

Longevity Clothes Using Adjustable Techniques for Children Ages 2 to 6 years

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Abstract:

A rapid growth rate of children, in addition to constant movement and activity, makes the rate of purchasing and consuming clothes high, and this has a negative impact on the family budget as well as on the environment.

The research aims to design and produce sustainable children's clothing from 2 to 6 years old, with a focus on quality and design, using four key axes: First, Analyzing the differences in sizes during the age period under study. Second, designing seven clothing pieces that contain functional techniques to control the differences in lengths and circumferences between different age sizes, which support a longer period of time for use. Third, Choosing fabrics with good performance quality. The process involves dyeing and printing the fabrics to enhance their aesthetic appeal. Ultimately, we execute the suggested functional designs and administer a survey to specialists and mothers\consumers, to gauge the effectiveness of these designs and the level of consumer demand for them.

Keywords:

Sustainable, longevity,
children's clothing,
functional techniques.

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Introduction:

The world today realizes the extent of the negative impact of industrial products and consumer behavior on the environment, society, and economy. In the clothing field, the awareness of designers and manufacturers has increased about the importance of designing and manufacturing more sustainable and environmentally friendly clothing through innovation and technology to produce clothing and fabrics that have less impact on the environment in terms of reducing the use of chemicals, reducing electricity and water consumption and water pollution, recycling, increasing the consumption period of the clothing item, and preserving natural resources, in trying to produce sustainable clothing.

In the first years of life, the child grows rapidly, especially in height, which forces the family to buy clothes constantly, and this constitutes a financial burden on their budget. But other clothing problems have also emerged resulting from: obesity or underweight, dwarfism, or being taller than the normal average for a child, which makes the sizes of clothing available in the market inappropriate in terms of dimensions for fit and size. This may affect sales of children's clothing, increase

inventory, and thus increase environmental problems.

It's better for children's clothing to acquire a sustainable character because clothing transfers from one child to another within the same family, and between families, friends, and neighbors, and this is a result of the rising costs of living, poverty, and the economic situation. In order for this to be achieved, the clothes must be characterized by quality, durability and be suitable to fit different body sizes and shapes.

Research problem:

The research problem is summarized in how to develop design ideas to boost the consumption of children's clothing while taking into account the child's psychological, motor, aesthetic, and functional needs.

Objectives of the research:

The research aims to propose some methods for designing and producing sustainable children's clothing with longevity. This is achieved by designing and implementing seven pieces of longer-lasting children's clothing for ages between 2 and 6 years utilizing extendable functional techniques. These pieces were designed to adjust and fit size differences through child growth. Also,

they could meet the needs of children who have special sizes due to malnutrition or genetic problems, and take into account both aesthetic and functional values. This reduces the economic burden on the family, in addition to reducing the amount of clothing thrown in waste, which represents a burden on the environment.

Importance of the research:

- 1- Increasing the consumption life of children's clothing, which may reach two years, by choosing good materials, extendable functional techniques, and choosing the parts of one piece of clothing wisely.
- 2- Adding functional techniques to control lengths and circumferences based on the size differences between each size and the next helps not only to change the dimensions of the child's size from one age to the next but also helps in finding solutions to adjust sizes to fit children who suffer from physical problems resulting from obesity, thinness, dwarfism, or being taller than their peers of the same age.
- 3- The longevity of children's clothes helps to reduce the purchasing process, reduce the economic burden on the family budget, reduce the stock of unsold clothes due to inappropriate fit and size, and thus reduce environmental problems.

Research Hypothesis:

- 1- The research assumes that the proposed designs will be accepted in general by specialists and mothers\consumers.
- 2- The research assumes that the use of extendable functional techniques will be successful in controlling fit and size, which increases the consumable life of the clothing item.
- 3- The research assumes that the implemented designs achieve integration between functional, aesthetic, and economic purposes and consider the overall child needs.
- 4- The research assumes that the used dyeing\printing techniques with colour harmony, materials, and applied techniques are compatible with the applied designs and added an aesthetic value to the product.
- 5- The research assumes that the product contributes to rationalization of expenditure and alleviation of the economic burden on the family budget, thus increasing demand for purchases as well as helping in the field of the clothing industry.

Research limitations:

- 1- Children's clothing ranges from 2 to 6 years old in Egypt.

- 2- Arab Republic of Egypt: To collect the opinions of a random sample of Egyptian consumers.

Research Methodology:

The research relies on an analytical and applied study, which involves analyzing the size chart for children aged 2 to 6 years, selecting functional techniques that are appropriate for the child's age group and motor requirements, and then applying the results to seven different proposed clothing designs.

