the dart intake by redrawing the facing line near the waist line (•), as shown.

« Remove the pocket mouth and true the side seam line by redrawing it.

- Because there is a length difference near the pocket mouth, raise the side line up the same length as the difference of the pocket mouth (♦), as shown.

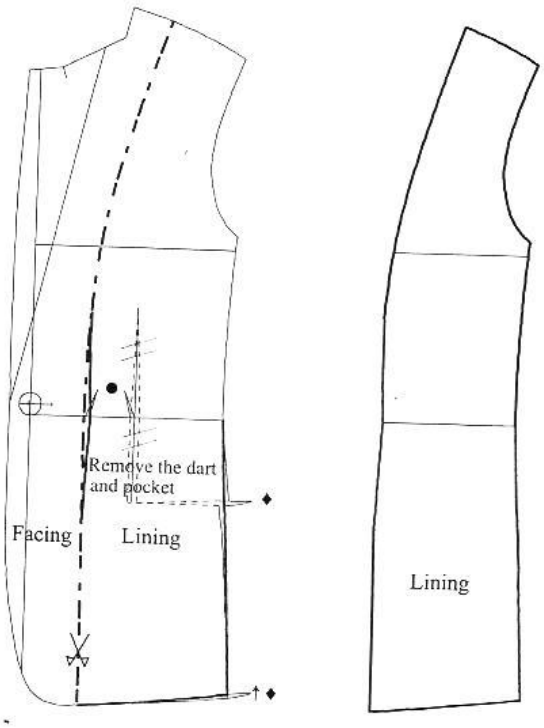


Figure 23: Front lining Draft

Front/ Side, and Back Lining Draft

- Trace the front (which is made from the previous steps), side, back, and sleeve patterns.
- Enlarge each line $^{1}/_{8}$"; on the center back, enlarge $^{3}/_{4}$" - l", as shown.
- Shorten $^{3}/_{4}$" from the hem lines and sleeve hem lines.
- Redraw the armhole lines.

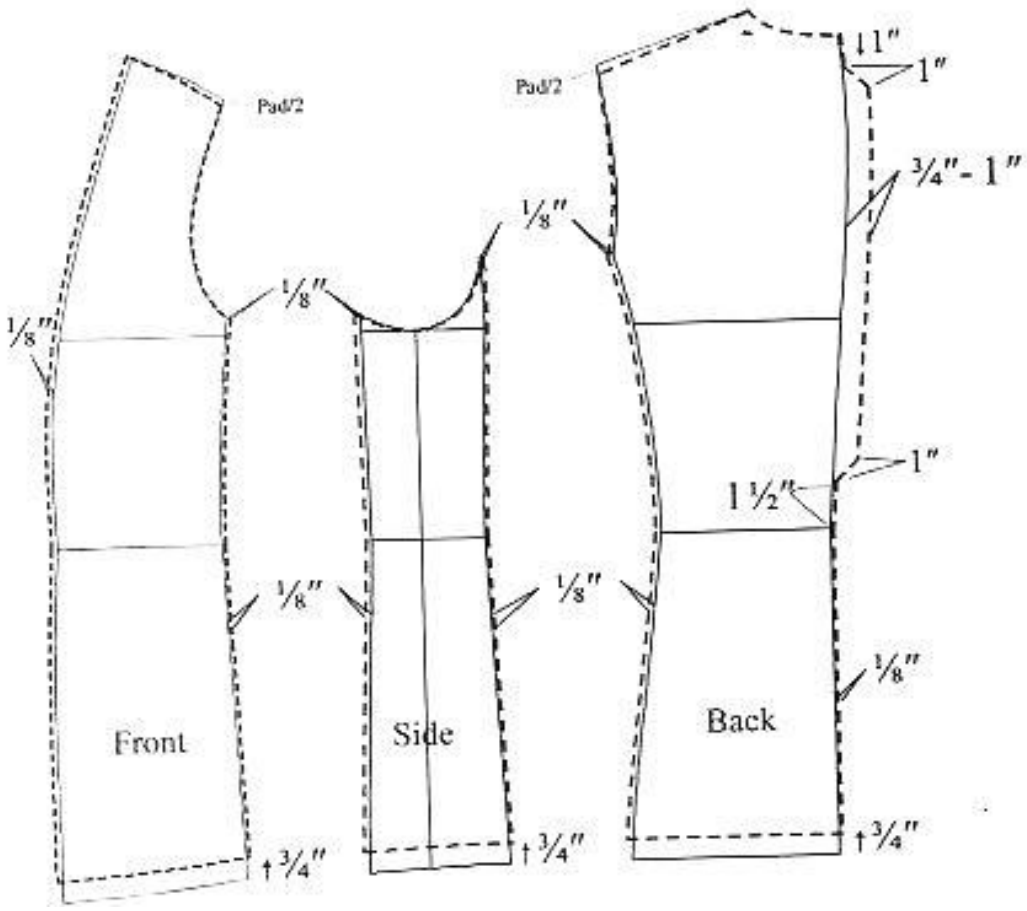


Figure 24: Side and Backlining

Sleeve Lining

NOTE: Seam allowance of the outer shell is $^{3}/_{4}$" for this pattern.

- A, B, C = (•) Extend an amount that is double the seam allowance of the outer shell ($^{3}/_{8}$" x 2 = $^{3}/_{4}$") plus $^{1}/_{4}$" of ease (total 1") from the bottom of the under-sleeve cap and the upper-sleeve cap as shown in Figure 11.15.
- D, E = Extend an amount that is half of the amount at A, B, and C ($^{1}/_{2}$").
- Redraw the sleeve cap by drawing curved lines as shown.
- Check the sleeve if there is ease in it. The lining pattern does not have a lot of ease in it. Ease is $^{1}/_{8}$ - $^{3}/_{8}$" in total front and back. Extending A, B, and C reduces the ease in the sleeve lining pattern to make sewing easier.

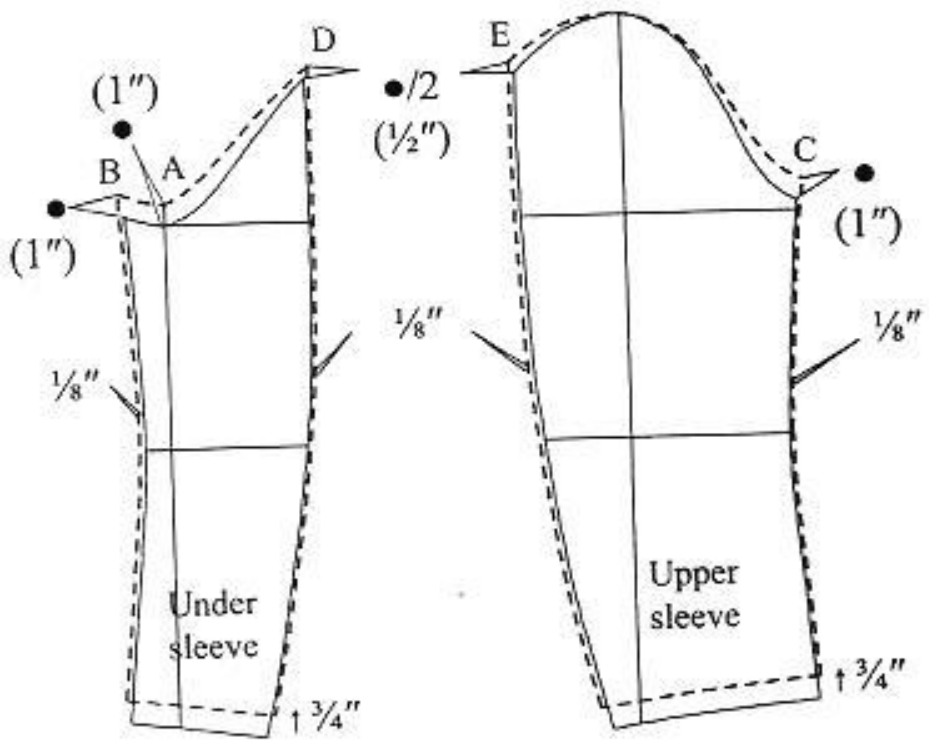


Figure 25: Sleeve Lining

COMPLETED JACKET

Design Style Points

This ubiquitous style of jacket—which is typically worn by adolescents—is a fitted six-panel suit jacket, with darts on the front, a breast pocket, front pockets, and a two-piece sleeve.

Slim-fit Style

1. Notched collar and lapel
2. Six panels with one button
3. Vertical darts
4. Double-welt pockets with flaps
5. Single-welt pocket on the chest
6. Two-piece sleeves
7. Side vents

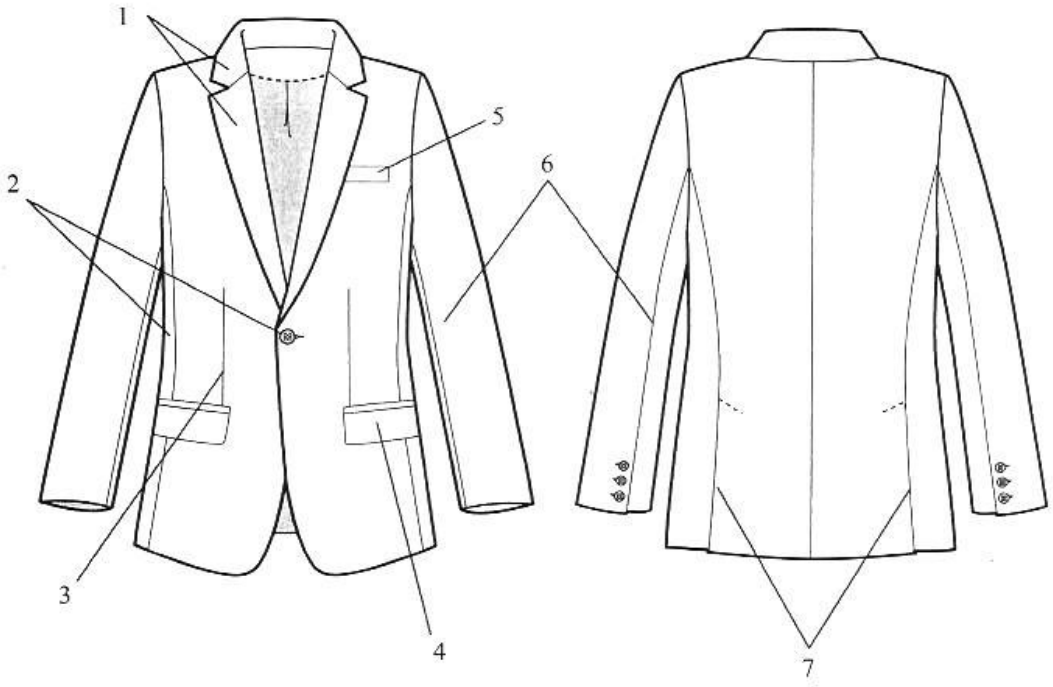


Figure 26: Completed Jacket

DRAFTED TROUSER PATTERN

When it comes to garments for the lower half of the body, trousers are the most common for menswear compared to women wear. When developing the trouser pattern, the most important measurements to consider are the hip circumference, waist circumference, and trouser length. Specific parts of the trousers are shown below:

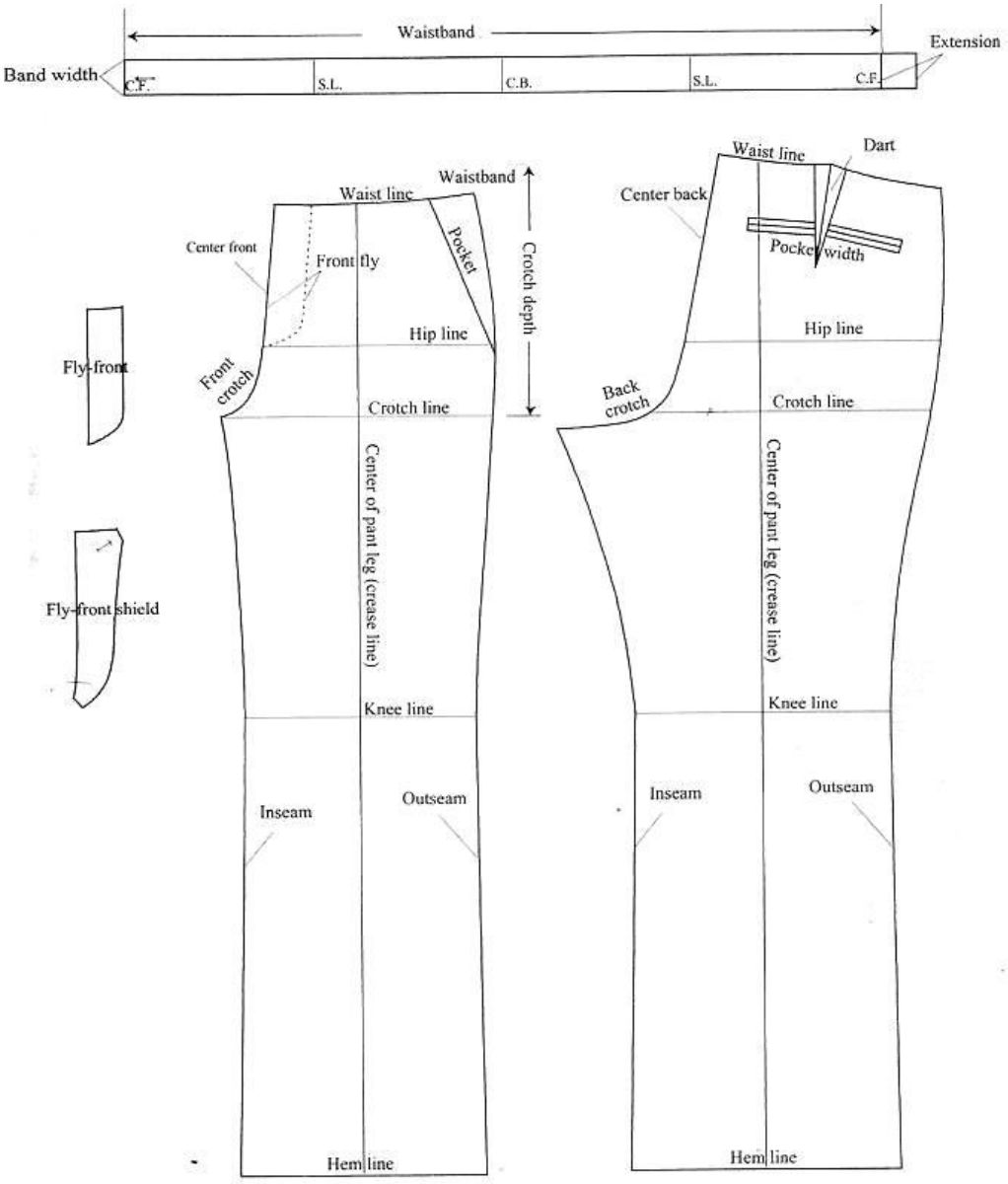


Figure 27: Specific Parts of Trouser

Front Draft

- A-B = Trouser length; outseam length (ex: 43").
- A-C = Waistband width (ex: $1^1/_4$"-$1^1/_2$").
- A-D = Crotch depth.
- D-E = One-third of C-D from D,
- E-F = Hip line (H.L.), square out from E one fourth of the hip circumference - $^1/_4$".
- C-H = Square out from C the same length as E-F.
- D-G = Square out from D the same length as E-F.
- H-G = Draw a straight line.
- G-I = (Hip circumference/16) - ($^3/_8$"-$^5/_8$"); extend from G.
- J = The midpoint of I-D,
- J-K = Crease line; square down from] to the hem line.
- Extend line J-K up to the waist line (C-H).
- L = Knee line; measure up 3" from the midpoint of J-K. Square out on either side.
- K-M, K-N = Half of front hem circumference (ex: $4^1/_2$"-5").
- D-O = Measure in $^1/_8$".
- O-M = Draw a straight line.
- P = Measure in $^1/_4$"-$^3/_8$" from the intersection at the knee level from line O-M.
- L-Q = Half of the front knee width; square out the same width as L-P.
- M-P, N-Q = Draw straight lines.

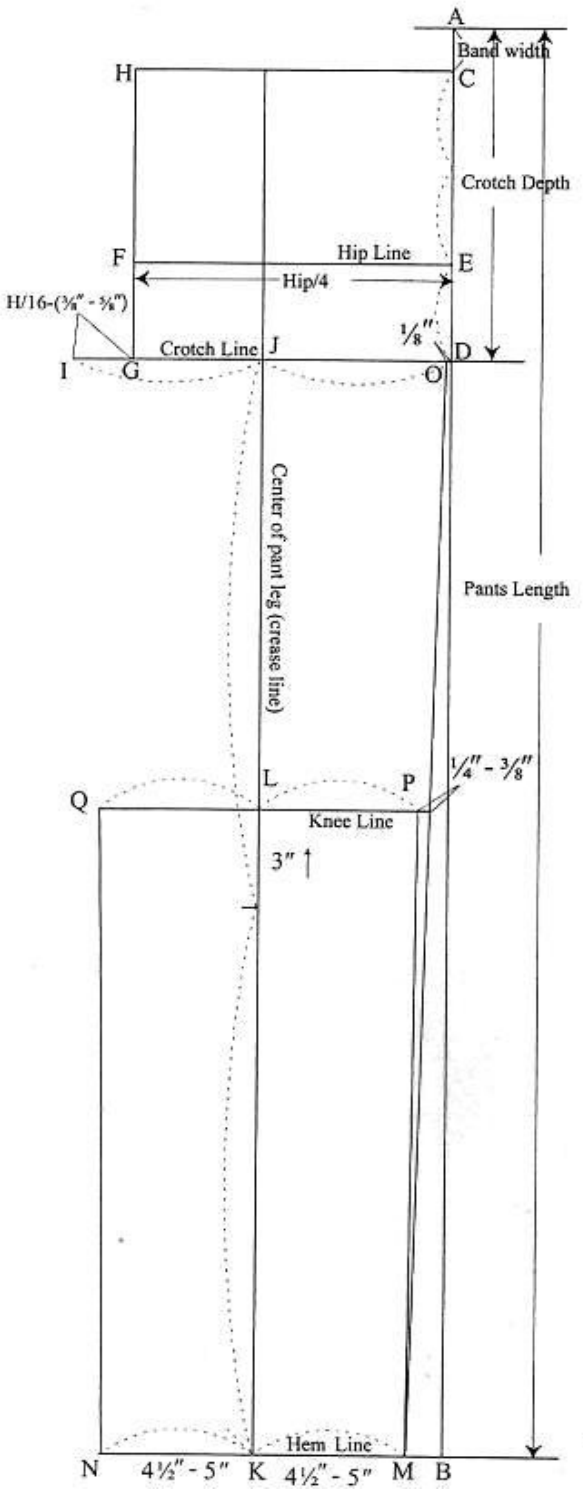


Figure 28: Front Trouser Draft

Inseam and Outseam

» I-Q = Draw a straight line. Then, one third of the way down, make a guide mark $^{1}/_{8}$"-$^{1}/_{4}$" in. Connect the points with a smooth curved line.

• O-P = Draw a straight line, make a guide mark $^{1}/_{8}$" in from line O-P and halfway down. Then draw a smooth curved line.

• H-R = Measure in $^{1}/_{2}$"-$^{5}/_{8}$".

• R-S = (Waist circumference/4) + $^{1}/_{4}$" for ease.

• Draw a curved line connecting S, E, and O to complete the side seam line.

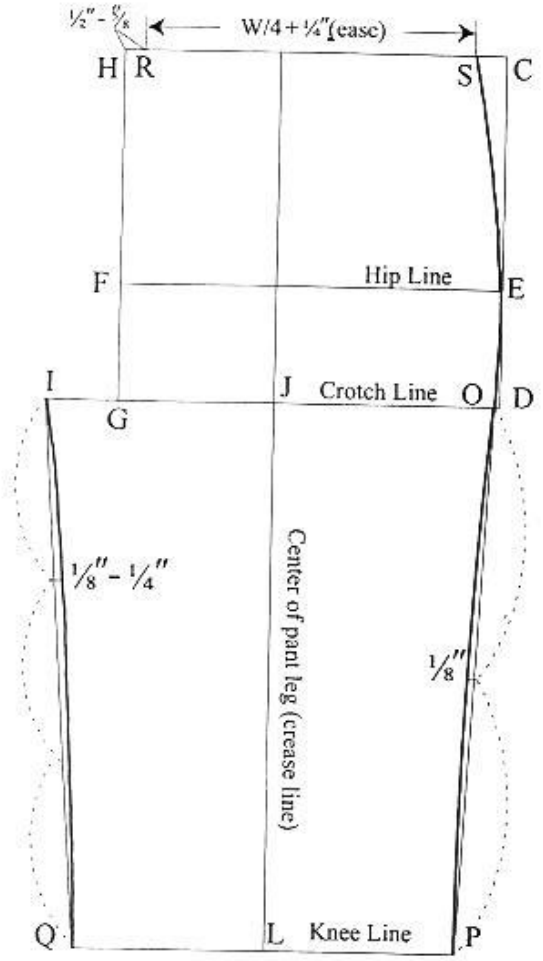


Figure 29: Inseam and Outseam of Trouser

Front Crotch and Waist Line

- S-T = Extend $^{1}/_{4}$" from S.
- R-T = Draw a smooth curved line, completing the front waist line.
- R-F = Draw a straight line.
- G-U = Measure up 1".
- U-I = Draw a straight line.
- V = From the midpoint of I-G, square up to line I-U.
- From the midpoint of I-V, make a guide mark $^{1}/_{8}$" in.
- Draw a curved line connecting I,V, and F to complete the front crotch seam line.
- Draw a fly zipper stitch line, $1^{1}/_{2}$" away from and parallel to F-R.

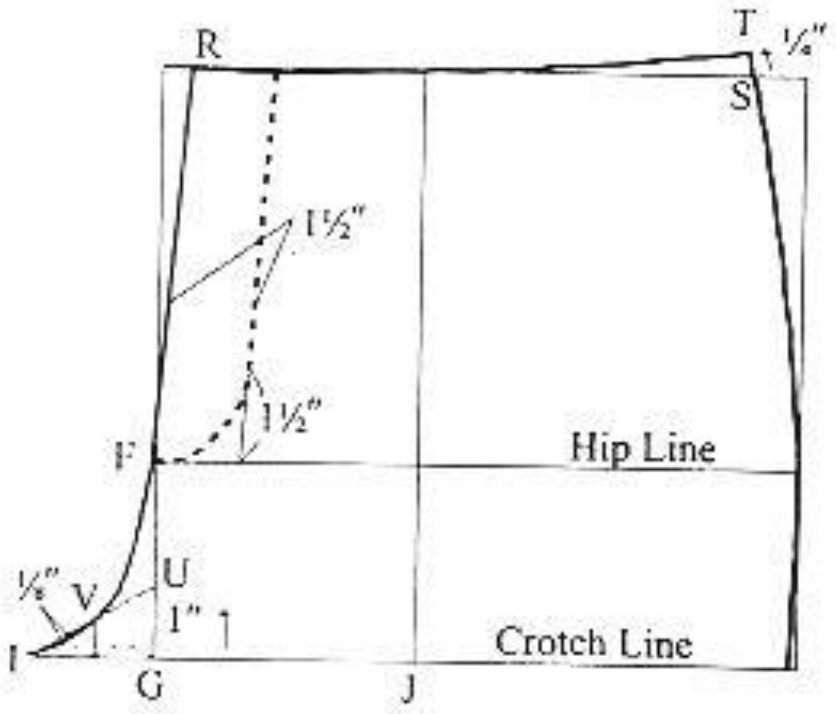


Figure 30: Front Crotch and Waist Line

Back Draft

- In order to draw a back draft, trace the front draft. Include the hip line, crotch line, knee line, and crease line 0-K).