Tools of the study:

A number of diverse sources including books, scientific research, International Information Network (the Internet), Microsoft Paint program, Adobe graphic programs (Photoshop), fabrics, dyes, pigments, auxiliary chemicals, the Egyptian Standard of children body dimensions, Metric pattern cutting for children's wear and baby wear from birth to 14 years (2), three different questionnaires.

1. Theoretical Study

Children continue to grow at huge rates ranging from 5 to 8 centimeters a year from birth to adolescence, making parents constantly replace clothes that are no longer suitable for the child, and children get rid of their clothes long before the clothing reaches the maximum wear, which has an impact on the increase in family expenses. In addition, most items that are discarded end up in landfills. Clothing and textile products usually take a long time to decompose. It releases dangerous toxins into the ground, causing serious environmental damage (16).

In recent years, societies have begun to look for ways and means to contribute to increasing awareness of sustainable life as designers, garment producers, and manufacturers continue to seek solutions through innovative and alternative designs to inhibit waste, excessive consumption, and pollution problems (10).

Sustainability, a concept that has garnered global attention from the 1980s to the present, is not a novel idea. People have practiced, from time immemorial, throughout different eras and generations, the elements of sustainability through coexistence with the environment and its natural elements, which contain the cycles that it passes through, as well as the changes and events in the ecosystem and natural phenomena (20). The term sustainability has many definitions and meanings. The world has not agreed on a single, specific definition for it; for example, it is defined as the capacity to continuously maintain or sustain a process over time. Sustainability is the attempt to prevent the depletion of natural or physical resources in a business and policy context, ensuring

their long-term availability (11). Also, it is defined as a process that contributes to the development of a high quality of life and a vibrant economy while also acknowledging the necessity of environmental protection and the conservation of natural resources." It articulates the principle that future generations should reside in a world that is relished by the current generation but not diminished (3).

1.1 Children classification and size categories

The childhood age categories, or what are called stages of growth, can be classified as early childhood (2–6) years, middle childhood (6–9) years, and late childhood (9–11) years.

1.1.1 Early Childhood Stage 2-6 years (Young Children)

This stage begins at the end of the second year and lasts until the sixth year. After the first two years (the toddler stage), physical growth slows down and starts to settle. At this point, the body's height grows by 6 to 7 cm annually, usually due to the legs growing longer than the trunk.

1.1.2. Middle Childhood (6-9) years

During these years, the child will grow at an average annual rate of 4 cm, and their weight will increase by about 2.5 kilograms per year.

1.1.3. Late Childhood (9-11) years

Generally, the body form in this stage takes on a slimmer look, with different bodily proportions. Fat gradually diminishes, and its distribution patterns change, contributing to the child's slimmer appearance. The girl's form is characterized by an undefined bust and a somewhat more delineated waistline (13).

1.2. Factors affecting child body size

The child's body size and dimensions are determined by a variety of critical factors. These factors, such as genetics and health, affect the children's growth, which describes the gradual alterations in physical attributes like size, weight, and height. Several variables influence children's growth and, consequently, their body sizes.

Figures (1) and (2) illustrate different sizes and different height for the same child age.



Figure (1) different sizes for the same child age (29)



Figure (2) different height for the same child age (8)

- **Heredity (genetics):** The main factor affecting a child's height is genetics. The average height of a person's parents determines their final height (12, 4).
- **Nutrition:** it is important because nutrient deficiencies can stunt growth. Malnutrition-related disorders can hinder children's growth. Conversely, overeating can cause obesity and other health problems (19, 12).
- **Health:** Certain illnesses might have a negative impact on a minor's growth status. Hormones, for example, such as insufficient growth hormone or an inactive thyroid, may affect a child's height (12, 4).
- **Socioeconomic Factors:** A family's standing affects the kind of opportunities a child receives. Young people from higher socioeconomic backgrounds typically have bigger sizes than those from lower socioeconomic backgrounds; this is due to access to quality education, a healthy diet, nutrients, health care, and appropriate housing (19, 12).

1.3. Factors to consider when selecting apparel for children:

There are many different types of children's clothing, and they come in many different styles and colours.

1.3.1. Clothes designs suitable for children clothes:

Clothes have to provide free movement for children. A garment that looks attractive but limits the child's mobility will not be favorable (21). Loose strings or excess fabric have to be avoided because they may get tangled. Avoid lengthy skirts or gowns that could trip the child, or very wide sleeves that could snag on objects. Limit the length of tie belts and drawstrings to be short, and ensure that buttons and trims are fastened securely (24). Properly finishing the edges of garments is essential to eliminate discomfort or irritation. Collars should be petite and lie flat against the surface (22). Wide, flexible neck openings are ideal.

1.3.2 Fabrics suitable for children clothes:

When selecting a fabric to make clothing for children, one must consider the most appropriate fabric (26). Natural fabrics, such as cotton and wool, are ideal for children's clothing. It is good to use lightweight fabrics. It is preferred for fabrics to "breathe" in hot weather so that respiration can evaporate. Fabrics used for children's clothing ought to be long-lasting, gentle, and easy to wash (28).

1.4. The methods of applying colours to garments:

Fabrics can be enhanced with colours and patterns by the application of dyeing and/or printing techniques.

1.4.1. Dyeing:

The present study applies colour to some products using the tie-and-dye technique. Folding, twisting, scrunching, or sewing fabric creates resistant areas that prevent dyeing. Rubber bands, string, or clothespins secure the fabric. Depending on the desired effect, dye is dipped, squirted, sponged, or brushed on fabric (25, 18).

1.4.2. Printing:

Textile printing is a highly adaptable and significant technique for applying coloured designs to textile surfaces, particularly fabrics. The current study employed the following printing techniques to imprint coloured designs on the fabrics:

1.4.2.1. Silk Screen printing:

It is a printing technique where ink is transferred onto a substrate using a mesh. A blade is used to fill the open spaces in the mesh with printing ink when the screen comes into contact with the substrate, causing the design to transfer onto it (18).

1.4.2.2. Sublimation Heat Transfer printing

Disperse dye inks print images on paper using digital or rotary photogravure screens, and then, through sublimation, the image is transferred directly onto fabric through heat and pressure. The process transforms solid ink on paper into a gas, which then transforms back into a solid as it transfers onto the fabric (23). Heat Transfer printing can be used on a variety of textile surfaces but works most effective on synthetic fabrics, primarily polyester (5). The transfer printing process is particularly well-suited for sportswear and swimwear due to the exceptional colourfastness of the disperse dyes. Additionally, it enhances the durability of the apparel item over extended periods of time.

This printing process is economical and less environmentally detrimental than many other processes due to the absence of chemicals and

excess dyes, which eliminates the need for washing off and reduces waste (23).

1.4.2.3. Digital (inkjet) printing

It refers to the act of printing directly onto substrates, such as fabric or paper, using an inkjet printing technique. Digital printing uses inkjets to propel dye or pigment onto substrates, resulting in a lower environmental impact due to the minimal presence of print paste residue. Consequently, this process requires less water and energy consumption (6, 7).

2. Methods:

The following steps are applied to extend the consumable life of children's clothing, solve the problem of fitting and sizing resulting from the rapid growth in the child's body size as well as the differences in body dimensions from one child to another in the same age group, and reduce the family's spending on buying clothes for their children:

- 1- Drawing different garments suitable for ages 2 to 6 years old using Microsoft Paint program., such as pants, dresses, skirts\skorts, jackets, blouses, and overalls, with different styles and parts such as puff, raglan, and kimono sleeves, as well as sleeveless styles, short and long pants, gathered and flared skirts, roll-up cuffs and waistbands, and different neckline styles, and adding detachable pieces to help in increasing and decreasing the difference in lengths and circumferences of the body measurements between different age sizes.
- 2- Adding the differences in measurements (in circumferences, widths, and lengths) for each model's pattern from one age size to another in accordance with the Egyptian standard specification table, using various techniques such as elastic thread in (design no. 1), double rows of buttons and button holes in (design no. 1, 2, 3, 5, and 7), zippers in (design no. 2), straps (design no. 3), elastic ribbon in (design no. 5), and knitted fabric in (design no. 4, 5, and 6), taking into consideration the differences in measurements between different ages.
- 3- Choosing some suitable fabrics to implement the designs with good quality.
- 4- Applying coloured designs to some of the chosen fabrics either by dyeing or printing to increase the aesthetic value of the apparel designs; taking into consideration some printing methods that achieve an economic printing process that can be considered less harmful to the environment and colourfast to help withstand the period of consumption. The

printed designs are formed with the aid of the Adobe Photoshop program.

- 5- Designing a survey (questionnaire) to specialists and mothers\customers, to gauge the effectiveness of these designs and the level of consumer demand for them.

2.1. Fabrics

- Woven fabrics: cotton\polyester (70\30 - twill 1\3), 375 g\m² - cotton (100% poplin - plain 1\1), 195 g\m², and polyester (100% - satin 5), 84 g\m².
- Knitted fabrics: cotton\ polyester (75\25 - derby), 450 g\m², and cotton (100% - jersey), 280 g\m². All fabrics were commercially obtained from the local market.