- (I)-A = Measure down $^{5}/_{8}$" vertically from the front crotch edge (I) and draw a horizontal line.

- A-B = Crotch width; (hip circumference/16) + ($^{1}/_{8}$" - $^{3}/_{8}$"), extend from A. This line is parallel to the previous crotch line in the front.

- C and D = W to the outside, draw lines parallel to front inseam and outseam line to the hem line.

- B-C = Draw a straight line, then complete the back inseam line by drawing a line that curves inside $^{4}/_{8}$"-$^{1}/_{2}$" near the midpoint of B-C. It should transition smoothly to the lower portion of the seam line.

- E = Measure in $^{3}/_{4}$" from the front hip line point (F).

- E-F - Hip circumference line (H.L.); (hip circumference/4) + (1"-1$^{1}/_{4}$").

NOTE: The width of the back hip is bigger than that of the front.

- D-F = Draw a straight line.

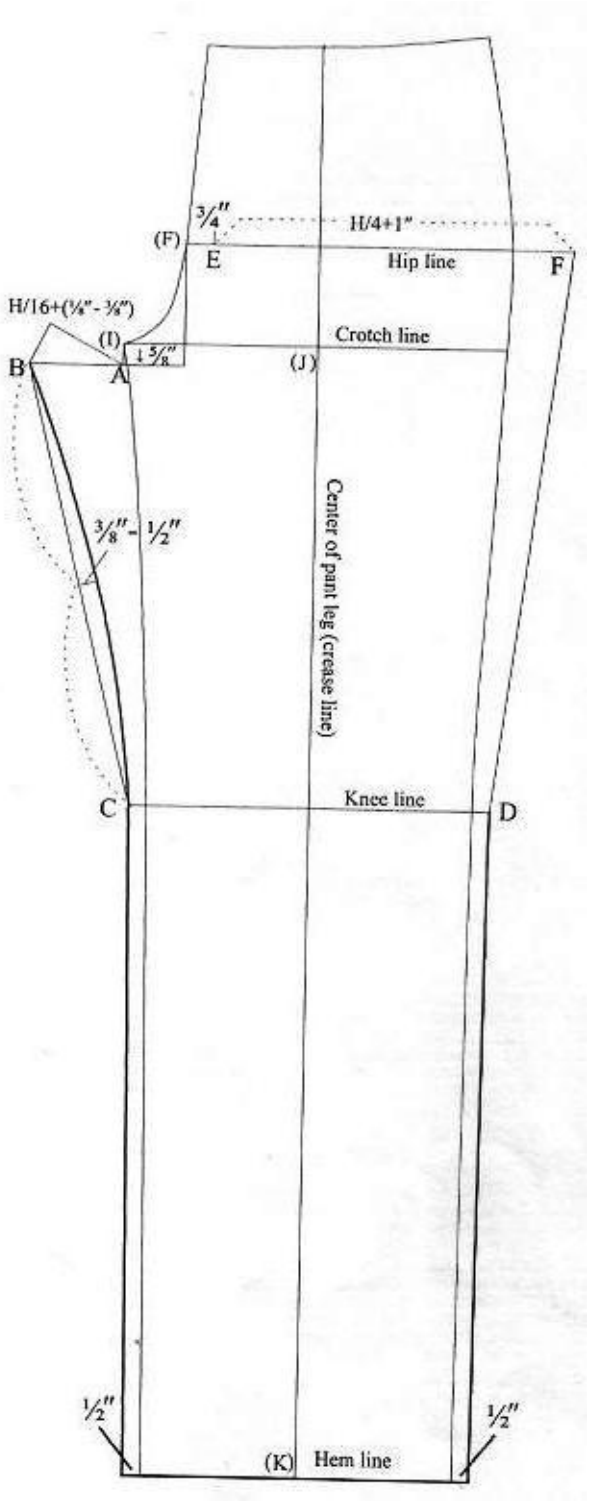


Figure 31: Back Trouser Draft

Back Crotch and Waist Line

- G = The front crease line at the waist line.
- R = The front center point,
- I = The midpoint of G-R.
- G-J = $1^{3}/_{4}$" - $2^{1}/_{4}$"; it should be located within R-I.
- J-E = Draw a straight line.
- Draw a curved line by connecting B and E, staying on line B-A for about 1" before curving upward, as shown.
- D-K = Extend from F the same length as the front outseam line (©).

» K-L = First, extend a guideline up from line J-E, Then, from K, draw a line that is perpendicular to the guideline. Mark the intersection as point L. L-K L L-E (L = perpendicular direction),

- L-M = Measure down $^{1}/_{4}$".
- M-K = Draw a straight line.

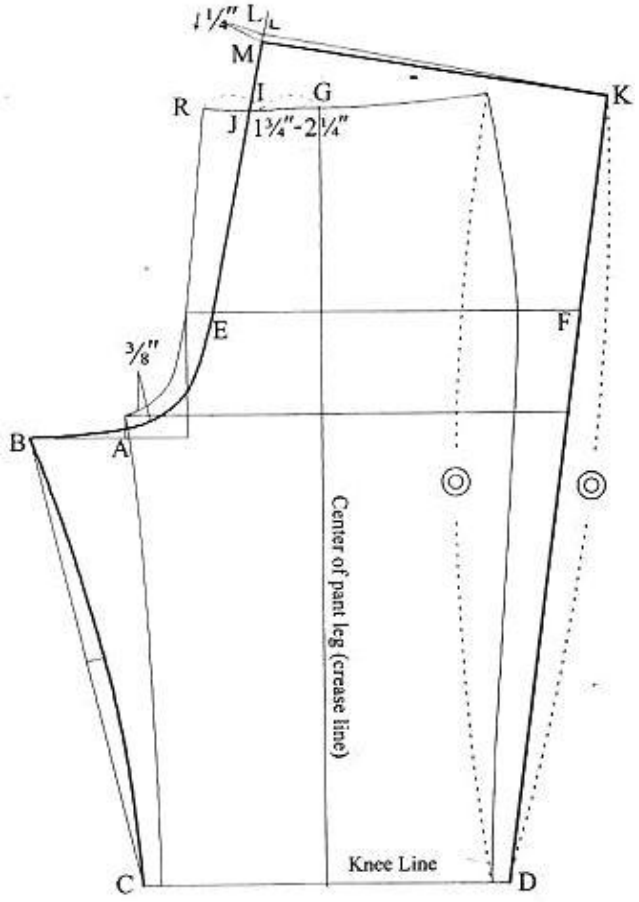


Figure 32: Back Crotch

Back Waist Circumference

- M-N = (Waist circumference/4) + $^{1}/_{8}$" for ease. Generally, it is better if there is less ease for the back waist compared to the front waist, which has an ease $^{1}/_{4}$".
- N'-K = The same width as S-C in the front.
- N'-N = The dart intake.
- O = The midpoint of M-N'.

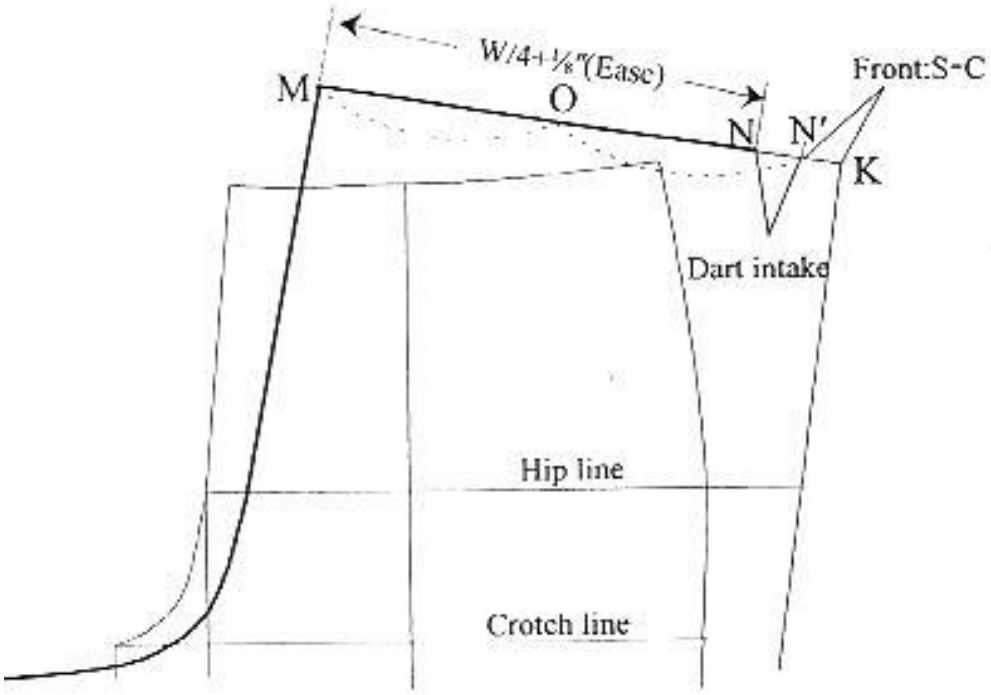


Figure 33: Back Waist

Back Dart

- O-P = Dart depth; square down $4^1/_2$" - 5" from M-K.

» O-Q, O-R ~ Measure out on either side of O half of the dart intake.

- Q-P, R-P = Draw a straight line for each.

- Complete the outseam line by drawing a curved line from $^3/_8$" to $^1/_2$", curving inward %" to W at the midpoint between the crotch and knee line.

- True the waist line by drawing a curved line after folding the dart legs.

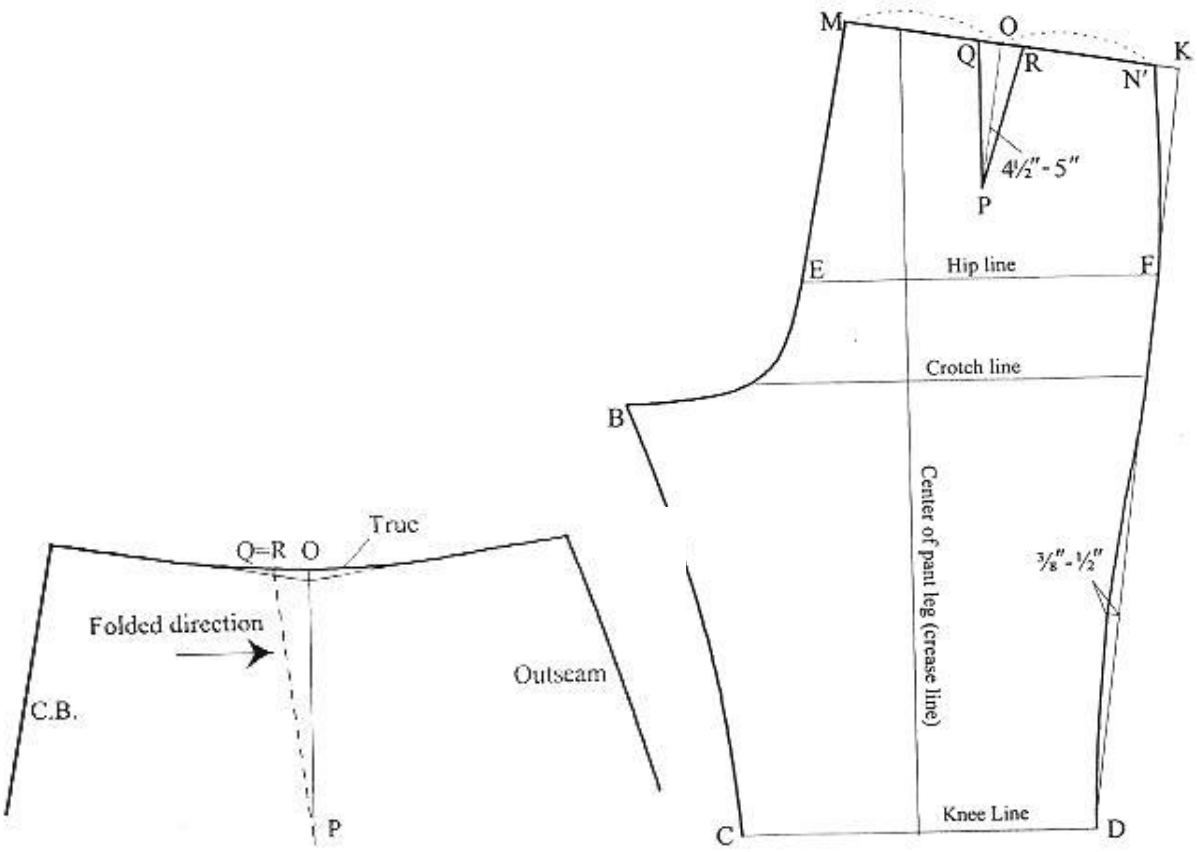


Figure 34: Back Dart

Waistband Draft

- A-B = {(Waist circumference/4) + $^{1}/_{4}$" ease} + {(Waist circumference/4) + $^{1}/_{8}$" ease}.
- B-C = Waistband width (ex: $1^{1}/_{4}$" - 2").
- Complete the rectangle A-B-C-D; A-D = center front line (C.E), B-C = center back line (C.B.).
- Reflect the rectangle (A-B-C-D) across line B-C to create the other half of the waistband.
- A'-X, D'-Y = Extend $l^{1}/_{2}$" - $2^{1}/_{4}$" (the front extension for the front fly zipper). Complete the rectangle,

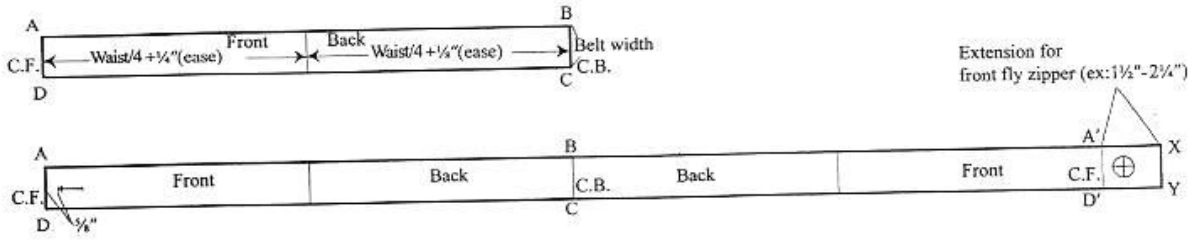


Figure 35: Waist Band Draft

Seam Allowances for Trousers

Examples of seam allowances for trousers

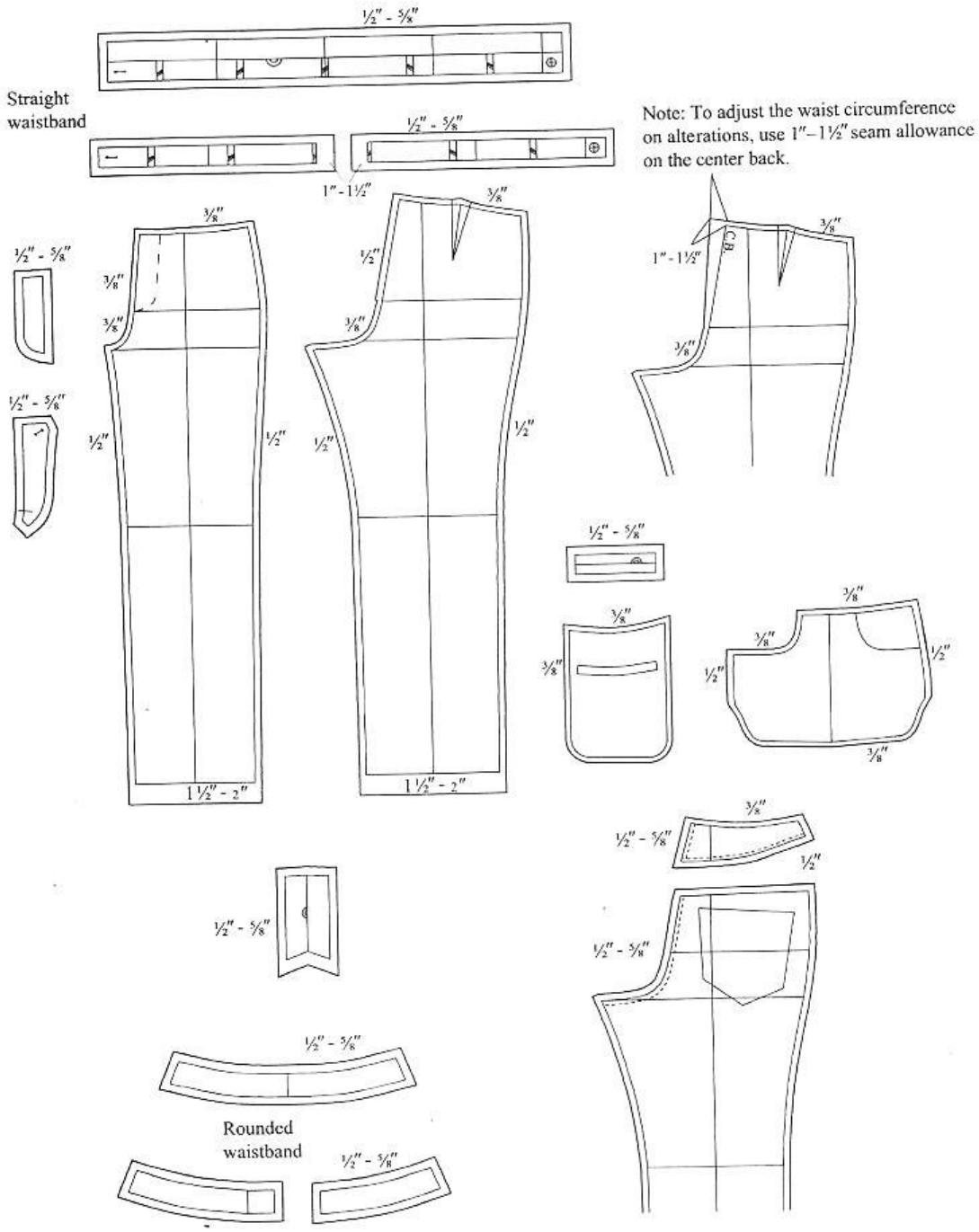


Figure 36: Seam Allowances for Trousers

Phase 4: This involved:

i. Construction of shirt, jacket and trousers (see appendix).

ii. Modeling of the suits by different models small, medium and large categories of adolescents (see appendix).

iii. Selection of judges for assessment based on fit, ease, mobility and aesthetic

   a. Adolescents as model users

   b. By judges who are tailors knowledgeable in clothing and dress makers.

3.6 Procedure for Data Analysis

Different methods were adopted for data analysis based on the type of instruments used for the study. Generally, descriptive statistics were employed for analyzing the data. Detailed approaches to the treatment of data were as follows;

1. Questionnaire on adolescents' body characteristics and classification was analysed using relative frequencies and percentages.
2. The body measurement chart for drafting patterns in three sizes categories of small, medium and large were analysed using means and standard deviations.
3. For the 4-point assessment criteria chart for adolescent model, a standard mean of 2.0 was used to determine the wearing fit, ease, mobility and aesthetics.
4. For the 4-point assessment criteria chart for judges, a standard mean of 2.0 was also adopted as decision mean since a 4-point rating scale was used by the judges for assessing clothing fit standards. Mean score of 2.0 and above was accepted as satisfactory on the questionnaire and any mean score below 2.0 was not accepted as satisfactory.

5. Analysis of Variance (ANOVA) was applied to test the null hypothesis at 0.05 level of significance to determine if significance differences existed among the three size categories of small, medium and large users of the functional suits.
6. All data obtained through the research questions were analysed using the Statistical Package for Social Sciences (SPSS) version 20.

CHAPTER FOUR

PRESENTATION OF ANALYSIS AND DISCUSSION OF RESULTS

The focus of this study was the development of patterns for mass production of suits for adolescents in Benue State. The data collected for this study were analysed and presented in four stages based on the research question and hypothesis that guided the study. The findings of the study were presented in the following sub-headings:

4.1 Answer to research questions.

4.2 Testing of research hypotheses

4.3 Summary of major findings

4.4 Discussion of findings

4.1 Answers to Research Questions.

Research question One: What are the body characteristics of adolescents in Benue State, Nigeria?

In order to answer this research question 1, frequency and percentages was used to answer this research questions and presented in Table 4.1

Table 4.1 Perception of respondents on body characteristics of adolescents

S/N	Body characteristics	Frequency	Percentage %
1	Adolescents of average body build, neither tall nor short	33	11
2	Adolescents with bow legs or k-legs	12	4
3	Short and thin adolescents	27	9
4	Short and stout adolescents	21	7
5	Adolescents with large shoulder and chest	30	10
6	Adolescents with short legs or very long legs	14	4.7
7	Adolescents with short neck or with long neck	46	15.3
8	Adolescents that are lean or slim	53	17.7
9	Adolescents with more muscle body physique	33	11
10	Adolescents with robust body physique	31	10.3
	Total	**300**	**100**

Table 4.1 revealed that majority of adolescents are lean and slim which has the highest frequency (53) of body characteristics representing 17.7% in Benue State. This was followed by adolescents that had short neck and long neck with frequency of 46(15.3%). Adolescents with bow leg or k-legs had the lowest frequency of 12 representing 4%.

Research Question Two: What are the categories of adolescents based on their sizes of small, medium and large?

To answer this research question, standard body measurements of adolescents were taken in size categories of small, medium and large in the height range of 130cm – 150cm and presented in table 4.2.

Table 4.2: Categories of adolescents body measurement based on small, medium and large (Height 130 – 150cm).

Variables	Small	Medium	Large
Neck	31.7	35.3	37.0
Chest	79.8	86.9	91.2
Scye depth	19.6	22.5	24.4
Natural waist	39.9	44.9	46.8
Half back	15.8	18.2	20.3
Length	64.6	69.5	79.8
Arm circumference	33.8	36.1	38.9
Wrist	18.9	21.2	22.3
Under arm	42.1	45.1	48.1
Hip/seat	71	92	81.9
Waist	56	76	77.4
Body rise/crotch	17	22	28.7
Inside leg	58	81	72.3
Ankle	32	40	43.4
Knee length	38	56	66.2
Full length	76	102	105.1
Thigh	41	58	60.7

Table 4.2 revealed that the widest distribution values of body categories among the three size groups of adolescent males are found on the chest width, hip, natural waist and length. The range for chest measurements had a minimum of 79.8cm to maximum of 91.2cm. The range for nape to waist length was from 53.5cm minimum to 61.7cm maximum. The

range for arm circumference had a minimum of 33.8cm to maximum of 38.9cm. The least range from the table is the wrist measurement which had a minimum of 18.9cm to maximum of 22.3cm.

Research Question Three: What are the Average body measurement in size categories of small, medium and large?

In order to answer this research question, needed parts of body measurements were taken, that is chest, waist, length, half back, sleeve, trouser length and others. The average body measurement were established. The analysis were presented in Tables 4.3, 4.4 and 4.5.