2.2. Test methods for fabrics

Performing mechanical tests for the fabrics used to implement designs to identify the characteristics and quality of the fabrics used, such as shrinkage, tensile strength, elongation, and pilling tests for woven fabrics and bursting strength and pilling tests for knitted fabrics. Shrinkage for woven fabrics is determined according to AATCC test method 135-2010 (14, I). Tensile strength and elongation for woven fabrics were determined according to ISO 13934. Bursting Strength and elongation of knitted fabrics were ASTM D6797-

2015 standard test method (2). Pilling test is performed according to ASTM Designation: D 4970-02 (9).

2.3. Dyeing and printing

- Silk screen printing components: Pigments: Imperon® blue K-B, Imperon® red K-GC, Imperon® yellow K-R, and Imperon® Green K-G - Sera Binder M-CPB, and synthetic thickener (Sera®Print M-CPK)
- Tie & dye components: Remazol Brilliant Blue BB 133%, Remazol Br Red 3Bs 150%, and Remazol Yellow X3RS - sodium carbonate (Na₂CO₃), and sodium chloride.

All of the products were kindly supplied by (DyStar Textilfarben GmbH & Co. Deutschland KG, Germany).

2.4. Dimension of Egyptian children human body.

All the measurements that used in the study were according to the body dimensions of Egyptian children (girls and boys from 1 year till 12 years) (Egyptian standards: 1321 for a year 2005) (30). Dimensions of age 2,3,4,5 and 6 are mentioned in table (1). taking into consideration the differences in measurements between different ages as shown in table (2).

Table 1: Body dimensions of Egyptian children (girls and boys from 2 to 6 years) according to Egyptian standards: 1321 for a year 2005

The measurement	2	3	4	5	6
Chest	54	56	58	60	62
Waist	54	54	56	58	60
Hips	56	60	62	64	66
Front waist length	22	23	27.5	29	30.5
Back waist length	22	23	24	25	30
Shoulder length	8	8.5	9	9	10
Skirt length	27	32	34	37	38
Sleeve width	17	18	18	19	19
Sleeve length	25	30	35	37	40
Wrist circumference	13	13.5	13.5	14	14
Upper arm	5	6	7	7	8
Crotch length	-	-	-	-	22
Outside leg	-	-	-	-	70
Inside leg	-	-	-	-	48

*Note: crotch length & inside leg measurements have been drawn according to Metric Standard Body Measurement (27)

Table 2: Differences in measurements between different ages

The age between	2,3 years	3,4 years	4,5 years	5,6 years
Chest	2	2	2	2
Waist	0	2	2	2
Hips	4	2	2	2
Front waist length	1	4.5	1.5	1.5
Back waist length	1	1	1	5
Shoulder length	0.5	0.5	0	1
Skirt length	5	2	3	1
Sleeve width	1	0	1	0
Sleeve length	5	5	2	3
Wrist circumference	0.5	0.5	0	0.5

Upper arm	1	1	0	1
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2.5. Basic blocks:

The basic blocks have been drawn according to Metric pattern cutting for children’s wear and baby wear from birth to 14 years, for Winifred Aldrich (27).

2.6. Software program:

- Microsoft Paint program to draw the primary sketches\designs.
- Photoshop software program to make printing designs.

2.7. Evaluation Scales (questionnaires):

Three evaluation scales were designed as follows:

The first evaluation scale (jurors’ evaluation scale):

To assess the validity of the two questionnaires, present them to the specialists in the field of textiles and clothing (16 members). The questionnaire contained four statements: the sentences' structure, the sentences' clarification, their logical sequence, and how they resemble the research goals.

The second evaluation scale (specialists’ evaluation scale):

This questionnaire included 13 statements to evaluate the clothing products by specialists in the textile and clothing field (3 ratings and 16 specialists).

The third evaluation scale (mothers’\consumers' evaluation scale):

The questionnaire included 11 statements to evaluate the clothing products by Egyptian mothers\consumers (3 ratings and 103 consumers).

3. Designs and Products:

Seven models, with adjustable features, were designed and carried out for ages 2 to 6 years (ages of this study) using different and several colours that suit the child, and these colours were applied by using different types of dyeing and printing methods.

3.1. Mechanical Tests:

Mechanical test results can help in understanding the quality, behavior, and performance of the fabrics, as well as helping in choosing the appropriate design and producing clothes with a longer consumer life and a pleasing appearance. Mechanical tests such as tensile strength for woven fabrics, bursting for knitted fabrics, and pilling are used to assess the quality, durability, and suitability of fabrics for specific applications.