Table 4.3: Average body measurement of small-sized adolescents (N = 40).

Shirt, Jacket & Trouser	Minimum		Maximum		Mean		SD
Measurements	**Inches**	**Cm**	**Inches**	**Cm**	**Inches**	**Cm**	
Chest	26	66	33	78	30	72	±3.78
Waist	23	58	25	64	24	61	±4.8
Neck size	11	28	12	31	10	26	+0.7
Half back	13	33	15	39	11	29	±3.6
Length	19	48	23	59	20	51	±1.2
Sleeve Measurements							
Over-arm	16	41	19	49	18	46	±4.7
Under arm	11	28	14	36	15	39	±10
Arm circumference	9	23	11	28	10	26	±0.9
Wrist circumference	6	15	8	21	7	18	±4
Trouser Measurements							
Waist	20	51	23	59	22	56	±3.74
Hip/seat	26	67	28	72	27	69	±4.4
Ankle	12	31	14	36	14	36	±1.8
Crotch	5	13	7	18	6	15	±1.5
Inside leg seam	20	51	24	61	22	56	±4.8
Thigh	14	34	16	41	15	38	+1.6
Length	21	54	25	64	23	59	±5

Table 4.3 showed the average body measurements required for constructing shirts, jackets and trousers for small-sized adolescents. The table revealed the analysis of maximum and minimum measurements and the standard deviations which indicates the range for alterations to achieve good fit. Having established the mean body measurements for the small-sized adolescents, the researcher used the measurements for drafting the basic blocks pattern for shirts, jackets and trousers.

Table 4.4: Average body measurement of medium-sized adolescents (N = 40).

Shirt, Jacket & Trouser	Minimum		Maximum		Mean		SD
Measurements	**Inches**	**Cm**	**Inches**	**Cm**	**Inches**	**Cm**	
Chest	28	72	30	77	29	74	±3.78
Waist	21	53	24	61	27	69	±4.8
Neck size	10	26	12	31	11	28	+0.4
Half back	13	33	15	38	14	36	±1.6
Length	20	51	23	59	22	56	±4.2
Sleeve Measurements							
Over-arm	19	49	21	54	20	51	±0.7
Under arm	15	38	18	46	13	33	±2.5
Arm circumference	10	26	12	31	12	31	±1.9
Wrist circumference	8	20	9	23	9	23	±1.7
Trouser Measurements							
Waist	21	54	22	56	26	66	±4.7
Hip/seat	27	69	30	77	28	72	±2.2
Ankle	13	34	15	39	16	41	±2.6
Crotch	6	15	8	20	7	18	±1.9
Inside leg seam	22	56	24	61	23	59	±3.2
Thigh	16	41	19	49	18	46	+2.0
Length	25	64	28	71	27	69	±3.4

Table 4.4 revealed the average body measurements of medium sized adolescents. The mean body measurement were used for drafting the basic blocks for shirts, jackets and trousers.

Table 4.5: Average body measurement of large-sized adolescents (N = 40).

Shirt, Jacket & Trouser	Minimum		Maximum		Mean		SD
Measurements	**Inches**	**Cm**	**Inches**	**Cm**	**Inches**	**Cm**	
Chest	30	76	33	84	31	79	3.1
Waist	22	56	25	64	28	71	3.2
Neck size	11	28	14	36	13	33	0.4
Half back	14	36	17	43	15	38	1.0
Length	21	54	23	59	22	56	2.4
Sleeve Measurements							
Over-arm	20	51	22	56	21	51	0.8
Under arm	16	41	18	46	17	43	1.2
Arm circumference	11	28	13	33	12	31	1.8
Wrist circumference	9	23	10	26	9	23	1.5
Trouser Measurements							
Waist	28	71	29	74	28	71	4.7
Hip/seat	30	77	32	82	31	79	2
Ankle	14	36	15	38	14	36	0.9
Crotch	7	18	8	20	8	20	4
Inside leg seam	24	61	26	66	25	64	3.4
Thigh	17	43	19	64	18	46	2.8
Length	26	66	28	72	27	69	4.8

Table 4.5 also shows the established average body measurements for large-sized adolescents. Mean measurements were applied for drafting block patterns for shirts, jackets and trouser with standard deviations which provides range for alterations to achieve good fit.

Research Question Four: How can the three different suits be constructed for the sizes of small, medium and large?

To answer this research question, shirts, jacket and trousers were constructed for small, medium and large size categories.

Construction procedures

Three sets of complete suits consisting of shirts, trousers and jackets in three size categories of small, medium and large were constructed for the three models of adolescents. Design specifications were adhered to in constructing the prototype suit using the average measurements shown in the appendix. The production of garments were carried out by the researcher using the generally acceptable sewing techniques adopted by Myoungok and Injoo (2014). The unit method of assembling different parts of the clothes into a fitting garment was adopted to sew the shirts, trousers and jackets.

Construction Directions for Shirts

Three sets of shirts for adolescents were constructed in small, medium and large size categories. The strategy adopted was getting all the required units of the shirts ready before assembling them into garments. The following steps were taken:

a. Transfer all pattern markings to the cloth
b. Neaten all cut edges with over locking stitches
c. Sew darts on front and back shirt sections
d. Prepare the sleeve and the cuffs
e. Carefully prepare the collars
f. Prepare the pockets and the flaps
g. Tack and stitch the flaps unto front bodice parts that were marked
h. Press the flaps down an topstitch some $^{1}/_{5}$ inch [6 mm] away from the stitching line

i. Attach the pockets at the marked places and topstitch 6 mm from the stitch line.

Directions for the yoke unit

The yoke is the fitted part of the garment, usually around the shoulders. The following steps were taken:

a. The yoke was tacked and stitched to the upper edge of the front and back bodice shirt ensuring that the right sides are together.
b. Back stitch the seam ends and overcast seam alloweances together pressing them into the yoke.
c. From the right side, stitch the edge of yoke along its seam line and pressing about 6 mm to secure the seam allowances.

Construction directions for the sleeve unit

a. The sleeve was basted with long loose stitches in order to hold pieces of material together temporarily.
b. Stitch the sleeves to arm holes ensuring right sides together.
c. Match sleeve underarm and shirt side seams
d. Match also the notches at sleeve cap and shoulder marks on the yoke.
e. Overcast seam allowances together and press into sleeves
f. Gather the lower sleeve edges and use the machine to baste each side of the marked seamline.
g. Press seam allowances into cuffs and trim.
h. Press all cuff edges and baste into place over the attachment seam.
i. From the right side of shirt, edge-stitch along the entire cuff edges to secure the inner layer of each.

Directions for the Collar Unit

All collar drafts had 0.4 inch (1 cm) seam allowance in the construction measurements.

a. Stitch right sides of collar pieces together and the wrong sides along un-notched edges.
b. Clip seam allowance and trim corners.
c. Turn collar right sides out and baste.
d. Press and top-stitch seamed edges to secure the edges
e. Baste the open edges together and stitch stand pieces together to catch the collar
f. Trim and clip allowances, notch the curves and press seamed edges into stand.
g. From the right side of shirt, edge-stitch along all stand-edges securing the inner layer.

Directions for the buttons and button holes

a. Work button holes into the right opening edge and collar end as marked.
b. Sew the buttons onto left opening edge and collar stand en.
c. Work button holes into cuffs as marked.
d. Sew buttons into cuffs.

Construction directions for trousers

a. Mark right side (RS) and wrong side (WS) of pattern pieces.
b. Baste and stitch right front to right back of trousers at the inside leg edges.
c. Baste and stitch left front to left back of trousers at the inside leg edges.
d. Baste and stitch crotch seam to match inside leg seams.
e. Stitch again about ¼ inch (6 mm) away in seam allowance between notches.
f. Trim seam allowance between notches to $^{2}/_{5}$ inch (1 cm)

g. Pin and baste back to front at sides, matching notches and circles.

h. Start from the lower trouser leg notch to stitch front to back at side seams.

i. Press, clip seams to stitching at curve for seam to lie flat.

Directions for the Darts

a. Match the stitching lines, take $^{3}/_{5}$ inch (1.5 cm) seam allowance and stitch darts in front trousers from upper edge; taper the stitching at dart ends.

b. Press towards the centre front and stitch upper edge of front trousers.

c. Match stitching lines of the back trousers and stitch darts in back trouser pieces.

d. Press towards centre back and stitch upper edge of the back trousers.

Directions for the zipper or Fly Front Opening

a. Mark the stitching line on the upper edge of opening on the right hand side of trousers front about 1 inch (2.5 cm) away from the edge.

b. Seam trouser fronts together from the crotch to opening.

c. Fold and baste the under edge of the opening $^{1}/_{8}$ inch (0.3 cm) outside the centre front line in the turning allowance. This gives a $^{1}/_{8}$ inch (0.3 mm) lap when the zipper is inserted. Press the fold.

d. Place the zipper behind the back edge of the opening with the fold up to the teeth and the top ¼ inch (6 mm) below the placket.

e. Tack and machine it in place using zipper that is about 12 inches (30 cm) long.

f. Lay the front edge flat over the zipper, pin and baste fold in place. Tack through the front of the opening to the zipper about $^{2}/_{5}$ inch (1 cm) away from the fold.

g. Machine-stitch on the tacking straight across the base. Trim down the turnings of the trousers on the wrong side; remove all tackling and press.

h. Change to the right side and machine-stitch through the trousers following the stitching lines including the free edges at the bottom of the opening on the wrong side.

i. Neaten cut edges and strengthen the zipper opening on the right side above the base of the opening.

Directions for the Waist Band

a. Fold and cut the waist band lengthwise with the right side inside and close to the 2 ends and machine-stitch.

b. Turn the right side of the fabric out; trim the turnings and tack seams and the fold in position.

c. Tack through the centre and press the waist band in place.

d. Attach the band to the waist edge of the trouser with overlaid seam; fasten the end of the band with a button and provide a button hole.

e. Provide 1 inch (2.54 cm) elastic at the back waist band for size variations and easy adjustability.

Research Question Six: What are the mean responses of fit, mobility, ease and aesthetic by adolescents?

This research question was answered by the responses of adolescents as models to the questionnaire designed. Analysis done were presented in Tables 4.6, 4.7 and 4.8.

ASSESSMENT BY SMALL SIZE ADOLESCENTS MODELS

Table 4.6: Assessment of wearing fit by small size adolescents models

S/n	Criteria	SM_1	SM_2	SM_3	Total	Mean
1	Collar (Shirt and Jacket)	3	3	3	9	3
2	Chest line ease in front	4**	2*	3	9	3
3	Ease across shoulder in back	4**	2*	3	9	3
4	Waistline	3	3	3	9	3
5	Front chest width	3	3	3	9	3
6	Sleeve cap fullness	2	3	3	8	2.67
7	Front bodice shoulder dart length	2	3	3	8	2.67
8	Waistline placement in back	3	3	2*	8	2.67
9	Hipline	3	3	2*	8	2.67
10	Sleeve length	2*	3	3	8	2.67
11	Ease at biceps	2*	3	3	8	2.67
12	Acceptability and Aesthetics	3.75	3.75	2.5*	10	3.33
	Criteria for trousers					
13	Waistline	3	3	2*	8	2.67
14	Ease at hip level	3	3	2*	8	2.67
15	Trouser full length	2*	3	3	8	2.67
16	Overall comfort of Trousers	3.75	3.75	2.5*	10	3.33
	Mean scores for the wearing fit	**2.91**	**2.96**	**2.69**	**8.56**	**2.86**

Note: * Aspect of the dress 'slightly too tight' causing slight discomfort.
** Aspect of the dress 'slightly too much' causing slight discomfort.

Evidence from Table 4.6 attests to the fact that the models found their dresses comfortable to wear. The mean score for all the three size categories is 2.86 which lies within the interval of 2.60 to 3.35 that denotes 'Satisfactory' or 'Comfortable'.

Table 4.7: Assessment of wearing comfort by small size adolescents models

S/n	Criteria	SM_1	SM_2	SM_3	Total	Mean
1	Collar (Shirt and Jacket)	3	3	3	9	3
2	Waistline	3	3	3	9	3
3	Front chest width	3	3	3	9	3
4	Front bodies shoulder dart length	2*	3	3	8	2.67
5	Waistline placement in back	3	3	2*	8	2.67
6	Hipline	3	3	2*	8	2.67
7	Sleeve length	2*	3	3	8	2.67
8	Trouser full length	2*	3	3	8	2.67
9	Trouser waistline	3	3	2*	8	2.67
	Mean scores for the wearing ease	**2.67**	**3.0**	**2.44**	**8.33**	**2.78**

Note: * Aspect of the dress 'slightly too tight' causing slight discomfort.

From Table 4.7, the overall mean for the wearing fit is 2.78 and this interpreted to imply "satisfactory". Thus, one can discern that the models in the small size category had no problems with the fit of their shirts and jackets. However, the same cannot be said about the fit of the trousers particularly with regards to the waisteline, the hipline and the length for the first and the third models (SM_1 and SM_3).

Table 4.8: Assessment of wearing ease and mobility by small size adolescents models

S/n	Criteria	SM_1	SM_2	SM_3	Total	Mean
1	Chest line ease in front	4**	2*	3	9	3
2	Ease across shoulder in back	4**	2*	3	9	3
3	Ease at hip level	3	3	2*	8	2.67
4	Front bodies shoulder dart length	2*	3	3	8	2.67
5	Ease at biceps	2*	3	3	8	2.67
	Mean scores for the wearing mobility and aesthetic	**3.0**	**2.6**	**2.8**	**8.4**	**2.8**

Note: * Aspect of the dress 'slightly too tight' causing slight discomfort.

The wearing ease was also assessed along with the mobility provided by the garments. From Table 4.8, it could be seen that the shirt and jacket were slightly too loose on the first model at the chest line and shoulder but slightly too tight for the second model. It is also apparent that the third model experienced some difficulty as regards mobility since the trouser seemed rather too tight at the hip level. A similar difficulty was experienced by the first model whose trouser was slightly too tight at the thighs. Nevertheless, the overall mean score for the wearing ease and mobility was 2.8 which was translated as 'satisfactory'.

Table 4.9: Assessment of Acceptability and Aesthetics by small-sized adolescents

S/n	Criteria	SM_1	SM_2	SM_3	Total	Mean
1	Overall acceptability for shirt	3.75	3.75	2.5	10	3.33
2	Overall acceptability for jackets	3.75	3.75	2.5	10	3.33
3	Overall acceptability for trousers	3.75	3.75	2.5	10	3.33
	Mean scores for the wearing mobility and aesthetic	**3.75**	**3.75**	**2.5**	**10.0**	**3.33**

Note: * Aspect of the dress 'slightly too tight' causing slight discomfort.

The mean score for acceptability and aesthetics of the garments by the adolescent models was 3.33 as indicated in Table 4.9. It suggests that the models were generally satisfied with the suits. However, the table also showed that while the first and second models in the small size category fully accepted their garments, the third model had some reservations either because of the wearing discomforts of the garments or due to their poor aesthetic quality in terms of colour of the fabric.

ASSESSMENT BY MEDIUM-SIZED ADOLESCENTS MODELS

Table 4.10: Assessment of wearing fit by medium-sized adolescents models

S/n	Criteria for Shirt	SM_1	SM_2	SM_3	Total	Mean
1	Collar (Shirt and Jacket)	3	3	3	9	3
2	Chest line ease in front	3	3	3	9	3
3	Ease across shoulder in back	3	3	2*	8	2.67
4	Waistline	3	3	3	9	3
5	Front chest width	3	3	3	9	3
6	Sleeve cap fullness	2*	3	3	8	2.67
7	Front bodice shoulder dart length	2*	3	3	8	2.67
8	Waistline placement in back	3	3	2*	8	2.67
9	Hipline	3	3	2*	8	2.67
10	Sleeve length	4**	3	3	10	3.33
11	Ease at biceps	3	3	3	9	3
12	Acceptability and Aesthetics	2.5*	3.75	3.75	10.0	3.33
	Criteria for trousers					
13	Waistline	3	3	3	9	3
14	Ease at hip level	3	3	3	9	3
15	Trouser full length	2*	3	3	8	2.67
16	Overall comfort of Trousers	3.75	3.75	3.75	11.25	3.75
	Mean scores for the wearing fit	**2.89**	**3.09**	**2.91**	**8.89**	**2.96**

Note: * Aspect of the dress 'slightly too tight' causing slight discomfort.
** Aspect of the dress 'slightly too much' causing slight discomfort.

Among the medium-sized adolescents, as could be observed from Table 4.10, there were cases of slight discomfort accounted for by the material being slightly too tight particularly at the chest line and across the shoulder in the back in one case and in the waistline and trouser length in other cases.

Table 4.11: Assessment of wearing comfort by medium-sized adolescents

S/n	Criteria	SM_1	SM_2	SM_3	Total	Mean
1	Collar (Shirt and Jacket)	3	3	3	9	3
2	Waistline	3	3	3	9	3
3	Front chest width	3	3	3	9	3
4	Front bodies shoulder dart length	3	3	2	8	2.67
5	Waistline placement in back	3	3	3	9	3
6	Hipline	3	3	2*	8	2.67
7	Sleeve length	4**	3	3	10	3.33
8	Trouser full length	2*	3	3	8	2.67
9	Trouser waistline	3	3	3	9	3
	Mean scores for the wearing mobility and aesthetic	**3.0**	**3.0**	**2.78**	**8.78**	**2.93**

Note: * Aspect of the dress 'slightly too tight' causing slight discomfort.
** Aspect of the dress 'slightly too much' causing slight discomfort.

Table 4.11 revealed that the mean score for wearing comfort was 2.93 which implied general satisfaction expressed by the models. However, it was observed that while the sleeve length was too long for the first model, the trouser length fits the legs. The second model has no problems wearing the garment. The third model, on the other hand, needed an increase in the alterations of his shoulder darts to achieve wearing comfort which was done.

Table 4.12: Assessment of wearing ease and mobility by medium size adolescents models

S/n	Criteria: Wearing Ease and Mobility	SM_1	SM_2	SM_3	Total	Mean
1	Chest line ease in front	3	3	3	9	3
2	Ease across shoulder in back	3	3	2*	8	2.67
3	Ease at hip level	3	3	3	9	3
4	Front bodies shoulder dart length	2*	3	3	8	2.67
5	Ease at biceps	3	3	3	9	3
	Mean scores for the wearing mobility and aesthetic	**2.8**	**3.0**	**2.8**	**8.6**	**2.87**

Note: * Aspect of the dress 'slightly too tight' causing slight discomfort.

Table 4.12 depicts the analysis of the wearing ease and mobility provided by the prototype suits for medium-size adolescents model. The mean score for the wearing ease/mobility is 2.87 which is an indication of satisfactory expression. Yet it could be seen that the shirt and jacket were slightly large for the third model.

Table 4.13: Overall Assessment of Acceptability of suits by medium-sized models

S/n	Criteria	SM_1	SM_2	SM_3	Total	Mean
1	Overall acceptability for shirt	2.5	3.75	3.75	10.0	3.33
2	Overall acceptability for jackets	2.5	3.75	3.75	10.0	3.33
3	Overall acceptability for trousers	3.75	3.75	3.75	11.25	3.75
	Mean scores for the wearing mobility and aesthetic	**2.92**	**3.75**	**3.75**	**10.41**	**3.47**

Note: * Aspect of the dress 'slightly too tight' causing slight discomfort.

The mean score for acceptability of the garments by the three medium-sized models was 3.47 as indicated in Table 4.13. It suggest that the models generally accepted the suits as satisfactory.

ASSESSMENT BY LARGE-SIZED ADOLESCENTS MODELS

Table 4.14: Assessment of wearing fit by large-sized adolescents models

S/n	Criteria for Shirt	LM_1	LM_2	LM_3	Total	Mean	Remarks
1	Collar (Shirt and Jacket)	2*	3	3	8	2.67	Satisfactory
2	Chest line ease in front	3	3	3	9	3	Satisfactory
3	Ease across shoulder in back	2*	3	3	8	2.67	Satisfactory
4	Waistline	3	3	2*	8	2.67	Satisfactory
5	Front chest width	3	3	3	9	3	Satisfactory
6	Sleeve cap fullness	4**	3	3	10	3.33	Satisfactory
7	Front bodice shoulder dart length	4**	3	3	8	3.33	Satisfactory
8	Waistline placement in back	3	3	2*	8	2.67	Satisfactory
9	Hipline	3	3	2*	8	2.67	Satisfactory
10	Sleeve length	3	3	3	10	3.33	Satisfactory
11	Ease at biceps	3	3	3	9	3	Satisfactory
12	Acceptability and Aesthetics	3.75	3.75	3.75	11.3	3.75	Acceptable
	Criteria for trousers						
13	Waistline	3	2	3	8	2.67	Satisfactory
14	Ease at hip level	3	3	3	9	3	Satisfactory
15	Trouser full length	2*	3	3	8	2.67	Satisfactory
16	Overall comfort of Trousers	3.75	2.5	3.75	10	3.33	Comfortable
	Mean scores for the wearing fit	**3.03**	**2.95**	**2.91**	**8.83**	**2.98**	Satisfactory

Note: * Aspect of the dress 'slightly too tight' causing slight discomfort.
** Aspect of the dress 'slightly too much' causing slight discomfort.

Data from the assessment criteria administered to the large category of adolescents were analysed in a similar manner as the other size categories. These are depicted in Table 4.14.Evidence from the table showed that sufficient allowances had been made for the garments of the large-sized adolescents at the waist line and hip line in both the shirt/jacket

and the trouser. This is because the allowances are necessary to take care of their future increase in size body proportion till they reach adults.

Table 4.15: Assessment of wearing fit by large-sized adolescents

S/n	Criteria	LM_1	LM_2	LM_3	Total	Mean	Remarks
1	Collar (Shirt and Jacket)	2	3	3	8	2.67	Satisfactory
2	Waistline	3	3	2	8	2.67	Satisfactory
3	Front chest width	3	3	3	9	3	Satisfactory
4	Front bodies shoulder dart length	4	3	3	8	3.33	Satisfactory
5	Waistline placement in back	3	3	2	8	2.67	Satisfactory
6	Hipline	3	3	2	8	2.67	Satisfactory
7	Sleeve length	3	3	3	10	3.33	Satisfactory
8	Trouser full length	2	3	3	8	2.67	Satisfactory
9	Trouser waistline	3	2	3	8	2.67	Satisfactory
	Mean scores for the wearing fit	**2.89**	**2.89**	**2.67**	**8.33**	**2.85**	Satisfactory

Note: * Aspect of the dress 'slightly too tight' causing slight discomfort.
** Aspect of the dress 'slightly too much' causing slight discomfort.

On the assessment of the wearing fit, data in Table 4.15, the mean scores of the large-sized models found to be 2.85 for wearing fit which gives a general impression of satisfaction with the prototype garments. However, more critical analysis shows that the front bodice shoulder dart for the first model (LM_1) was slightly too long.