Fabrics with high tensile or bursting strength values can have a longer consumer life and are more durable against tearing or puncture. Elongation is the fabric ability to deform without breaking. High value of elongation test indicates its good durability during wearing. Pilling can affect the overall feel and comfort, effecting the wearer's appearance and confidence because it makes the fabric look worn and old. The highest test grade is 5 which refers to no pilling and the lowest grade is 1 indicating very sever pilling. The highest value of the shrinkage test indicates a small percentage of shrinkage. Fabric shrinkage is important for consumers. It helps ensure that garments maintain their shape and fit after washing and drying.

The mechanical tests of the used fabrics; namely tensile strength, elongation, shrinkage, and pilling tests for woven fabrics, and bursting strength test for knitted fabrics, were examined. Results in tables (3) and (4) illustrated that polyester fabric has the advantage of gaining higher tensile strength (or bursting in case of knitted fabrics), higher elongation, and less shrinkage values than cotton, therefore more durability and longevity, but cotton, as known, is more comfortable to wear according to its breathability and subjected to less pilling than polyester, so blends of them have the advantage of the two fibers to some extent according to the blend ratio.

Table 3: mechanical tests for woven fabrics

Fabric		Gabardine cotton\polyester (70\30- twill 1\3)	Poplin cotton (100% poplin- plain 1\1)	Satin polyester (100%- satin 5)
tensile strength \ N		1350	600	1900
Elongation %		18.125	13.125	21.875
pilling		4.2	-	3.7
Shrinkage %	warp	1.75	3.8	1.25
	weft	1.75	4.3	1

Table 4: mechanical tests for knitted fabrics

Fabric		cotton\ polyester (75\25- derby)	cotton (100%- jersey)
Bursting \ N		704	693
pilling		3.7	-

3.2. Sketches\ Designs and Products:

Seven designs of children's clothes from two to six years old were carried out, taking into



consideration: 1) Using light-weight fabrics to make the product less weighty and decrease the bulk that results from using many layers of thick fabrics. 2) The design provides safety features for children so that it does not cause the child to stumble or hit corners. 3) Easy to put on and off by the child himself. 4) Selecting high-quality fabrics

that are washable, soft, durable, colorful, and printed in vibrant, lively colours. 5) Employing simple designs to reduce production costs and sell the product at an affordable price. The primary sketches\designs were designed by the researcher using Microsoft Paint program, and are shown in figure (3):