Table 4.16: Assessment of wearing ease and mobility by large size adolescents models

S/n	Criteria: Wearing Ease and Mobility	LM_1	LM_2	LM_3	Total	Mean	Remarks
1	Chest line ease in front	3	3	3	9	3	Satisfactory
2	Ease across shoulder in back	2*	3	3	8	2.67	Satisfactory
3	Ease at hip level	3	3	3	9	3	Satisfactory
4	Front bodies shoulder dart length	4**	3	3	8	3.33	Satisfactory
5	Ease at biceps	3	3	3	9	3	Satisfactory
	Mean scores for the wearing mobility and aesthetic	**3.0**	**3.0**	**3.0**	**8.6**	**3.0**	Satisfactory

Note: * Aspect of the dress 'slightly too tight' causing slight discomfort.
** Aspect of the dress 'slightly too much causing slight discomfort.

Table 4.16 depicts the analysis of the wearing ease and mobility provided by the prototype suits for large-size adolescents model. The mean score for the wearing ease/mobility is 3.0 which is an indication of satisfactory expression.

Table 4.17: Overall Assessment of Acceptability of Suits by Large-Sized Models

S/n	Criteria	LM_1	LM_2	LM_3	Total	Mean
1	Overall acceptability for shirt	3.75	3.75	3.75	11.25	3.75
2	Overall acceptability for jackets	3.75	3.75	3.75	11.25	3.75
3	Overall acceptability for trousers	3.75	2.5	3.75	10	3.33
	Mean scores for acceptability and aesthetics	**3.75**	**3.33**	**3.75**	**10.83**	**3.61**

The mean score for acceptability of the garments by the three large-sized models was 3.61 as indicated in Table 4.17. By the interpretation of the data, this figure suggests that the models found the suits generally acceptable.

Research Question Seven: What are the mean responses on fit, mobility, ease and aesthetic by judges?

Table 4.18: Judges mean scores on clothing fit, mobility, ease and aesthetics

S/n	Criteria for Shirt/jacket	Small size	Medium size	Large size	Total	Mean	Remarks
1	Collar	3.33	3.33	3.33	9.99	3.33	Satisfactory
2	Front neck depth	3.33	3	3	9.33	3.11	Satisfactory
3	Shoulder seam length	3.00	3	3	9.00	3	Satisfactory
4	Should slope	3.00	1.67*	3	7.67	2.56	Satisfactory
5	Front chest width	2.67	3	3	8.67	2.89	Satisfactory
6	Chest line ease	2.33	3	2.67	8.00	2.67	Satisfactory
7	Waist line ease	2.67	3.33	2*	8.00	2.67	Satisfactory
8	Front bodies waistline dart length	3.33	4.33**	3.67	11.33	3.78	Satisfactory
9	From bodies waistline dart size	3.33	3	3	9.33	3.11	Satisfactory
10	Back bodies waistline length	3	3	3	9.00	3	Satisfactory
11	Back bodies waistline dart length	3	3	3	9.00	3	Satisfactory
	SLEEVE						Satisfactory
12	Sleeve length	2.33	2.33	3	7.66	2.55	Satisfactory
13	Ease at biceps	3	3	3	9.00	3	Satisfactory
14	Arm circumference	2.67	4**	2.67	9.34	3.11	Satisfactory
	TROUSERS						Satisfactory
15	Trousers topside full length	2.67	3.67	2.67	9.00	3.00	Satisfactory
16	Underside length	3	3	3	9.00	3	Satisfactory
17	Pocket size and facing	3	3	4**	10.	3.33	Satisfactory
18	Fly piece length	3	3	3	9.00	3	Satisfactory
19	Trouser seat depth	3	3	3	9.00	3	Satisfactory
20	Ease at thigh level	3	3	3	9.00	3	Satisfactory
21	Trouser leg width	3.33	3	1.67*	8.00	2.67	Satisfactory
22	Hem line	3	2.33*	3	8.33	2.78	Satisfactory
23	Waistline ease	2.67	3	2.67	8.34	2.78	Satisfactory
24	Ease at hip level	3.33	3	1.67	8.00	2.67	Satisfactory
25	Overall aesthetics	2.67	3	3.67	10.3	3.45	Satisfactory
26	Wearing comfort	3	3	2.67	8.67	2.89	Comfortable
27	mobility	2.67	3	2.67	8.34	2.78	Comfortable
	TOTAL	**74.66**	**73.32**	**74.69**	**222.7**	**74.45**	
	MEAN	**2.99**	**2.93**	**2.99**	**8.91**	**2.98**	Satisfactory

Note: * Aspect of the dress ‘slightly too tight’ causing slight discomfort.
** Aspect of the dress ‘slightly too much’ causing slight discomfort.

Table 4.18 revealed that the mean responses of the 13 judges who used the assessment criteria for judges to evaluate the utility value of the suits. The judges were selected on the basis of their knowledgeability in clothing and textile. The judges rating of the clothing fit of the prototype suit for adolescents was generally satisfactory since their mean score of 2.98 is within the range of 2.60 to 3.35 that is interpreted as 'satisfactory'. Nevertheless, the judges observed that the sleeve lengths for two of the small-sized models were slightly too short. While the clothing fit was generally satisfactory, there were few exceptions.

OVERALL ASSESSMENT OF WEARING FIT, EASE, MOBILITY AND AESTHETICS BY THE THREE MODELS OF ADOLESCENTS AND JUDGES

Table 4.19: Percentage analysis of scores for overall clothing fit by the three categories of adolescents and judges

Criteria for assessment	Assessment by the adolescents			Assessment by the judges		
	Small size	Med. Size	Large size	Small size	Med. Size	Large size
Very comfortable	30.40	30.0	31.12	23.15	53.0	37.2
Comfortable	45.16	50.0	41.10	43.52	30.30	46.13
Slightly uncomfortable	23.33	17.78	24.44	33.33	16.67	16.67
Extremely uncomfortable	1.11	2.22	3.33	0.0	0.0	0.0

The overall assessment of the models and judges were expressed as percentage scores for the clothing fit is depicted in Table 4.19. It is evident that the models scored the wearing comfort and clothing fit with a mean of 77.78% with a wide range of 16.7. The judges referred to overall clothing fit of the prototype suits as generally satisfactory. Their mean score of 21.62 representing 70.86% was interpreted as satisfactory.

4.2 TESTING RESEARCH HYPOTHESES

4.2.1 Null Hypothesis One: There is no significant difference between the mean responses of small, medium and large categories of adolescents on the acceptability of the suits.

In order to answer this research hypothesis, Analysis of Variance (ANOVA) statistical tool was used and presented in Table 4.20 and 4.21

Table 4.20: Assessment of mean responses of adolescents models for acceptability of suits in three size categories of small, medium and large.

	Small	Medium	Large	R (total)	R (mean)
BC	25.76	29.81	34.11		
SM	15.77	17.65	17.82	89.68	29.89
TM	24.90	29.47	33.02	51.24	17.08
C (Total)	66.43	76.93	84.95	87.39	29.13
C (Mean)	22.14	25.64	28.31	228.31	
				Gm =	25.36

Variation of Row Means (Vr):	= 309.84	BC = Body Characteristics
Variation of Column Means (Vc):	= 57.42	SM = Sleeve Measurement
Total variation of Means (V):	= 464.72	TM = Trouser Measurement
Random Variations of Means (Ve):	= 97.46	GM = Grand Mean

Table 4.21: Two-way ANOVA for difference in the mean response of adolescents

Variance	Df	Mean Square	f-ratio	F(table)
Vr = 309.84	2	SSr = 154.92	fr = 6.36	19.25
Vc = 57.42	2	SSc = 28.71	df (2, 4); ($\alpha = 0.05$	
Ve = 97.46	4	SSe = 24.36	fc = 1.18	19.25
V = 464.72	8		df (2, 4); ($\alpha = 0.05$)	

The ANOVA Table 4.21 shows that the obtained F-ratios (6.36 and 1.18) with 2 and 4 degrees of freedom at 0.05 level of significance were far below the table value which was 19.25. The null hypothesis which states that there is no significant difference in the mean response of small, medium and large adolescent models for the acceptability of suits is therefore retained.

4.2.2 Null hypothesis two: There is no significant difference in the mean responses of the adolescents and judges on the clothing fit of the suits**.**

In order to answer this research hypothesis, Analysis of Variance (ANOVA) statistical tool was used and presented in Table 4.21

Table 4.22: Comparison of Clothing Fit by Three Size Categories of Models

Category	Model 1	Model 2	Model 3	R (total)	R (mean)
Small-sized	2.91	2.96	2.69	8.56	2.85
Medium-sized	2.89	3.09	2.91	8.89	2.96
Large-sized	3.03	2.95	2.91	8.89	2.96
C (Total)	8.83	9.00	8.51	GT=26.89	
C (Mean)	2.94	3.00	2.84		
				Gm =	2.926

Variation of Row Means (Vr): = 0.024

Variation of Column Means (Vc): = 0.039

Total variation of Means (V): = 0.097

Random Variations of Means (Ve): = 0.034

Table 4.23: Two-way ANOVA for difference in the mean response of judges

Variance	Df	Mean Square	f-ratio	F(table)
Vr = 0.024	2	SSr = 0.0120	fr = 1.41	19.25
Vc = 0.039	2	SSc = 0.0195	df (2, 4); ($\alpha = 0.05$)	
Ve = 0.034	4	SSe = 0.0085	fc = 2.29	19.25
V = 0.097	8		df (2, 4); ($\alpha = 0.05$)	

The ANOVA Table 4.21 shows that the obtained F-ratios (1.41 and 2.29) with 2 and 4 degrees of freedom at 0.05 level of significance were far below the table value which was 19.25. The null hypothesis which states that there is no significant difference in the mean response of adolescents and judges on the clothing fit of the suits of the three sizes of adolescents is therefore retained.

4.4 Summary of Major Findings

1. The findings from the study revealed that adolescents with body characteristics of slim bodies has the highest perception by the respondents representing 17.7%, followed by adolescents with short and long necks representing 15.3%. adolescents with bow legs or k-legs had the least body perception reprinting 4% (See Table 4.1).
2. The widest distribution of body categories among the three sizes of small, medium and large from the findings include; chest measurement (79.8 – 91.2 cm) range, hip (71 – 81 cm) range, natural waist (39.9 – 46.8 cm) range, legs (58 – 72 cm) range. The least measurement was found to be the wrist with a minimum of (18-9 – 22.3 cm) range. (See Table 4.2)
3. The established average body measurement were used for the constructed suit for the three size categories of small, medium and large adolescents. The set of completed suits consisted shirts, jackets and trousers in the three size categories for male adolescents. The design and specifications for clothing construction were followed in constructing the prototype set of suits. (See Appendix G).

4. The overall assessment of wearing fit, ease, mobility and aesthetic of the suits by adolescents models had a mean score of 16.7 representing 77.78%. This signifies general acceptability of the suit. (See Table 4.19).
5. The overall assessment by judges on clothing fit, ease, mobility and aesthetic of the prototype suits on adolescents was generally satisfactory with a mean score of 21.63 representing 70.86%. (See Table 4.19).
6. The null hypothesis which states that there is no significant difference in mean responses of small, medium and large categories of adolescents for the acceptability of the suits was retained.
7. The null hypothesis of no significant difference in the mean responses by adolescents and judges on clothing fit of the suits was also retained.

4.5 Discussion of Results

The findings on the body characteristics of adolescents revealed that adolescents with slim or thin bodies had the highest rating by the respondents representing 17.7%. This was followed by adolescents with bow legs or k-legs. The bow or k-leg was prominent in adolescents because they have not attained final growth. This findings is in agreement with Aldrich (2006), that the average boy starts growth at the age of thirteen and grows rapidly until the age of fifteen, then more slowly until he is seventeen. The finding suggests that at this growth spurt, adolescents become thinner but gain more muscle. In some adolescents, before puberty, leg length grows faster than trunk. During the period of peak growth, the trunk grows faster than the limbs. The amount of ease shown on specific areas of measurement chart are the average amounts allowed for fabrics of moderate thickness. Shaolong and Igbo, 2009 noted that the ease is for free movement of the body.

The established average body measurements of adolescents were used to construct the three set of suits for the three size categories of small, medium and large. The findings revealed that jacket had more ease than shirt and trouser measurements. All circumference measurements have ease added to allow room for the suits to fit comfortably. This was in line with the writing of Ogla and Adams (2006) that ease is necessary at sleeve head to allow arm to move freely, at sleeve length to allow the elbow to bend and at crotch depth to allow ease of movement in trousers. The drafted patterns using the body measurement were placed over the body to check the balance on centre front, center back and side seams. Adjustments were made on patterns until it hangs perfectly plumb, straight up and down without twisting to front or back. This findings is in support of the findings of Shailong and Igbo (2009), that patterns should be fitted over tight-fitting clothing on the body to check fitting alignments. The authors stated that because patterns are made on the half, only one-half of the body will be fitted to check balance. The measurement of back armhole of sleeve is 1.5cm longer than the front armhole and the center back pattern of shirt is 2.5cm longer than the center front. This is because the body is always bent to front position thereby stretching the back clothes forward.

The study also revealed that back trouser pattern had more width of 7.5cm than the front trouser pattern. The back trouser pattern had waist line measurement raised to 3.5cm at center back to take care of hip. This is because leg movements are usually forward but rarely backward. This findings was in line with support of Ogla and Adam (2006) in their study that trousers are sized by the waist measurement.

The findings revealed that symbols or marks on the patterns help an individual to identify each pattern piece. The long arrow at the middle of pattern piece means place on

straight gain of fabric. The bent arrows on the edge of pattern means place on fold. Broken lines on patterns signify seam allowance while the row of stitches is the stitching line. Notches means matching edges and darts at folds of fabrics to take care of fullness, (Igbo, 2003). When laying out the pattern on the fabrics, it was prepared on the wrong side of the fabric. This makes it easy to transfer pattern makings and to protect fabric from soiling. The wrong side of the fabric were carefully identified and marked with tailors chalk to help notice the layers.

The findings revealed that fabrics were folded along the lengthwise grain, selvedge to selvedge and in line with cross grain alignment. The entire pattern pieces were pinned in place. The pattern pieces were pressed with dry iron to remove any creases. The fabrics were cut according to pattern layout. A cheap light weight fabrics was used as trial for fitting garment before actual cutting of fashion fabrics. The sewing techniques in these work was the transferring of style lines onto the other layer of fabrics. This was followed by fixing of dart positions, pockets and general sewing and ironing the different sections of garment occasionally. Accessories were attached after the completion of sewing. This is in line with the work of (Lenore and Emma 2005). The overall assessment of wearing fit, ease, mobility and aesthetics of suits by adolescents were generally accepted as comfortable.

One can discern that small size model category had no problem with the fit of their shirts and jackets. However, the same cannot be said about the fit of the trouser particularly with regards to the waistline, the hipline and length for the large size model. Nevertheless, the overall mean score for wearing mobility and aesthetics which was 2.8 was translated as satisfactory. This implies that the neckline have natural curve without stitching line of facing showing on outside. Collar edge lies against coat and under collar is not turned up. It was

found that collar points have the same length and placed equal distance from center front of garment. The shoulders are smooth, no wrinkles. The waistline is in normal indication for position of waistline. Darts were found to be pointing toward the fullest part of bust and end in a sharp point with no bulges. Front chest garment have crosswise yarns parallel to floor without wrinkles or pulling. The center front closing hangs straight down, perpendicular to floor with no swinging toward either side. Buttons and button holes were of the same length, position and on grain line as others. Button holes were neatly done with no fray edges. Zipper closings were flat, smooth, even, narrow and inconspicuous. Only the fly front top of zipper seam stitching showing on outside of garment. Zipper teeth completely hidden when garment is worn. This agreed with the writing of (Ogla and Adam 2006).

Null hypothesis in respect of mean responses of small, medium and large categories of adolescents for acceptability of the prototype suits was retained. The finding is in support of Adrich (2006) that designers of clothes should be aware of the way the adolescents body shape changes at a particular time. Well constructed clothes take account of the adolescents changing shape. The findings in respect of the null hypothesis of no significance difference in the mean responses by the adolescents and judges on clothing of the suits on adolescents accepted.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Summary

This study focused on the development of basic patterns for mass production of suits for adolescents in Benue State, Nigeria. Specifically, the study sought to identity and classify the body characteristics of adolescents, establish average body measurements of adolescents in three size categories of small, medium and large, draft basic suit blocks to fit male adolescents, construct three (3) suits for three (3) size categories, determine the appropriateness of the suits through testing for fit, ease, mobility, acceptability and aesthetics by the adolescents models and the judges, and compare the ratings of the users and the judges. Seven research questions were asked and two null hypothesis were formulated to guide the study. A preliminary survey of 740 adolescents from institutions in Benue State was conducted for classifying them into 3 categories of small, medium and large. Body measurements of 140 adolescents were taken and their average body measurements established.

The research and development design was utilized for the study. Four instruments: a questionnaire, a measurement chart, assessment chart for adolescents models and assessment chart for judges were developed by the researcher were face-validated by 3 experts and were used for data collection. Reliability was ascertained through trial testing of the instruments. The questionnaire was used to answer research questions 1-3. Average body measurements were established by measuring 140 adolescents and was used to draft pattern pieces for adolescents in three size categories of small, medium and large. Three prototype garments namely shirt, jacket and trousers were constructed for the three size categories of the 3

models. Judges knowledgeable in clothing and textiles and the adolescent models rated the constructed suits using assessment criteria charts for clothing fit, wearing ease, mobility, aesthetics and acceptability. Data derived from the study were analysed using frequency and percentages for research question one. Means was used to answer research questions 2-6.

Analysis of Variance (ANOVA) was used for testing the null hypothesis at 0.05 level of significance. Major findings from the study include the identification of body characteristics of adolescents, average body measurements of adolescents and design specifications required for the construction of suits. Three different patterns segregated according to relevant body parts were produced. The models were satisfied with the fit conditions of the prototype suits although alterations or modifications were made in a few areas. The null hypothesis which stated that there is no significant difference in the mean responses of small, medium and large categories of adolescents for acceptability of the suits was retained and the null hypothesis of no significant difference in the mean responses by adolescents and the judges on clothing fit of the suits on adolescents was also retained.

5.2 Conclusion

In the objective one, it was found out that adolescents with slim or thin body characteristics were the highest. This signifies that the adolescents have not yet attained final growth. Body proportions of individuals are not static as a result of changes in shape and development. The shape of human beings vary from one geographical location to another. The body type also vary among different ethnic groups and race to race. Constant field studies on body measurement is necessary as it enables the dress makers to construct garments that fit individuals based on current fashion trend. The clothing wears for children is different from teenagers, adolescents and adults.

From the findings, the areas of body categories of adolescents that have high range of body measurements for small, medium and large include chest measurement, hip, natural waist and legs. These wide ranges of measurement is prominent in the large size categories of adolescents. The older the adolescents, the more matured body because of muscle development. Garments tends to fit a more developed body shapes than the less developed. Good fitted garments depends on the accurate body measurement by individual, professional pattern drafting and good tailoring techniques. If this processes were not followed strictly, the undesired garment may be tight to wear, causing creases, restricts wearers movement or too baggy for good fitting.

The overall assessment of wearing fit, ease, mobility and aesthetics of the suits by adolescents was generally accepted. The judges assessment of the prototype suits on clothing fit of the adolescents was generally satisfactory, The developed patterns and the constructed suits successfully addressed the increasing demand for corporate dressing in Benue State.

5.3 Recommendations

The following recommendations were proffered based on the findings of the study:

i. The established mean body measurements should be used by students of fashion design, clothing and textile to help them in pattern drafting and alteration courses.

ii. Lecturers in tertiary institutions of clothing and textile should make as many copies as they can of the drafted patterns to help them teach students in a more practical method.

iii. The fitted garment on male adolescents students should serve as an example of life model to garment makers instead of using dress stands which is not necessary

for mass production of suits. This will enable them to see the actual fitting techniques on different sections of the body and correct any fault on them.

iv. In order to enhance mass production of suits, extension workers in Home Economics should enlighten families through trade fairs or workshops on fashion shows, the importance of using drafted patterns before cutting out clothes. This saves fabrics from wastage, money and time.

v. The Nigerian sizing charts which has just been developed and drafted for block patterns be posted on internet for easy accessibility for those who need them and use as a foundation for further studies.

5.4 Limitations of the Study

Difficulty exists in getting some students record on age because some students records were missing. The break time was short to measure seventeen (17) parameters on different parts of one student. The researcher and the assistants have to add more weeks to cover the number of students required for the study.

The experienced tailors and dress makers who assessed the clothing fit of students were not very free with the researcher as many thought that the questionnaire schedule was to evaluate their professional capability. The researcher explained the purpose of the study to them emphasizing that it was strictly confidential. It was not easy to get the consent of the parents for model pictures of the clothing fit.

5.5 Implications of the Study

The study has some implications for sizing system for different categories of adolescents. Clothing for infants is different from children's wear, so also teenagers, adolescents and adults. If the sizing charts of these groups of individuals is not known, how

can one construct a number of garments that are easy fittings with styles. The attraction of these garments depends heavily on fabric design, simple but innovative shapes and decorative features.

Constant field study of body measurement of individuals starting from children to adult stage is necessary because of changes in body shapes and development. Patterns drafted from their blocks can be used to make shirts, blouses, leisure wear, sports, night wear and outdoor wears. Data generated from the body measurements enable comparism of individuals between ethnic groups or geographical locations. The study on body measurement of people were used to compare black and white races in recent times. This determine the size and type of clothes worn by the these races.

Since the clothing fit assessment by adolescent models and judges were in favour of the constructed prototype suits, fashion garments should be subjected to acceptability test before mass production for marketing. This saves time, money and wastage of fabric.

5.6 Suggestion for Further Studies

The following topics have been suggested for further studies:

1. Standard body measurement and development of basic block patterns for mass production of suits for adolescent females.
2. Evaluation of existing clothing and textile industries and production level in Nigeria.
3. Factors that influence the consumption of second hand clothes by the families.
4. Marketing strategies of locally made garments.
5. Development of patterns for traditional garments.

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APPENDIX A

INTRODUCTORY LETTER

DEPARTMENT OF VOCATIONAL & TECHNICAL EDUCATION
AHMADU BELLO UNIVERSITY, ZARIA NIGERIA
FACULTY OF EDUCATION

Telephone: ***069-51755, 50692***
Vice Chancellor: [redacted]
Head of Department : **Professor A.A Udoh** B.Ed. (Hons) Nsukka M.Ed. & Ph.D Bus Edu. (ABU)

*Your Ref:*_____ 25th May, 2015

Our Ref: Ph.D/Educ/7364/2009-2010 *Date:*_____

Letter of Introduction

EDACHE AJUNWA – PH.D/EDUC/7364/2009-2010

This is to certify that the above mentioned name is a Postgraduate student (Ph.D Home Economics) in the Department of Vocational and Technical Education, Ahmadu Bello University, Zaria carrying out a research topic: **Investigation of the Three Multidimensional Optimized Sizing Systems Generated From Anthropometric Data For Mass Customization of Students Garments in Benue State, Nigeria.**

Please, kindly give him every assistance he may require.

Professor A.A. Udoh
HEAD OF DEPARTMENT

Appendix A2

QUESTIONNAIRE

Introductory Letter

Department of Vocational and
Technical Education,
Ahmadu Bello University,
Zaria.
Date:……

Dear Sir/Madam/Miss

REQUEST TO RESPOND TO A QUESTIONNAIRE

I am a postgraduate student in the Department of Vocational and Technical Education, Ahmadu Bello University, Zaria. I am undertaking a research dissertation titled: **Investigation of the Three Multidimensional Optimized Sizing Systems Generated from Anthropometric Data for Mass Customization of students Garments in Benue State.**

The attached questionnaire schedule is to elicit the necessary information for the study. You are requested to respond to the items as objectively as possible.