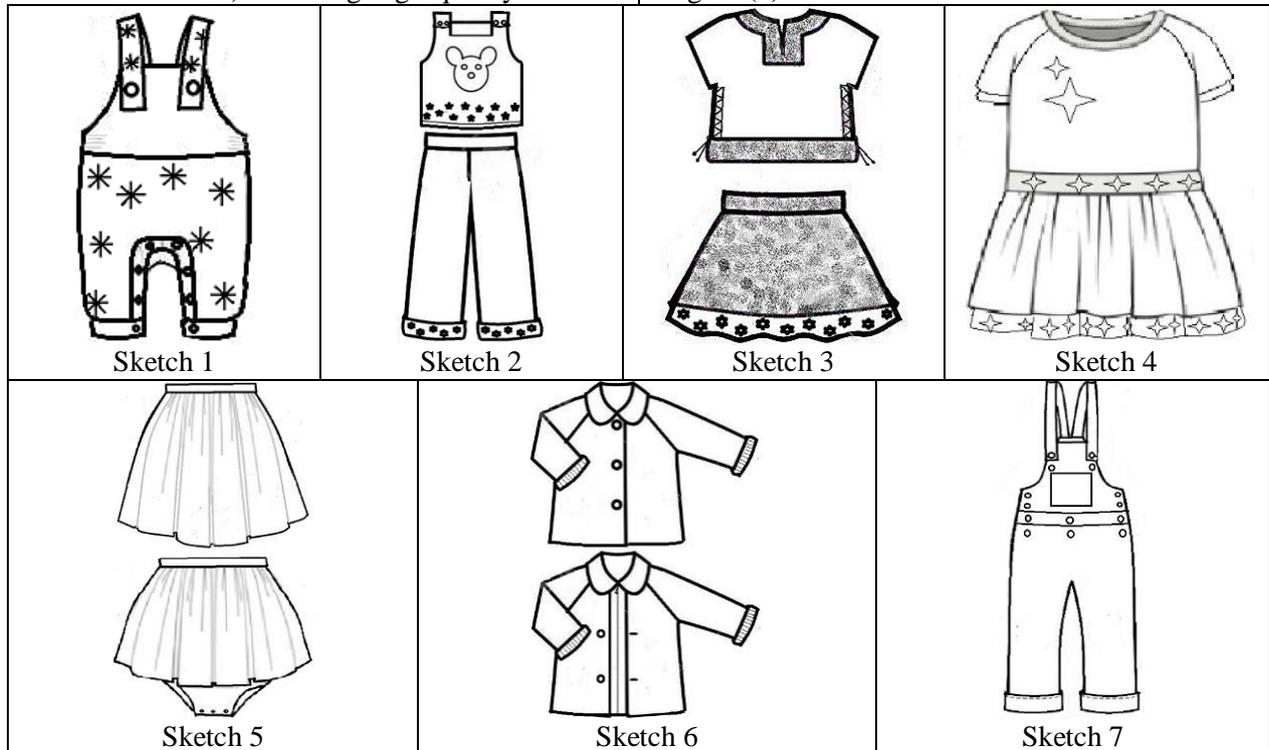


Figure (3) The primary sketches of the seven sketches\designs (designed by the researcher)

The results of executed designs and products are shown as follows:

3.2.1. Product (1):

Product (1) is suitable for children from 2 to 4 years old, as shown in table (5). It consists of one piece, which is a jump suit with extra fullness trousers. This piece is made from cotton\polyester 70\30 plain, white and printed fabric with a waist line that separates between them. Also, there is a facing with

two rows of buttons and buttonholes in the inside leg of the trousers and a cuff at the hem of each leg. Aesthetically, the colours of this design are violet (mixing of red and blue pigments), which is the colour of spirituality bright green (mixing of yellow and blue pigments) and a colour of growth and health, and dark yellow which conveys fresh energy. both colours look brighter when used side by.



Fabric: cotton 100% (poplin) plain 1\1.
 Technique: silk screen printing technique.
 Pigments used in silk screen printing have high wash fastness, so the brightness of the colours of child clothes will be permanent and won't fade due to repeated washing.
 Design: Design (1) was inspired by motifs (1) by using the legs of birds in the form of circles with different sizes.
 Colour: Imperon® blue K-B, Imperon® red K-GC, Imperon® yellow K-R, and Imperon® Green K-G, Sera Binder M-CPB

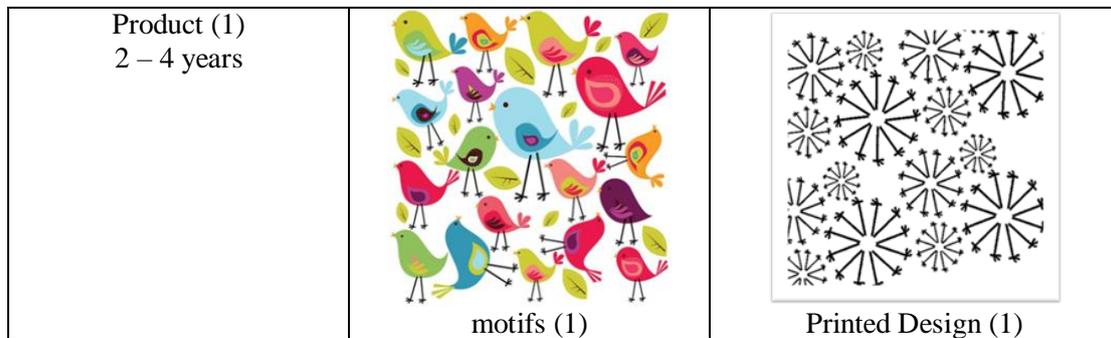


Table 5: The difference between the children ages 2 & 4 years of product no. 1

Photo No.	The product for age 2 years	Extendable functional techniques	The difference between ages (2- 4 years)
1.a		<ul style="list-style-type: none"> - Sleeveless arm holes are one of the growing features of the design. - straps with consecutive button holes controls the total length of the garment according to age. 	2.2 cm the difference between the two ages in length until the waist line.
1.b		Gathering with elastic thread helps to obtain different circumferences for different sizes of children between 2 and 4 years; it also makes the product easy to put on and off.	2 cm the difference in circumference
1.c		<ul style="list-style-type: none"> - Using the double row of buttons and buttonholes in the inside leg helps to control the decrease and increase of the crotch and the leg circumference. - The trousers help the child have free movement. 	3.5 cm the difference in crotch length between the two sizes 1.5 cm in width along the trouser
1.d		Using the double row of buttons and buttonholes in the cuff helps to control the decrease and increase of leg circumference.	2.3 cm the difference in cuff circumference

3.2.2. Product (2):

Product (2) is suitable to the child from 3 to 5 years as shown in table (6). It consists of two pieces which are sleeveless top piece (tank top) and trousers. These pieces are made from three types of fabrics; satin, cotton (poplin) and gabardine. Double face top piece, the right side made from

polyester 100% (satin 5) for the sleeveless top piece, the wrong side is fully lined with cotton, due to its absorbency, softness, and breathability, in addition to use the lining to finish the edges of the garment to avoid discomfort or irritation. The third fabric (gabardine) used for the trousers. There is a lap with double row of buttons and buttonholes at

the shoulder line and zips in the side lines of the top piece as well as the two side lines of the trousers. There is a printed satin lining under each zipper. When opened the zipper, the lining appears and works to increase the body circumference, also add a beautiful new look to the design. The foldable cuffs at the hem line of the trousers help to increase the length for the next age.

Aesthetically, the colours of this design are off-white for the top, watermelon for the trousers, and mixed colours for the printed design. The bear element and writing on the front and back sides of

the bodice represent focus points; the repetition of the rose unit into a strap shape at the shoulder line and hem line of the bodice and the trousers give rhythm. Mixing colours of the bodice, trousers, and also the printed designs gives this garment an aesthetic side and a new look, so the child doesn't feel bored when wearing it during this period of age, as well as harmony, which gives the feeling that all the parts of the outfit belong together, and they are also adorable and preferred for children's wear.

<p>Product (2)</p>  <p>3-5 years</p>	<p>Fabric: Double face top piece. The right side made from polyester 100% (satin 5) for the sleeveless top piece; the wrong side is fully lined with cotton 100% (poplin) plain 1\1; cotton \polyester 70\30 (gabardine) twill 1\3 for the trousers.</p> <p>Technique: inkjet printing technique (sublimation transfer printing - disperse dyes) on satin.</p> <p>Design: Design (2) was formed from motifs (2) using the bear element, roses, writings, and a simple repeated formation for the rose unit.</p> <p>Colour: Cyan, Magenta, Yellow, Black (CMYK) for ink jet printing.</p>	 <p>motifs (2)</p>  <p>Printed design (2)</p>
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Table 6: The difference between three and five ages of the child of product no. 2

Photo No.	The product for age 3 years	Extendable functional techniques	The difference between ages (3-5 years)
2.a		<p>Putting a lap with a double row of buttons and buttonholes at the shoulder line to increase or decrease the difference in the length of the bodice between the two ages</p>	<p>4.3 cm the difference in length till the waist line</p>
2.b		<p>Using the zippers in the side line of the bodice helps to increase or decrease the little difference in chest and abdomen circumferences between the two ages.</p>	<p>2 cm the difference in chest and waist circumference</p>

2.c		zippers in the outside lines of the trousers to control the increasing or decreasing waist and leg circumferences to be suitable for children sizes from three to five years	4.2 cm the difference in crotch length 3.2 cm the difference in width along the trousers
2.d		Using foldable cuffs at the hem of the trousers helps to increase or decrease the total length from age 3 to 5.	8.8 cm the difference in length of the trouser

3.2.3. Product (3):

Product (3) consists of two pieces: a bodice and a skirt with a separated lining, suitable for sizes between 2 and 4 years old, as shown in table (7). The bodice has cutting pieces of coloured fabric around the front and back neck, as well as a wide band of coloured fabric at the hem and sidelines that shift with straps. The skirt is slightly flared and above knee length, with a waist band and a lap of double rows of buttons and buttonholes at the two sidelines. The separated lining of the skirt is fastened with buttons and buttonholes on the wrong side of the waistband inside the skirt. It ends with a

wide piece of lace that is shown under the hem of the skirt when used to increase length at an older age.

Aesthetic design depends on the colours of the white bodice with a mix of pink and blue by using the tie and dye technique. The result is different colour shades that gave shape resembled waves, which added movement and activity to the design and created a good rhythm. Blue gives a feeling of trust, white resembles calm, and pink is associated with love, all of which make the design suitable for girls in this age period.