Every information supplied as regards your response will be treated as confidential and be used strictly for the purpose of this research dissertation.

Thanks for your anticipated co-operation.

Yours sincerely,
AjunwaEdache
Ph.D/EDUC/7364/2009-2010.

Appendix B

Body Characteristics of Adolescents

Please Tick (√) for each item in the response continuum below that is most appropriate for you.

Key

Strongly agree = SA (4 points)

Agree = A (3 points)

Undecided = UD (2 points)

Not Agree = NA(1 point)

S/N	Criteria	Response			
		SA	A	UD	NA
1	Adolescents of average body build, neither tall nor short				
2	Adolescents with bow legs or k-legs				
3	Short and thin adolescents				
4	Short and stout adolescents				
5	Adolescents with large shoulder and chest				
6	Adolescents with short legs or very long legs				
7	Adolescents with short neck or long neck				
8	Adolescents that are lean or slim				
9	Adolescents with more body physique				
10	Adolescents with robust body physique				

Appendix C

Body measurement of adolescents



Plate 1: Chest measurement



Plate 2: Across front measurement



Plate 3: Across back measurement



Plate 4: Waist measurement



Plate 5: Hip Measurement



Plate 6: Center Back Measurement



Plate 7: Shoulder length measurement



Plate 8: Neck measurement



Plate 9: Long sleeve measurement



Plate 10: Arm circumstance measurement



Plate 11: Wrist measurement



Plate 12: Trouser length measurement



Plate 13: Ankle measurement



Plate 14: Crotch length measurement

Appendix D

BODY MEASUREMENT CHART GUIIDE

Section 1: Students Bio-Data

School: ……

Age:……..

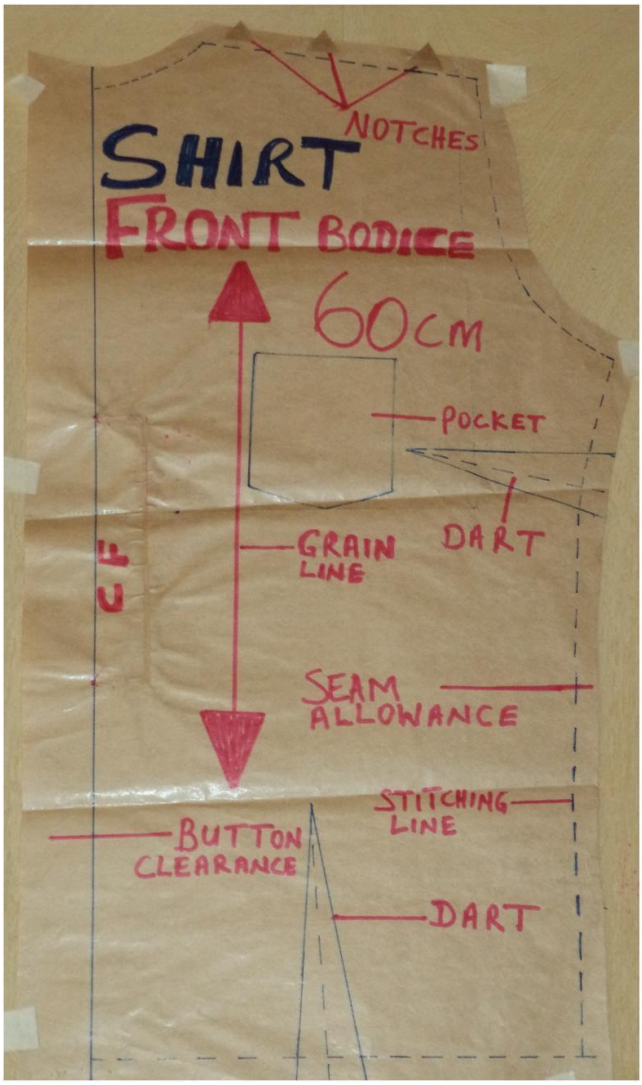
Marital Status:……..

S/No	Part of Body	Where to Measure	Actual Measurement
1.	Across front	From armhole seam to armhole seam halfway between shoulder and bust line	
2.	chest	Around the body directly under the arms and across the top of the breasts	
3.	Across back	From armhole seam to armhole seam over shoulder blade	
4.	Waist	Over the natural waistline curve.	
5.	Hip	Use 18-20cm or $7^{1/2}$ to 8" below the waistline over the fullest part of the hip	
6.	Centre front	From the base of the neck to the waistline	
7.	Centre back	From nape of the neck to waistline	
8.	Shoulder	From base of the neck to shoulder bone	

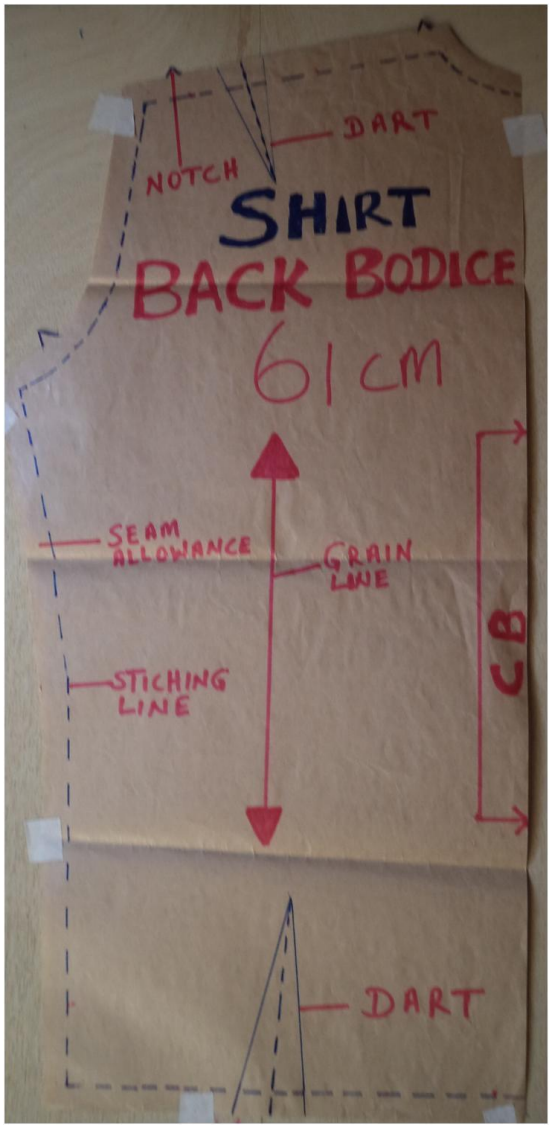
9.	Long or full sleeve length	From the shoulder bone to the wrist with arms slightly bent	
10.	Half length	from the highest point on the shoulder over the bust to 1 inch or 2.5cm above the navel.	
11.	Short sleeve	From shoulder bone to the bicep	
12.	Biceps or arm circumference	Round the fullest part of the arm circumference	
13.	Trouser length	from the waist to the ankle, making sure that the correct shoe is worn, in order to obtain appropriate measurement.	
14.	Inside leg	Measure from thecrotch depth to ankle	
15.	Thigh	Over the fullest part of the thigh. Do not hold the tape tightly	
16.	Crotch	From the waist over the hip prominence to the surface of a chair, with the person to be measured sitting on a firm chair.	
17.	Ankle	Round the ankle, observing the width, based on the current fashion.	

APPENDIX E

Drafted patterns for established average body measurement



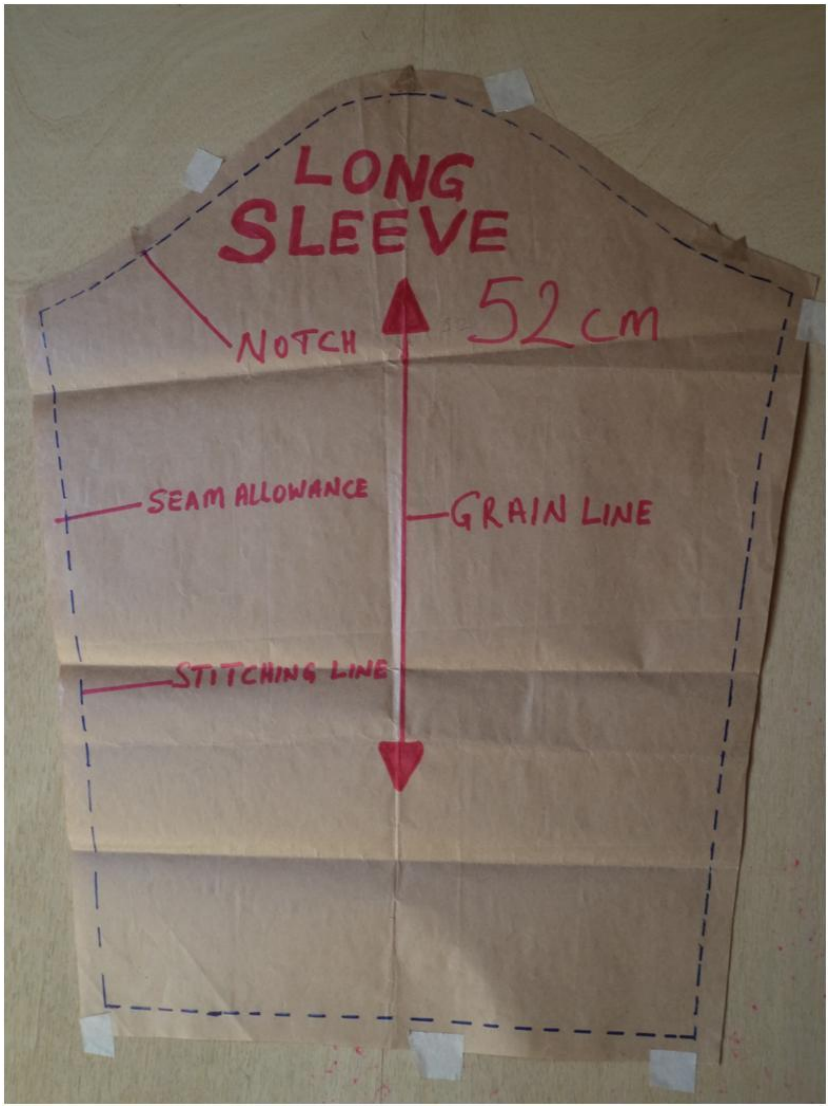
Shirt front pattern



Shirt back pattern

Fig 37: Drafted patterns for front and back shirt.

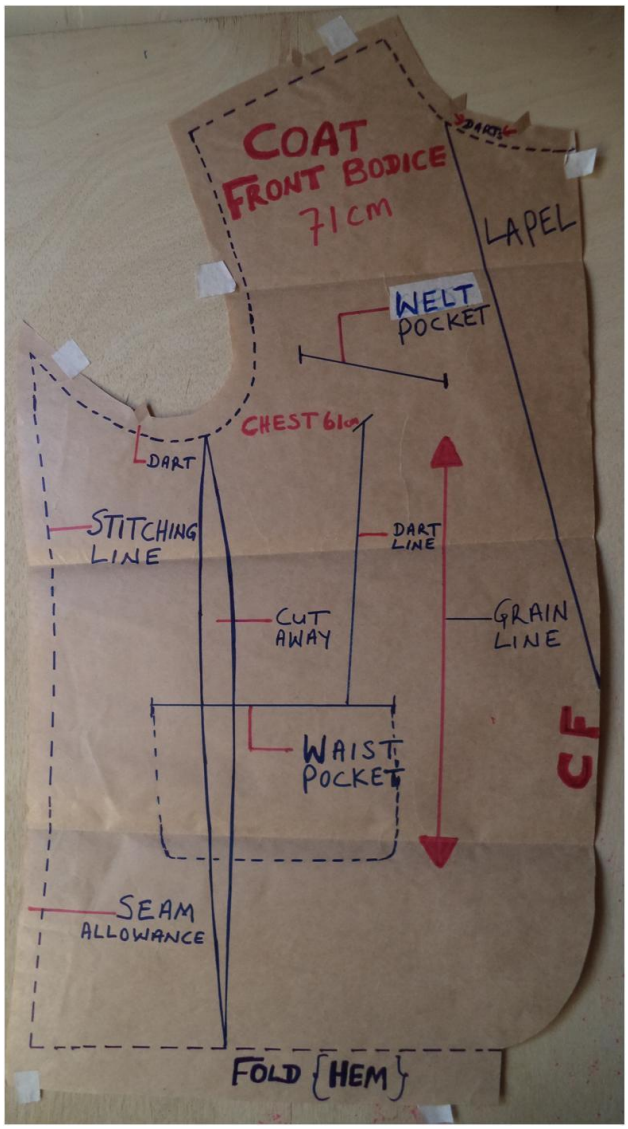
Source: Ajunwa E. 2015



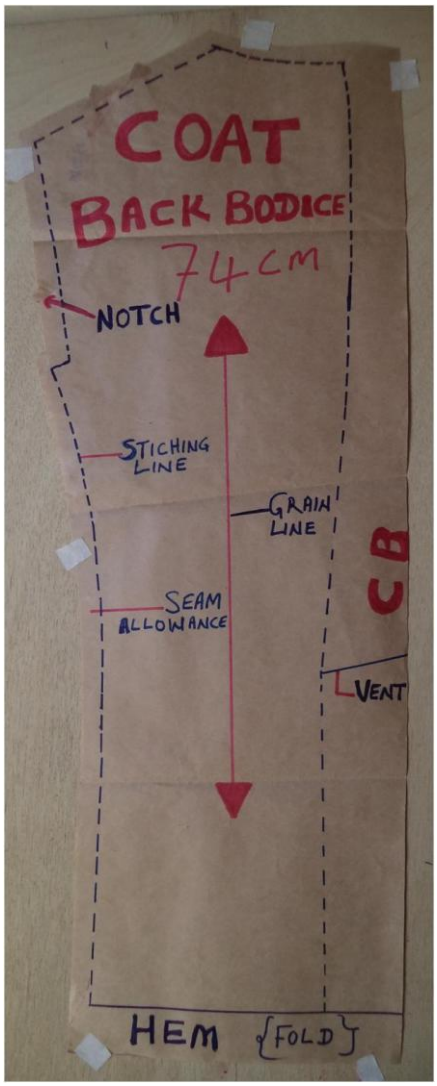
Long sleeve pattern

Fig 38: Drafted pattern of long sleeve

Source: Ajunwa E. 2015



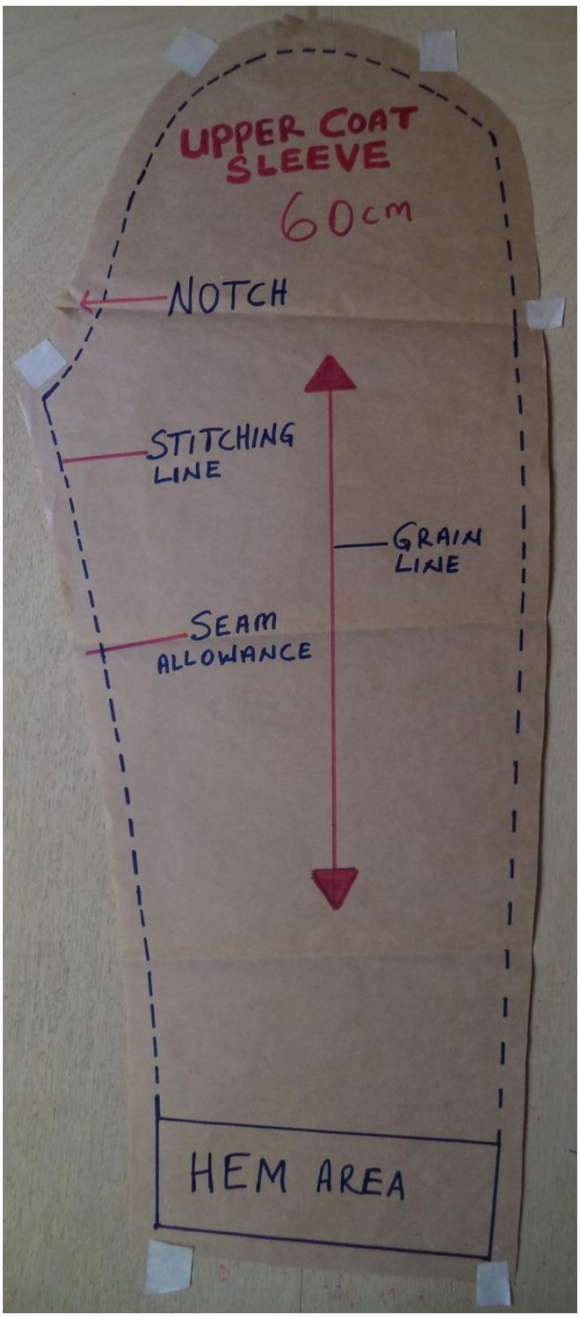
Coat: front pattern

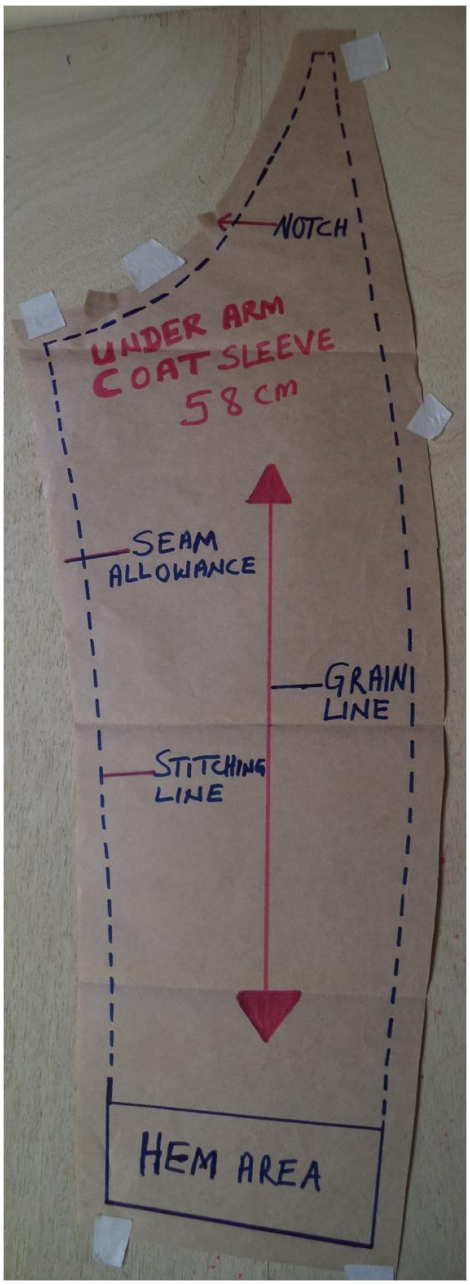


Coat: back pattern

Fig 39: Drafted pattern of front and back coat

Source: Ajunwa E. 2015



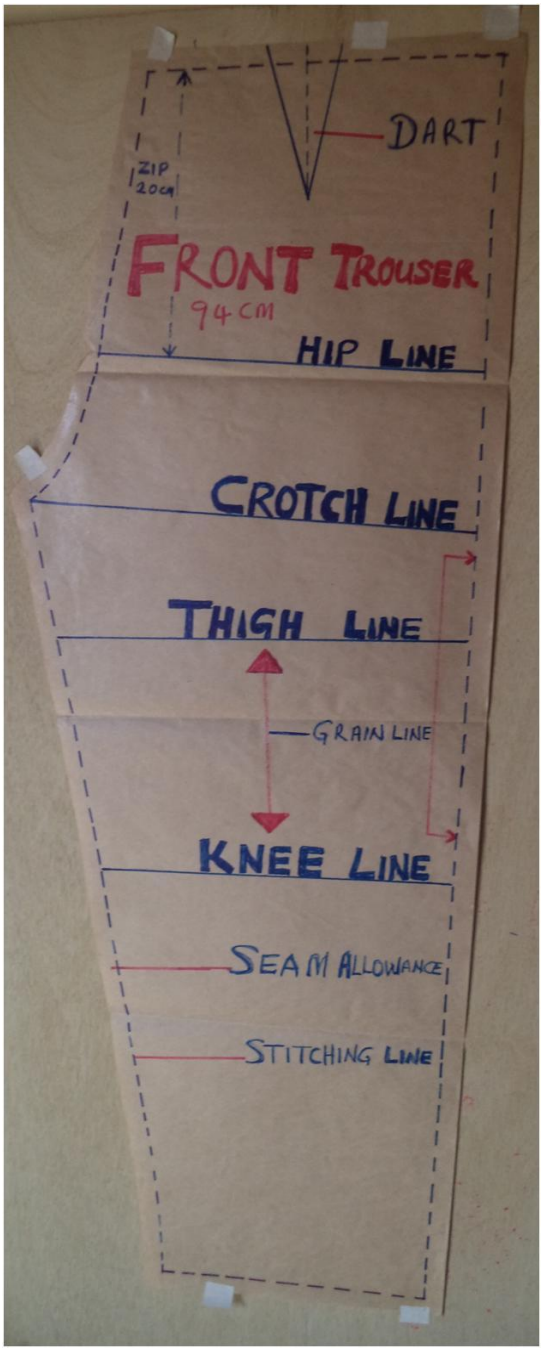


Two piece sleeve: Upper arm coat sleeve

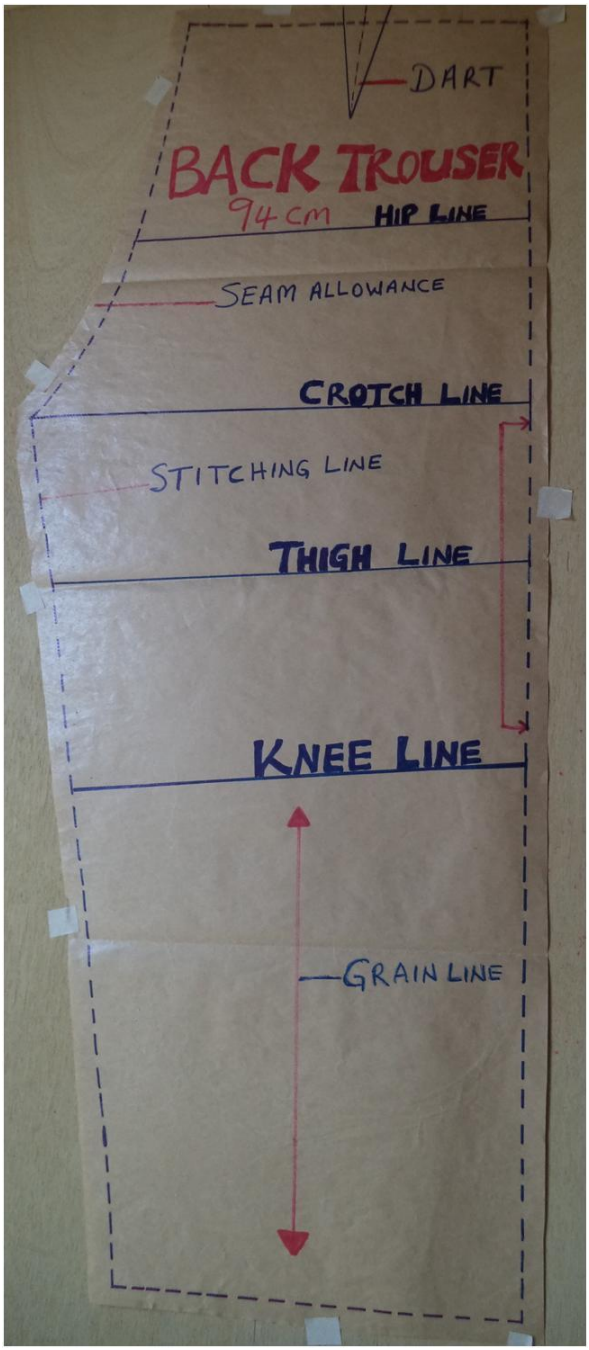
Under arm coat sleeve

Fig 40: Drafted pattern for two piece coat sleeves

Source: Ajunwa E. 2015



Trouser: front pattern



Trouser: back pattern

Fig 41: Drafted patterns of trouser front and back

Source: Aiunwa E. 2015

APPENDIX F

PATTERN LAYING AND CUTTING



Plate 15: Pattern laying and cutting of shirt fabric by the researcher



Plate 16: Pattern laying and cutting of coat fabric by the researcher



Plate 17: Pattern laying and cutting of trouser fabric by the researcher

APPENDIX G
CONSTRUCTION OF PROTOTYPE SUITS



Plate 18: Sewing of shirt by the researcher



Plate 19: Sewing of coat by the researcher



Plate 20: Sewing of trouser by the researcher

APPENDIX H

Fitted suits on different size categories of small, medium and large adolescents



Plate 21: Fitted suits on small-sized adolescents (front and back view)



Plate 22: Fitted suits on medium-sized adolescents (front and back view)



Plate 23: Fitted suits on Large-sized adolescent (front and back view)

Appendix I

Assessment criteria chart for adolescents on wearing fit, ease, mobility and aesthetics by small, medium and large adolescent models.

S/N	Criteria	SA	A	UD	NA
1	Collar (shirt and jacket)				
2	Chest line ease				
3	Ease across shoulder back				
4	Waistline ease				
5	Front chest width				
6	Sleeve cap fullness				
7	Front bodice shoulder dart length				
8	Waistline placement at back				
9	Hipline				
10	Sleeve length				
11	Ease at biceps				
12	Aesthetic and acceptability				
	Criteria for trousers				
13	Waistline allowance				
14	Ease at hip level				
15	Trouser full length				
16	Overall comfort of trousers				

Appendix J

Assessment criteria chart for judges on wearing fit, ease, mobility and aesthetics.

S/N	Criteria	SA	A	UD	NA
1	Collar alignment				
2	Front neck depth				
3	Shoulder seam length				
4	Shoulder slope				
5	Front chest width				
6	Chest line ease				
7	Waistline ease				
8	Front bodice waist dart length				
9	Back bodice waistline dart length				
	SLEEVE				
10	Sleeve length				
11	Ease at biceps				
12	Arm circumference				
	Trousers				
13	Trouser topside full length				
14	Underside length				
15	Pocket size and facing				
16	Fly piece depth				
17	Trouser seat depth				
18	Ease at thigh width				
19	Trouser length width				
20	Ease at hip level				
21	Hem line				
22	Overall aesthetics				
23	Mobility and comfort				

Appendix K

Pilot Study

PILOT STUDY

To determine the reliability of instrument

Cronbach alpha formula was used to determine the reliability of the instrument.

The formula is given as,

$$\alpha = \frac{K}{K-1}\left(1 - \frac{\sum S_i^2}{S^2}\right)$$

Where, α = reliability coefficient alpha
K= number of items in a test
$\sum S^2$= sum of the item variance
S^2= variance of total test
1 = unity

According to the formula:

P= the proportion of respondents that give positive or correct answers
Q= the proportion of respondents that give negative or wrong answers. In this research, it is the five points Likert scale.

K= 13 = number of items on Likert scale
p= 243
q= 84

From the table of correlational matric and its subjects,

Therefore, $\alpha = \frac{K}{K-1}\left(1 - \frac{\sum S_i^2}{S^2}\right)$ since K = 13, then

$$\alpha = \frac{13}{13-1}\left(1 - \frac{84}{243}\right)$$

α= 1- 0.3456

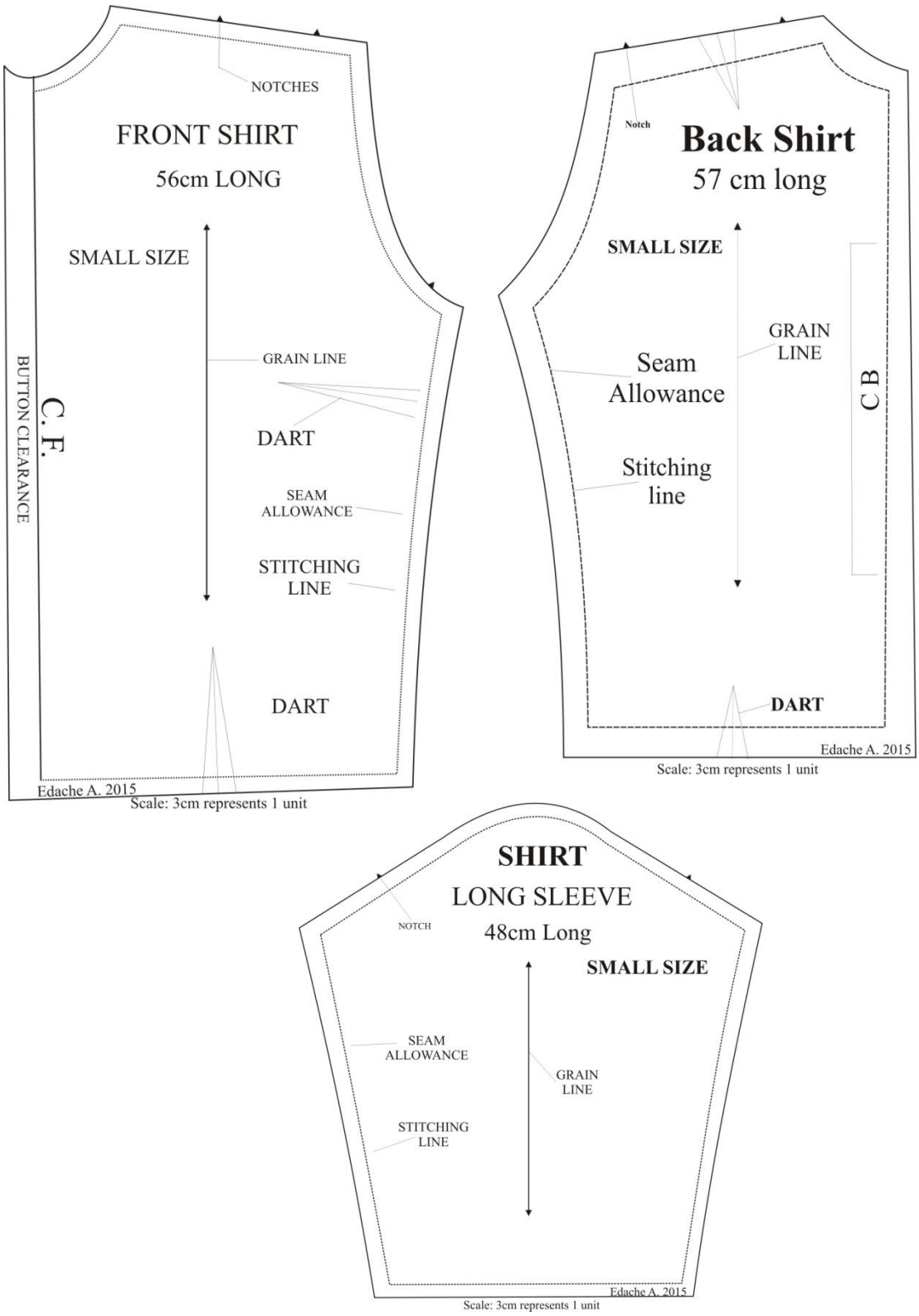
= 0.7

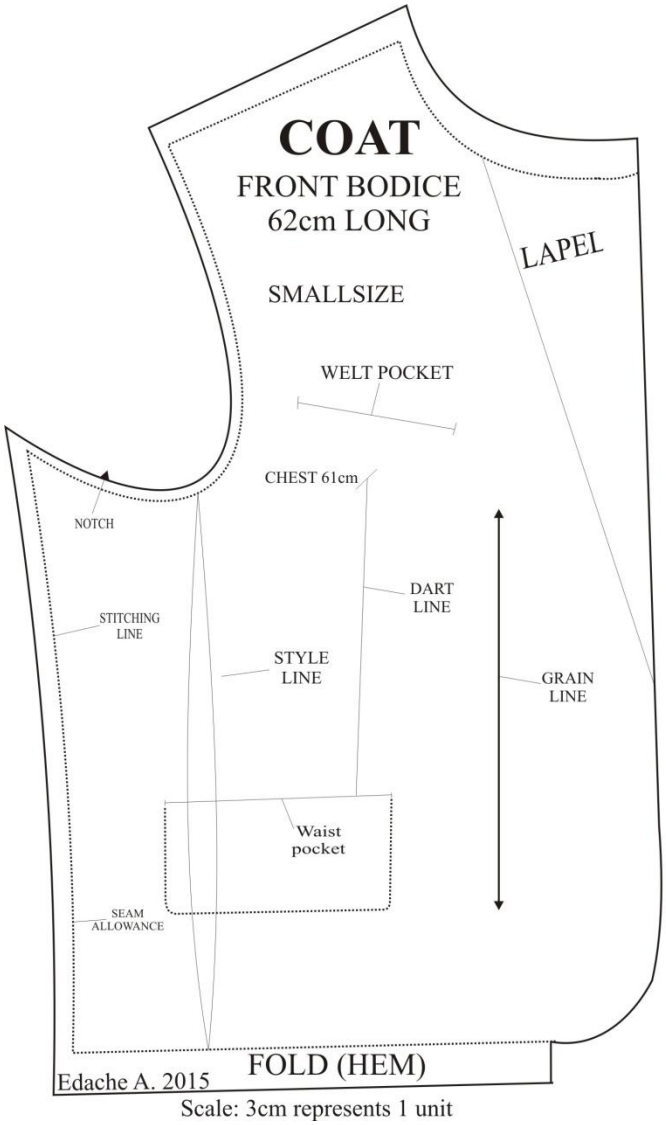
N.B

1. The alpha value depends on the number of items in the test or instrument as well as the average inter-item correlation
2. As the average correlation increases, the alpha value also increases.
3. As the number of items in the instrument or test increases, the value of alpha also increases.

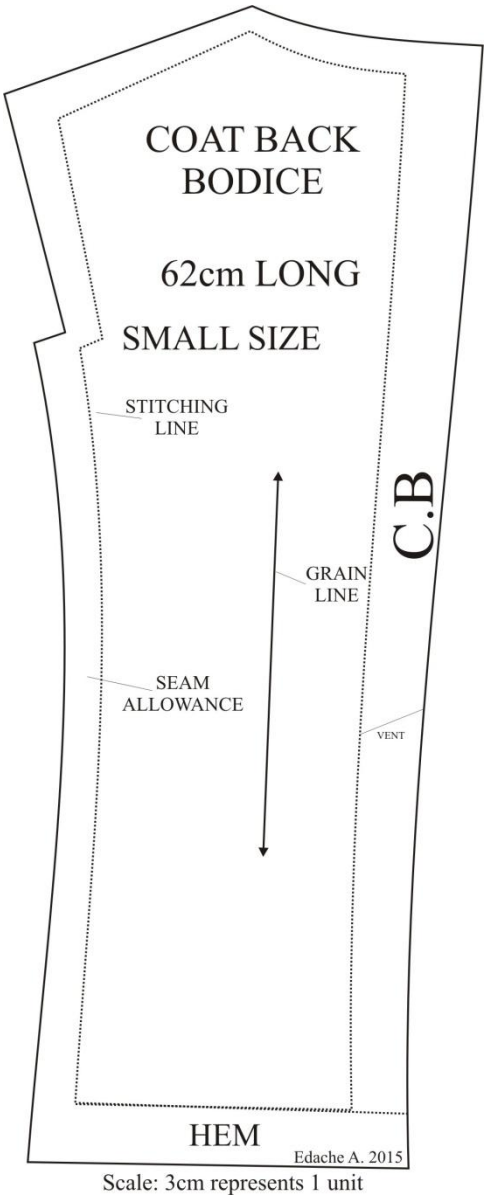
Appendix L

Graphic Design Version of the Patterns for Small, Medium and Large Adolescents

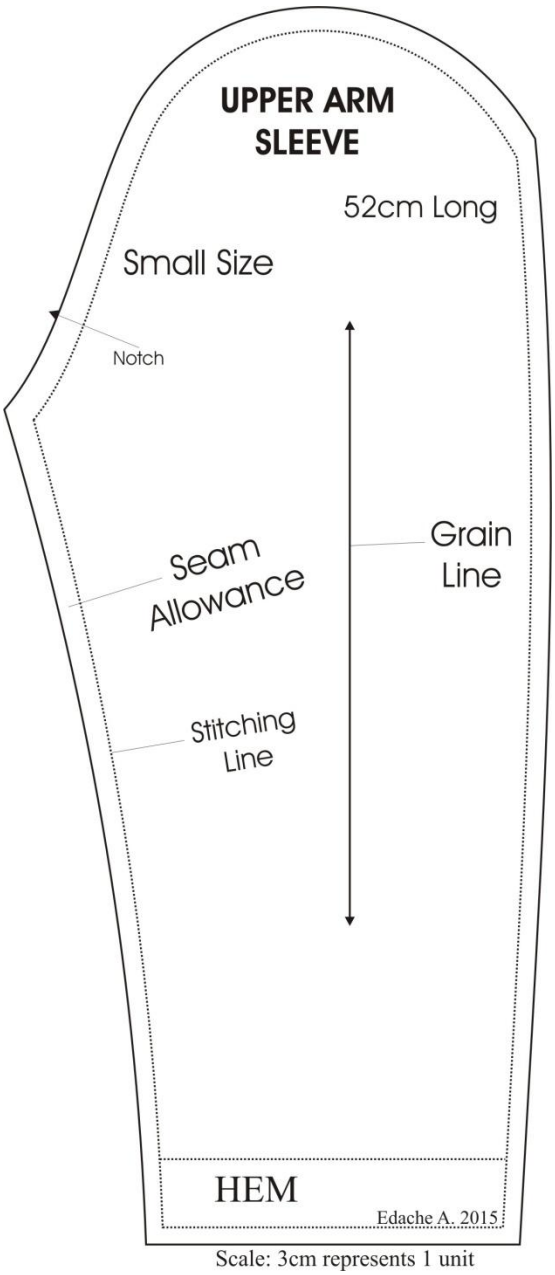




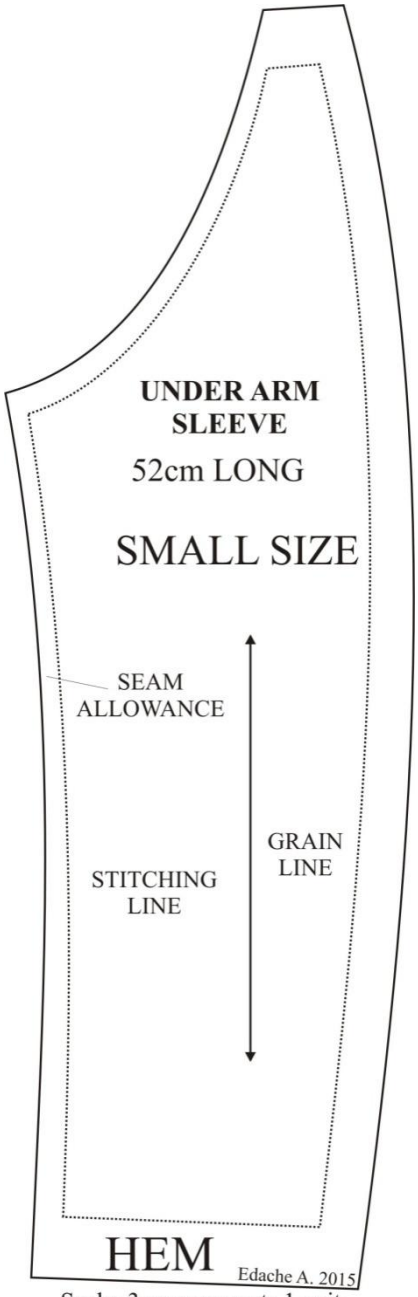
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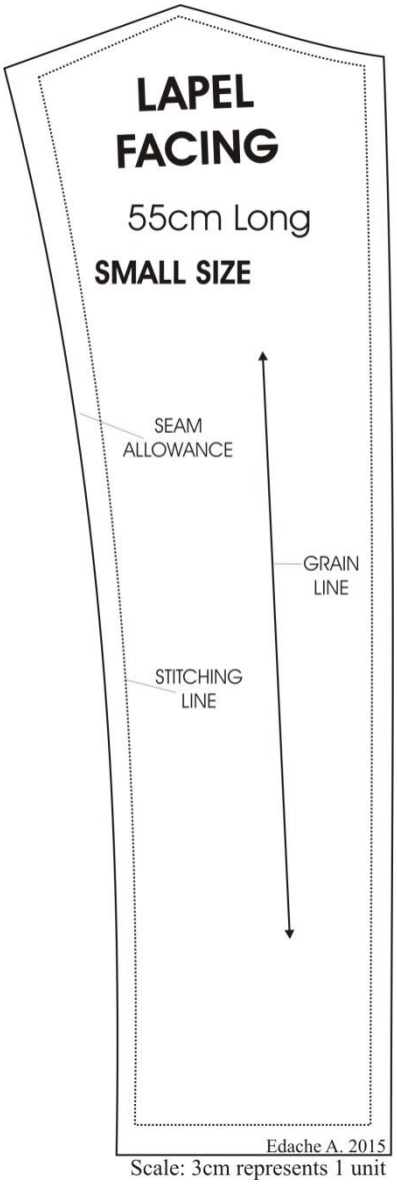
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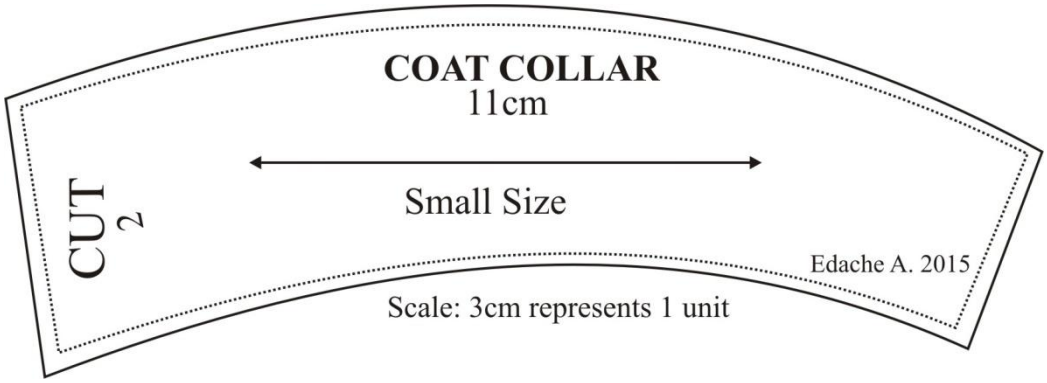
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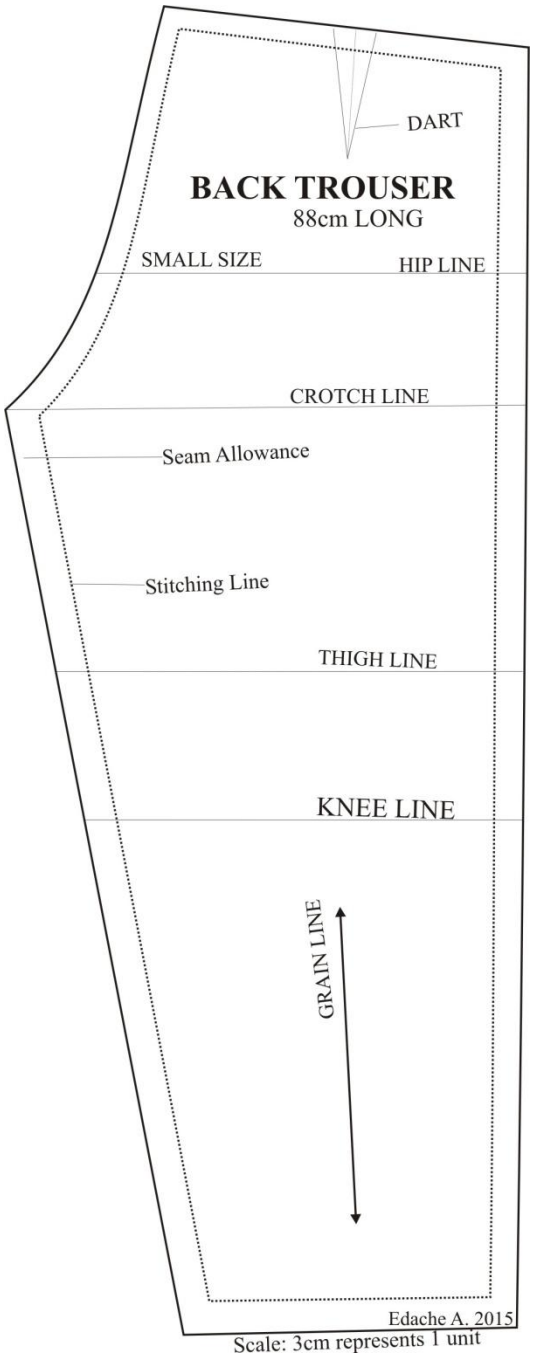
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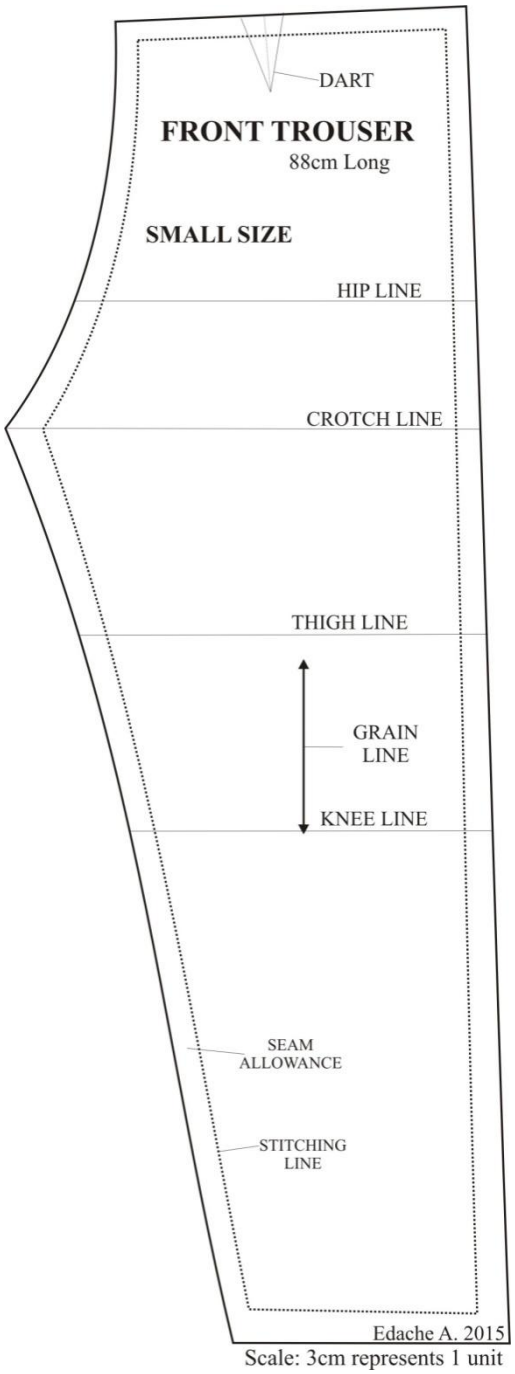
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Scale: 3cm represents 1 unit

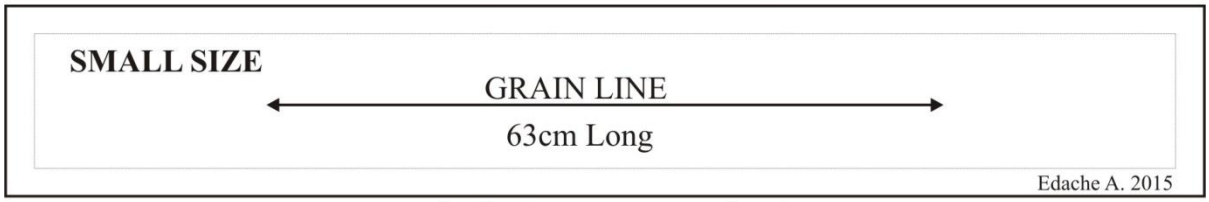


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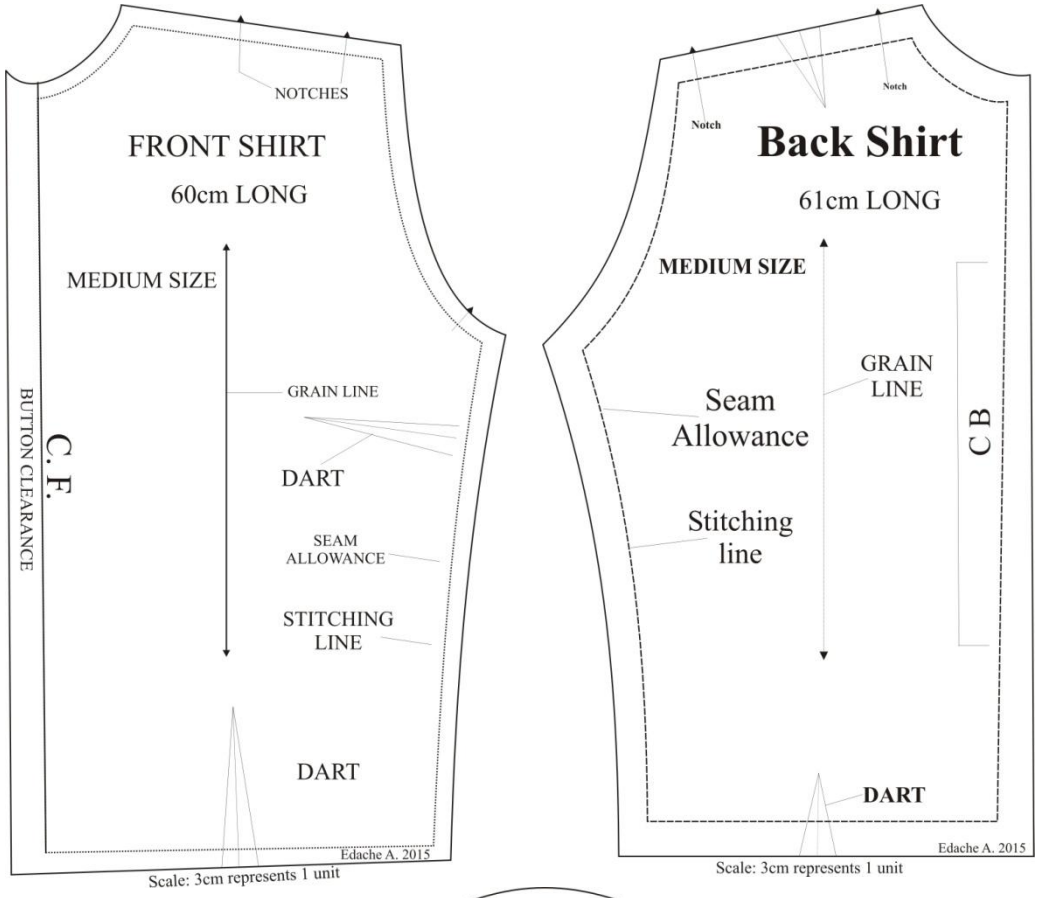
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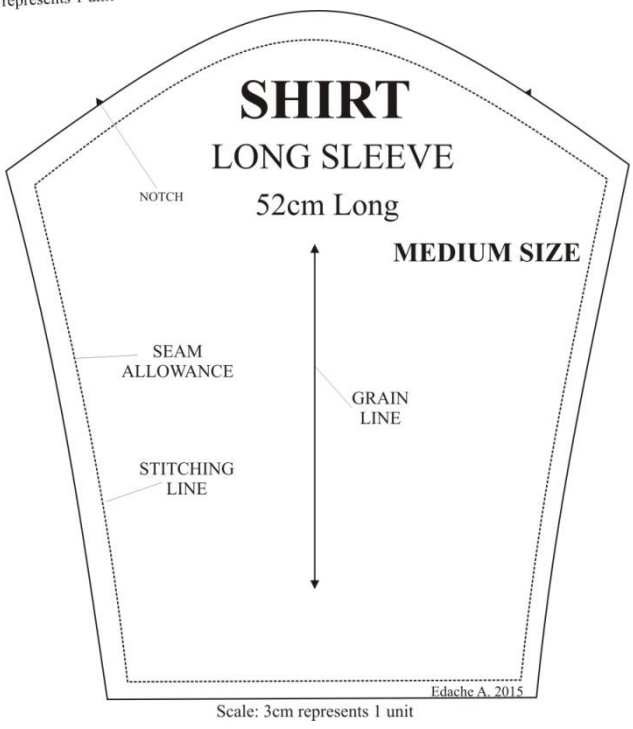
TROUSER WAIST BAND

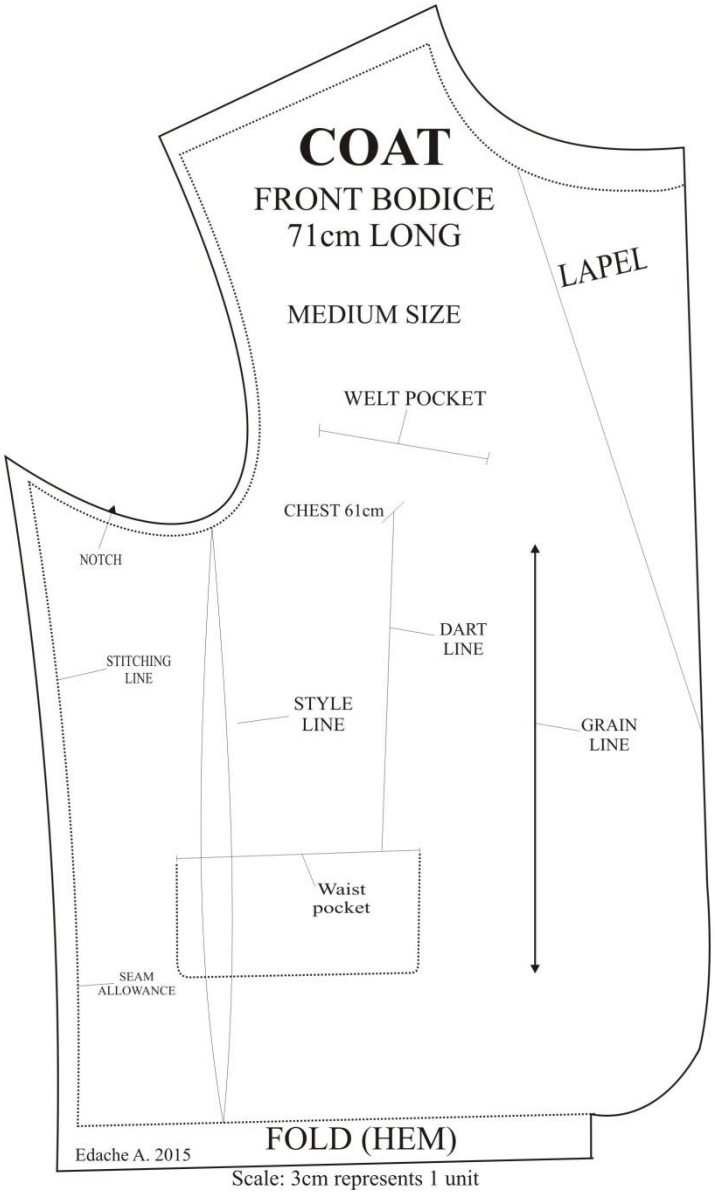


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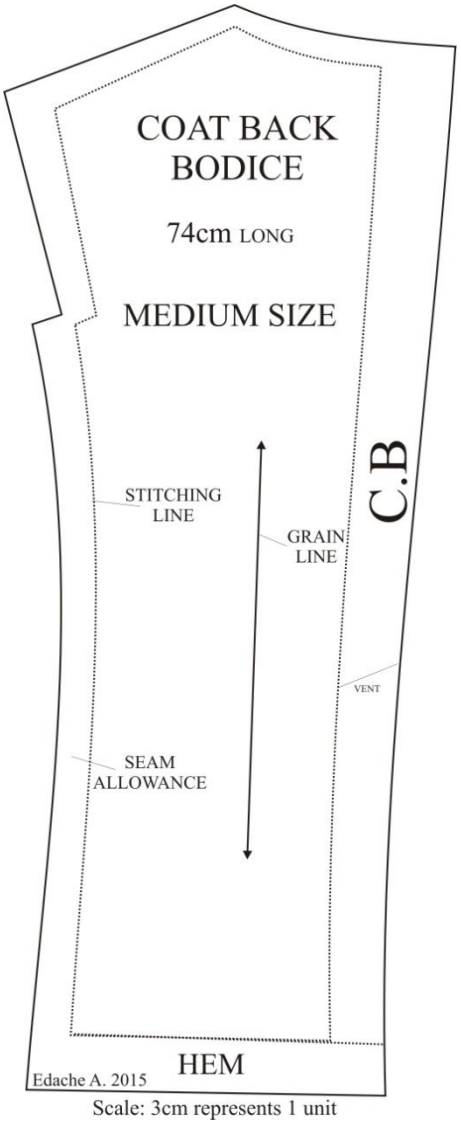
MEDIUM SIZE


NOTCHES
FRONT SHIRT
60cm LONG
MEDIUM SIZE
GRAIN LINE
DART
SEAM ALLOWANCE
STITCHING LINE
DART
C. F.
BUTTON CLEARANCE
Edache A. 2015
Scale: 3cm represents 1 unit
Notch
Notch
Back Shirt
61cm LONG
MEDIUM SIZE
GRAIN LINE
Seam Allowance
Stitching line
C B
DART
Edache A. 2015
Scale: 3cm represents 1 unit

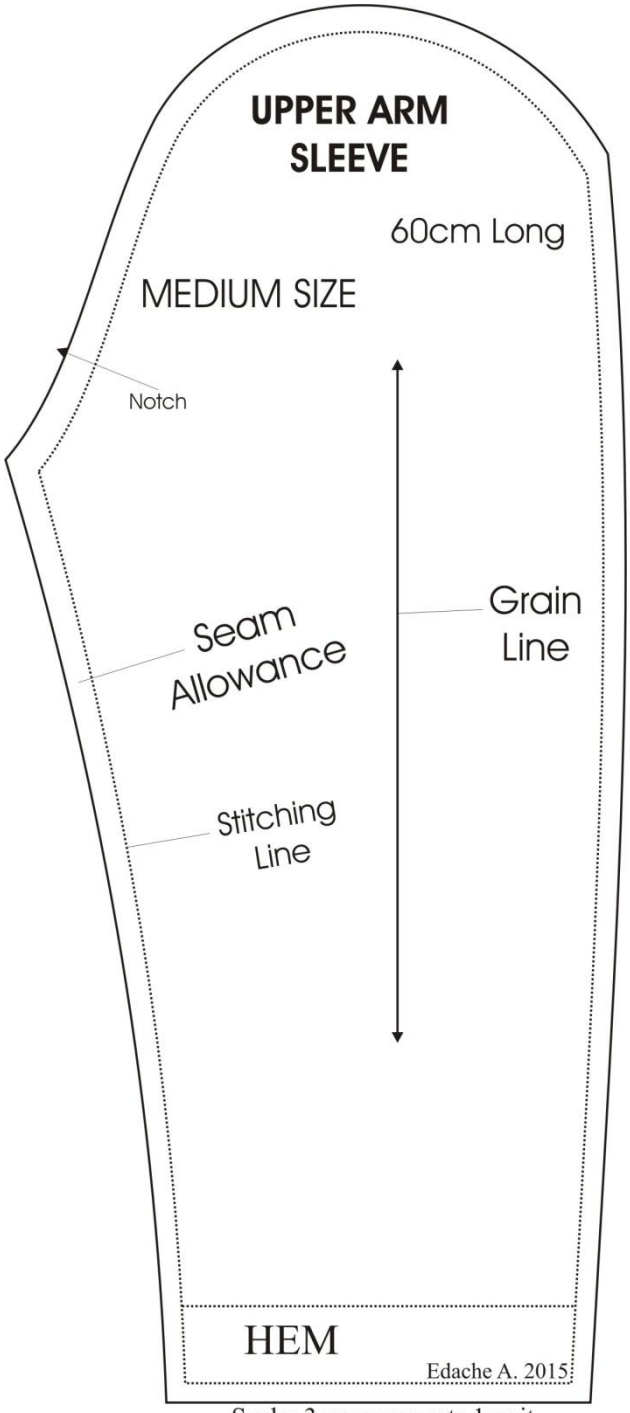

SHIRT
LONG SLEEVE
52cm Long
NOTCH
MEDIUM SIZE
SEAM ALLOWANCE
GRAIN LINE
STITCHING LINE
Edache A. 2015
Scale: 3cm represents 1 unit



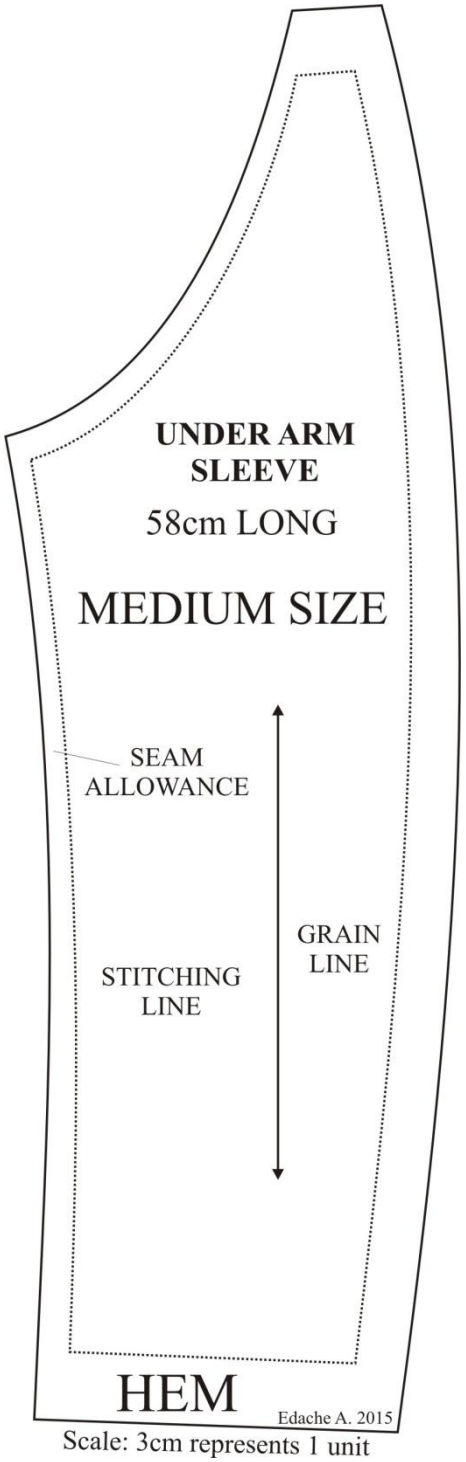
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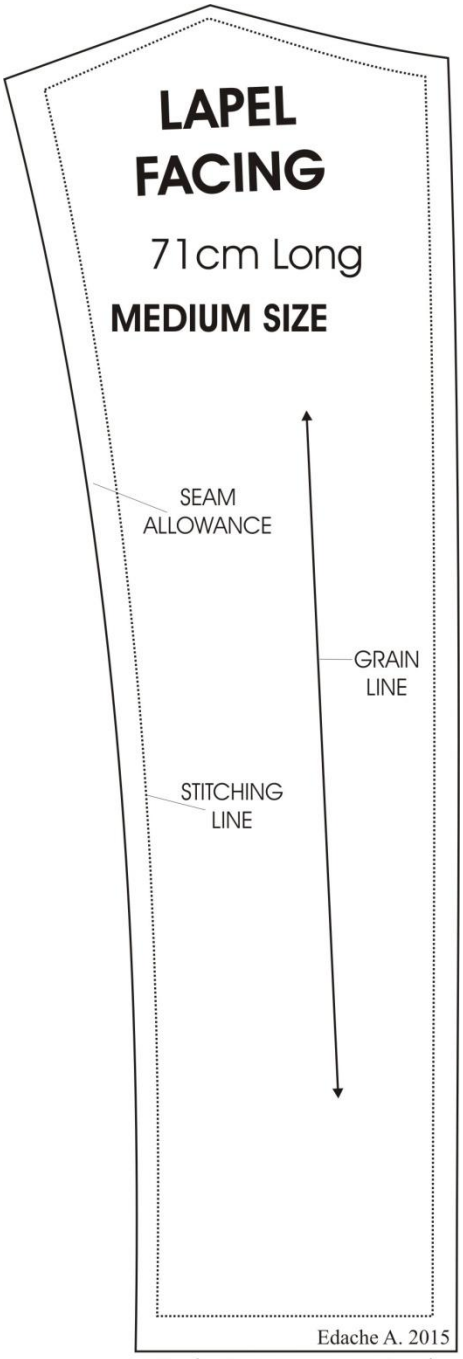
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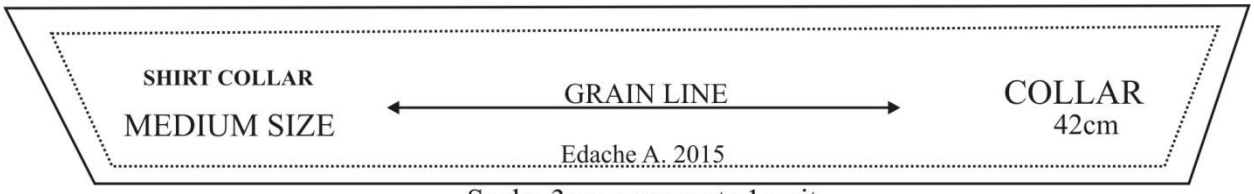
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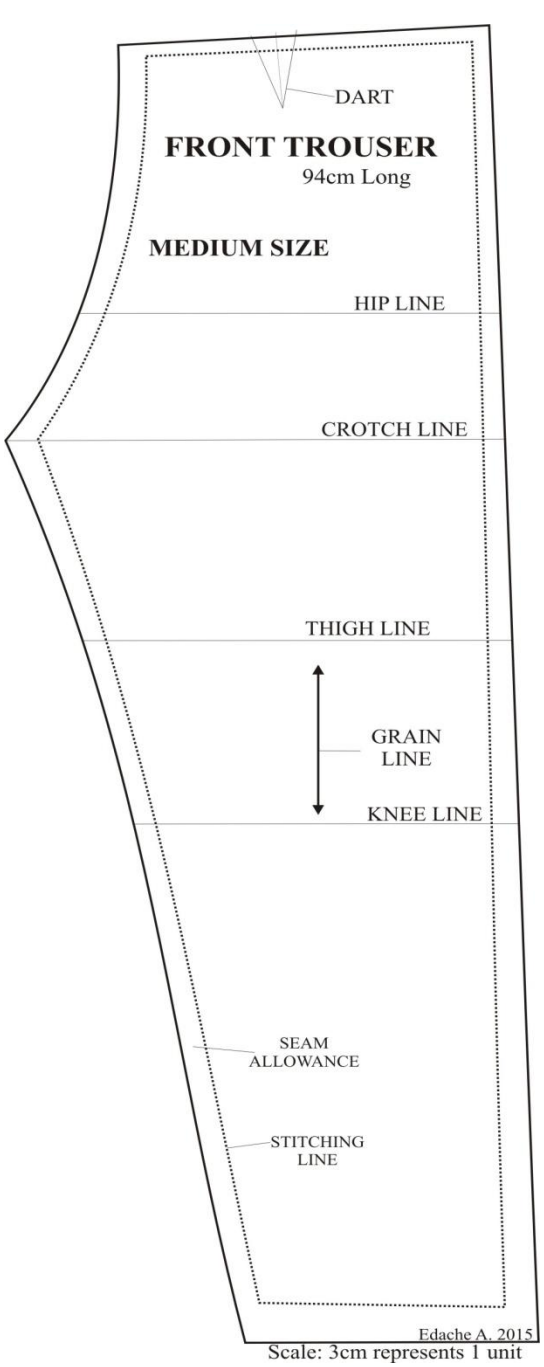
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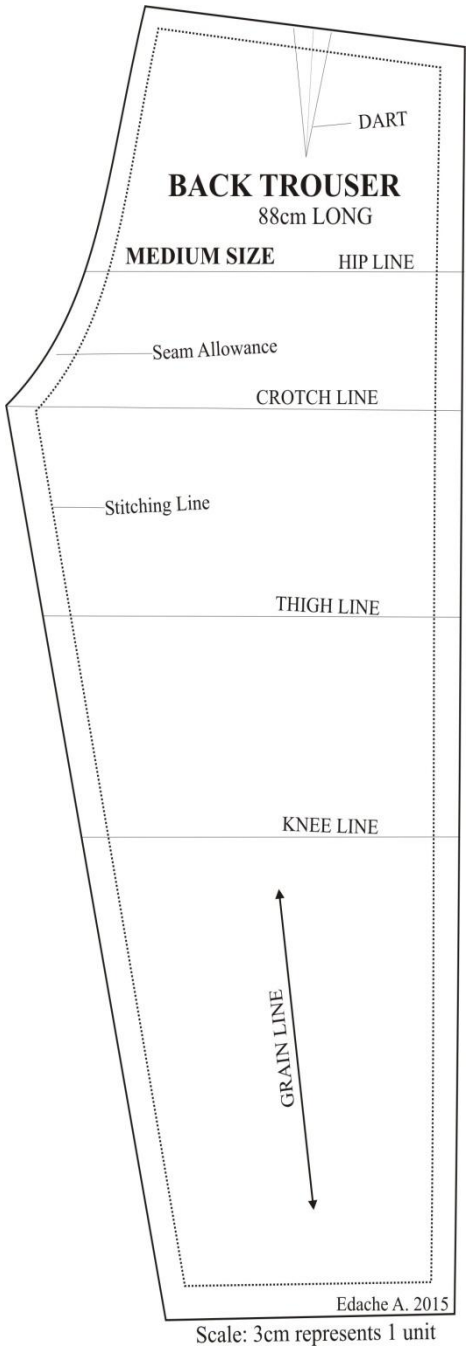
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Scale: 3cm represents 1 unit

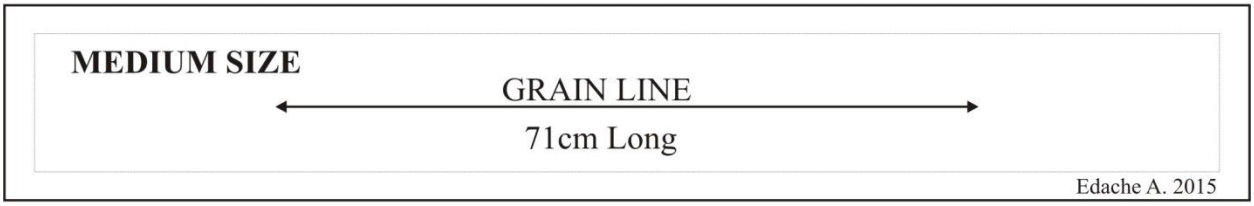


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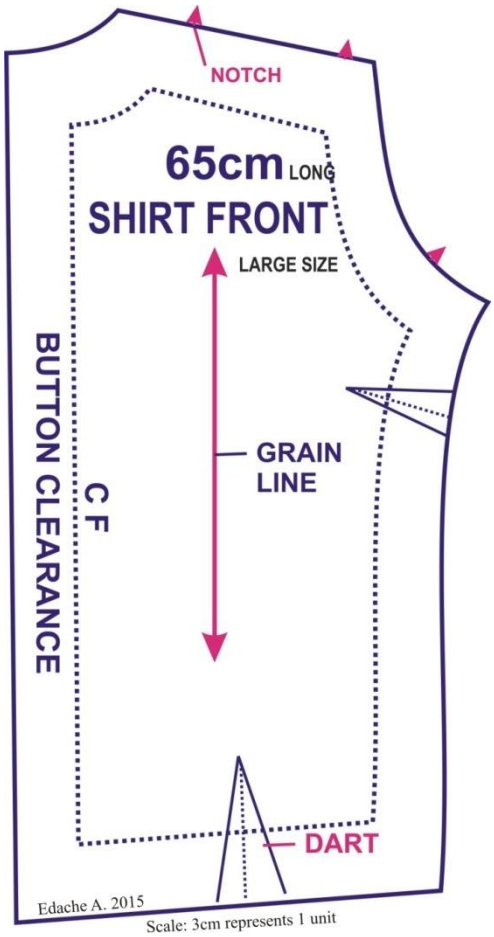
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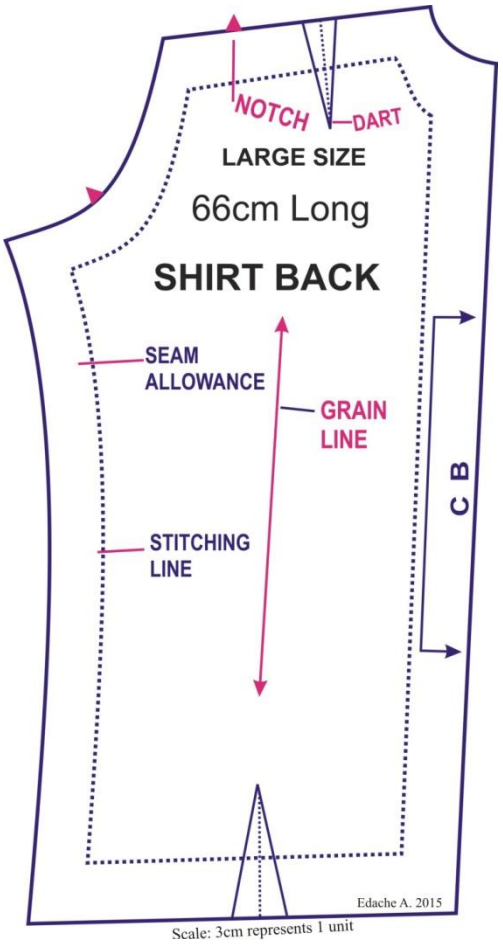
TROUSER WAIST BAND

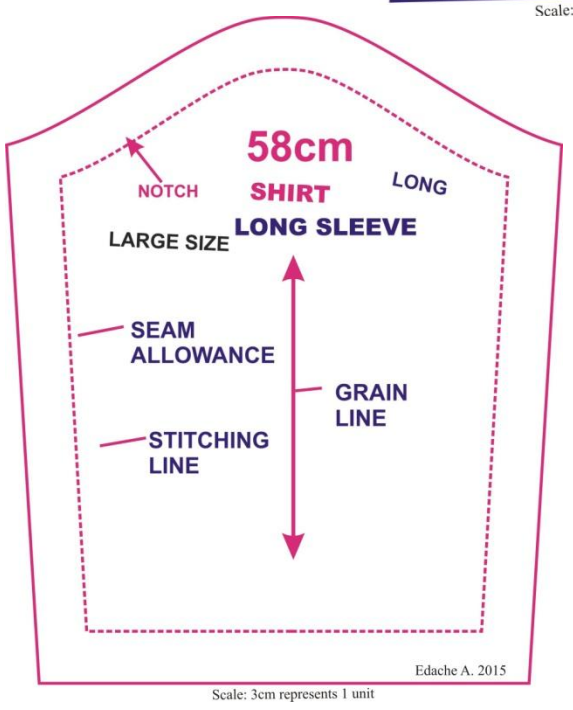


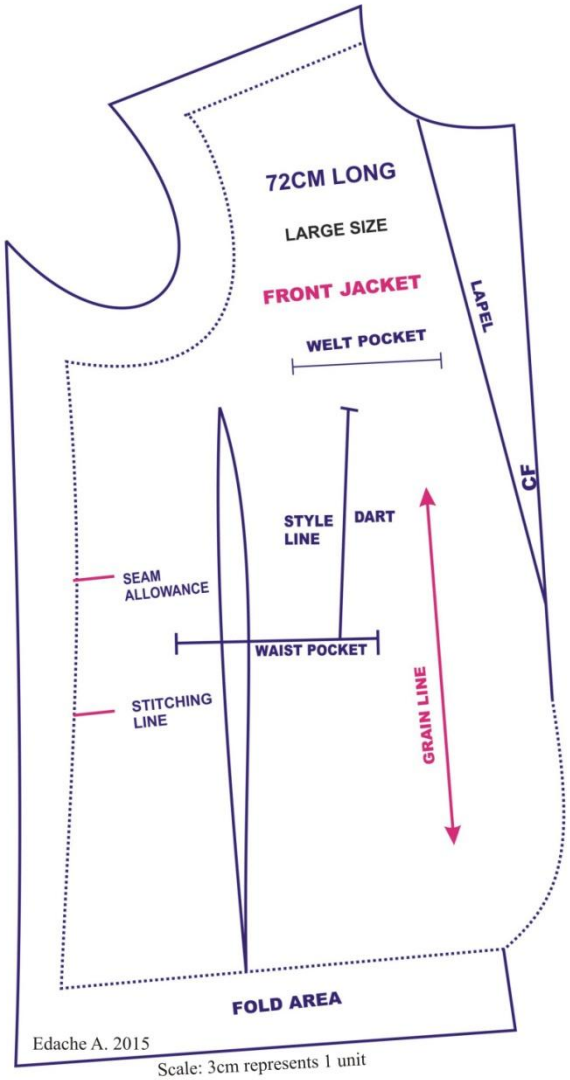
Scale: 3cm represents 1 unit

LARGE SIZE

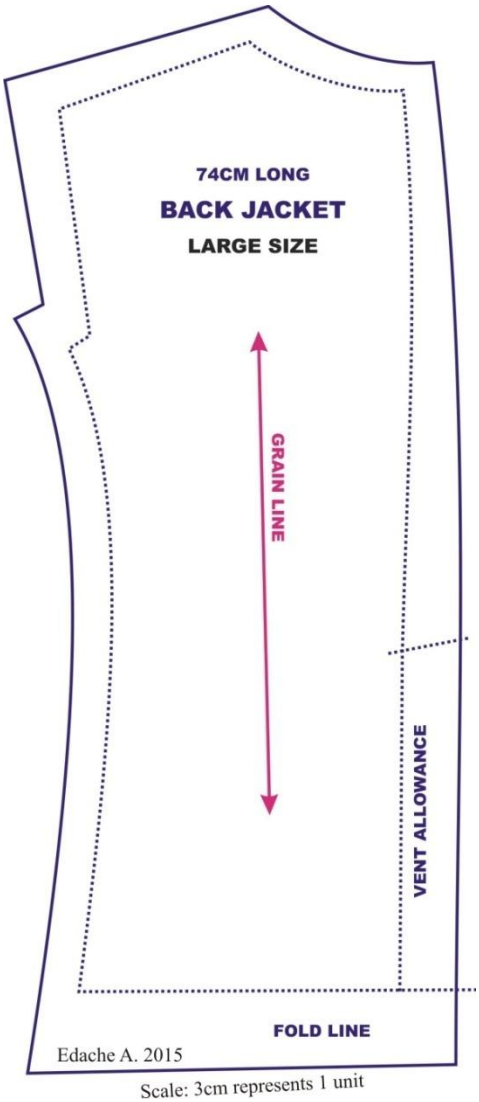

NOTCH
65cm LONG
SHIRT FRONT
LARGE SIZE
GRAIN LINE
C F
BUTTON CLEARANCE
DART
Edache A. 2015
Scale: 3cm represents 1 unit


NOTCH
DART
LARGE SIZE
66cm Long
SHIRT BACK
SEAM ALLOWANCE
GRAIN LINE
STITCHING LINE
C B
Edache A. 2015
Scale: 3cm represents 1 unit

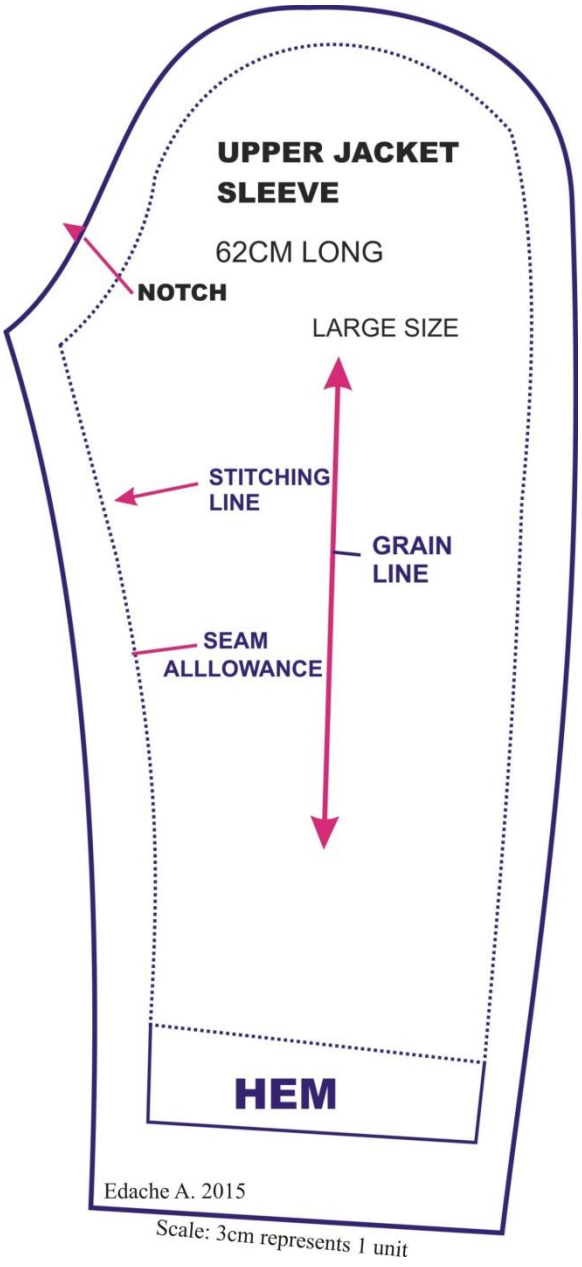

58cm
NOTCH
SHIRT
LONG
LONG SLEEVE
LARGE SIZE
SEAM ALLOWANCE
GRAIN LINE
STITCHING LINE
Edache A. 2015
Scale: 3cm represents 1 unit

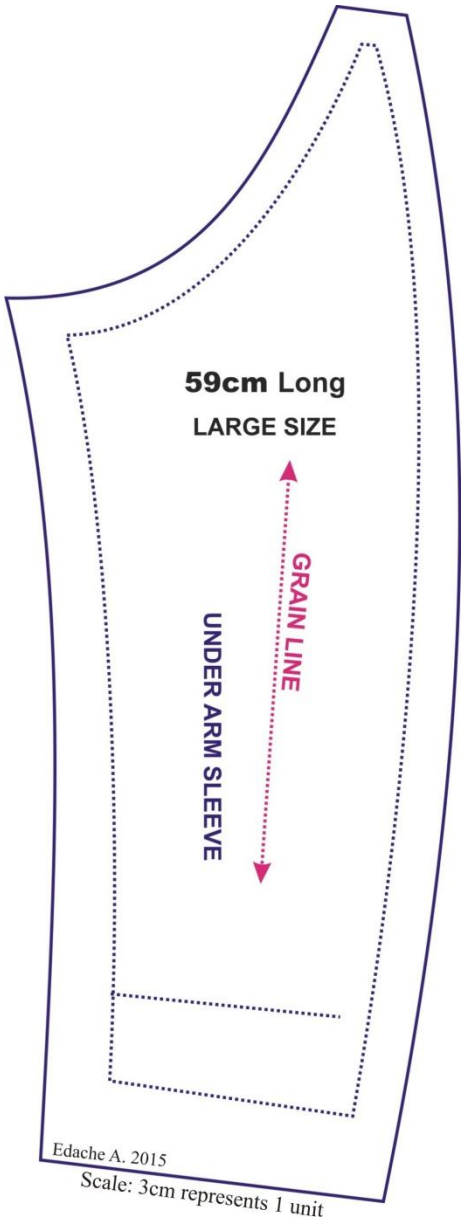


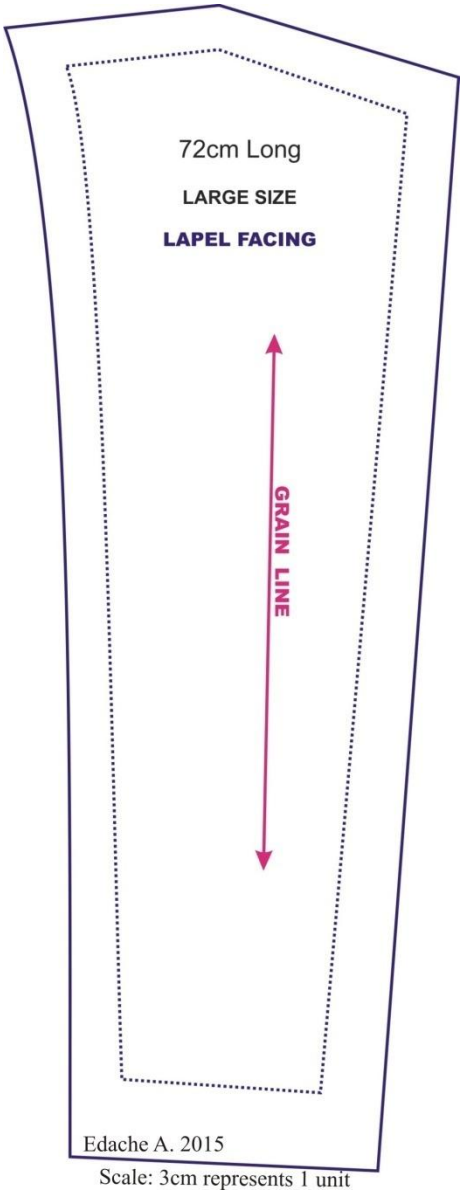
Scale: 3cm represents 1 unit

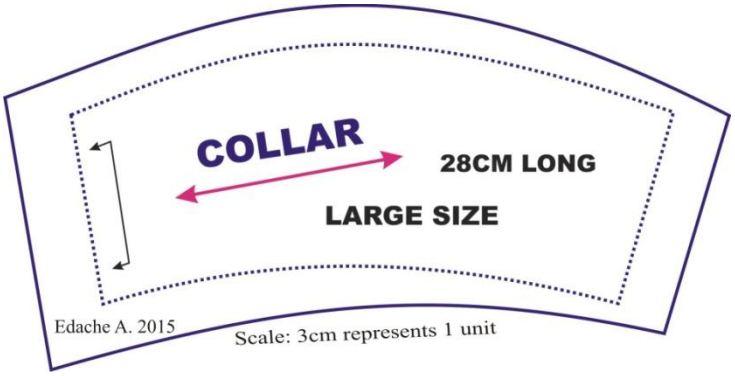


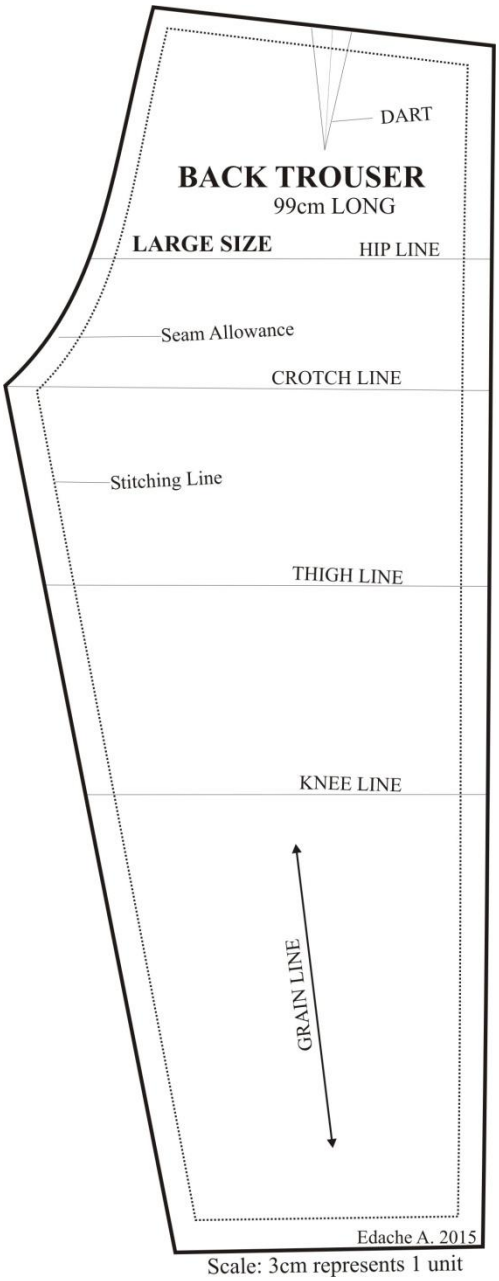
Scale: 3cm represents 1 unit


UPPER JACKET
SLEEVE
62CM LONG
NOTCH
LARGE SIZE
STITCHING
LINE
GRAIN
LINE
SEAM
ALLLOWANCE
HEM
Edache A. 2015
Scale: 3cm represents 1 unit

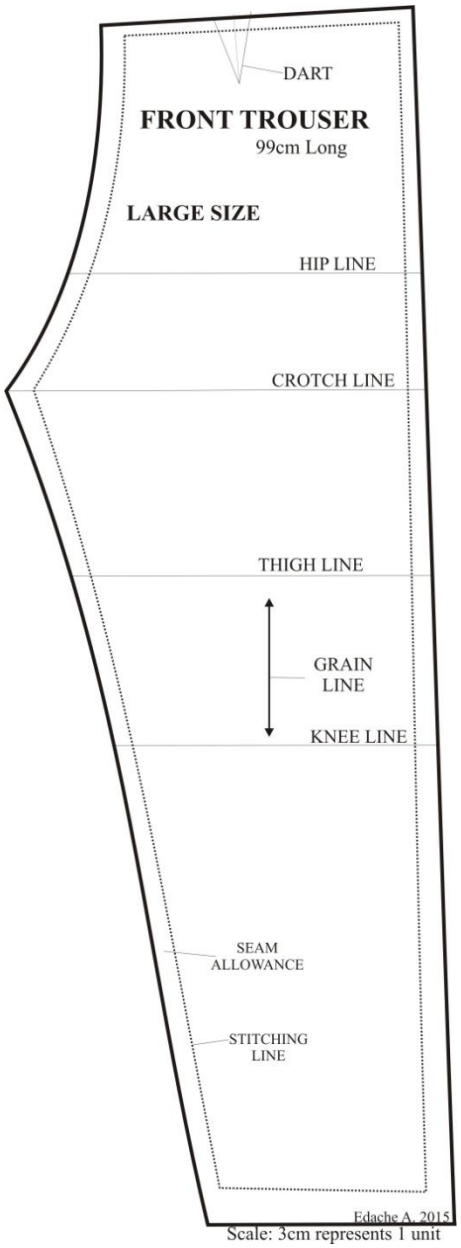

59cm Long
LARGE SIZE
GRAIN LINE
UNDER ARM SLEEVE
Edache A. 2015
Scale: 3cm represents 1 unit


72cm Long
LARGE SIZE
LAPEL FACING
GRAIN LINE
Edache A. 2015
Scale: 3cm represents 1 unit


COLLAR
28CM LONG
LARGE SIZE
Edache A. 2015
Scale: 3cm represents 1 unit

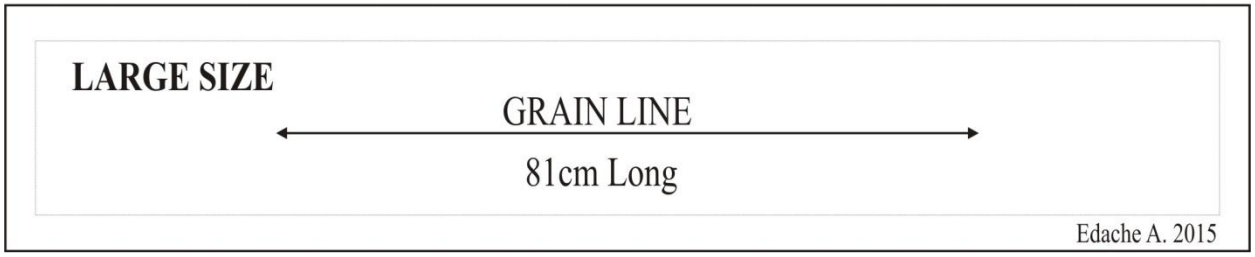


Scale: 3cm represents 1 unit



Scale: 3cm represents 1 unit

TROUSER WAIST BAND



Scale: 3cm represents 1 unit