<p style="text-align: center;">Product (3)</p>  <p style="text-align: center;">2-4 years</p>	<p>Fabric: cotton 100% (poplin) plain 1\1. Technique: tie and dye technique. Design: random designs with circles and wave shapes. Colour: Remazol Brilliant Blue BB 133%® and Wash fastness* = 5 Light fastness* = 6 Remazol Br Red 3Bs 150%®. Wash fastness* = 5-6 Light fastness* = 6 Notice: (*) is according to the schema in ref. no. (17)</p>
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Table 7: The difference between two and four ages of the child of product no. 3

Photo No.	The product for age 2 years	Extendable functional techniques	The difference between ages (2- 4 years)
3.a		Using the straps on both side lines to control the difference in bodice circumference between the two ages	2 cm the difference in chest and waist circumference

3.b		A wide band at the bodice's end allows for folding or extending it to fit the child's length	3.5 cm the difference in length till the waist line
3.c		Add buttons and buttonholes to the skirt's waistband to adjust its width or tightness based on the child's size.	2.6 cm the difference in width circumference
3.d		Using a separated skirt lining, which is added at the elder age to compensate for the little difference between the two ages in length.	4 cm the difference in length till the knee line

3.2.4. Product (4):

Product (4) consists of one piece. A peasant knee-length dress with a separated lining, a short raglan sleeve, a zipper at the half-back line, and a cutting piece with a belt shape at the waist line. This design is suitable for the age range between 4 and 6 years old, as shown in table (8).

Aesthetic design depends on the printed fabric with different butterfly shapes with mixed colours (pink, bright purple, dark purple, olive, and orange) and a

white background. White suggests purity, pink is associated with love and femininity, bright and dark purple is the colour of spirituality, inspiring reflection and self-awareness, and finally, olive and orange are colours that convey excitement and warmth, and it is said that these are the colours of the soul. This colour group exudes happiness and joy, and the harmony between these colours makes the child feel happy, active, and energetic when wearing this outfit.

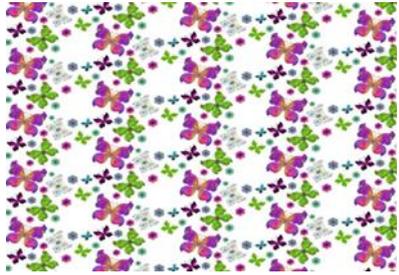
<p>Product (4)</p>  <p>4-6 years</p>	<p>Fabric: cotton 100% plain 1\1 and cotton 100% knit 2\2 (jersey). Technique: inkjet printing technique (direct printing – reactive dyes). Design: The cotton 100% knit 2\2 (jersey) fabric was printed by design (3) that formed from motifs (3) using units consisting of butterflies with different colours and sizes. Colour: Cyan, Magenta, Yellow, Black (CMYK) for ink jet printing.</p> <div style="display: flex; justify-content: space-around;"> <div data-bbox="564 1395 922 1715">  <p>motifs (3)</p> </div> <div data-bbox="927 1395 1399 1715">  <p>Printed design (3)</p> </div> </div>
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Table 8: The difference between four and six ages of the child of product no. 4

Photo No.	The product for age 4-6 years	Extendable functional techniques	The difference between ages (4- 6 years)
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Photo No.	The product for age 4-6 years	Extendable functional techniques	The difference between ages (4- 6 years)
4.a		Using knitted fabric in the neck line helps in making the design more comfortable and also helps in size flexibility.	0.5 cm the difference in the half neck circumference. 0.6 cm on the shoulder
4.b		The use of raglan sleeves allows the shoulder line to be unlimited in length, making it suitable for various body measurements at different ages.	0.5 cm at the end of the short sleeve
4.c		Using knitted fabric in the waist area not only enhances the comfort of the design but also contributes to the flexibility of the size due to its inherent elasticity.	2.2 cm the difference of the half waist circumference
4.d		Adding and removing the separate lining helps to control the length between different sizes. Also, it gives a different aesthetic value to the dress.	6 cm the difference between the two ages in the dress length
4.e	 		The separated lining shape

3.2.5. Product (5):

Product (5) consists of a knee-length skort (skirt with a pair of integral shorts), made from cotton 100% 2\2 jersey knitted fabric, suitable for the sizes of age 3 to 5 years, as shown in table (9). The waistband features elastic ribbon with buttons and buttonholes to adjust the waist size, while the crotch of the shorts features a double row of buttons and buttonholes to adjust the length.

Aesthetic design depends on using printed design of different colourful bird shapes and white colour of the background and the short. The combination of colours (white, light blue, light olive, green, purple, and red) in the applied printed design on the skirt evokes a sense of energy, movement, and activation, making it a preferred colour scheme for children of this age.

Product (5)	<p>Fabric: Cotton 100% knit 2\2 (jersey).</p> <p>Technique: inkjet printing technique (direct printing – reactive dyes).</p> <p>Design: The fabric was printed by design (4), that was formed from motifs (1) using units consisting of birds with different bright colours on a white background.</p> <p>Colour: Cyan, Magenta, Yellow, Black (CMYK).</p>
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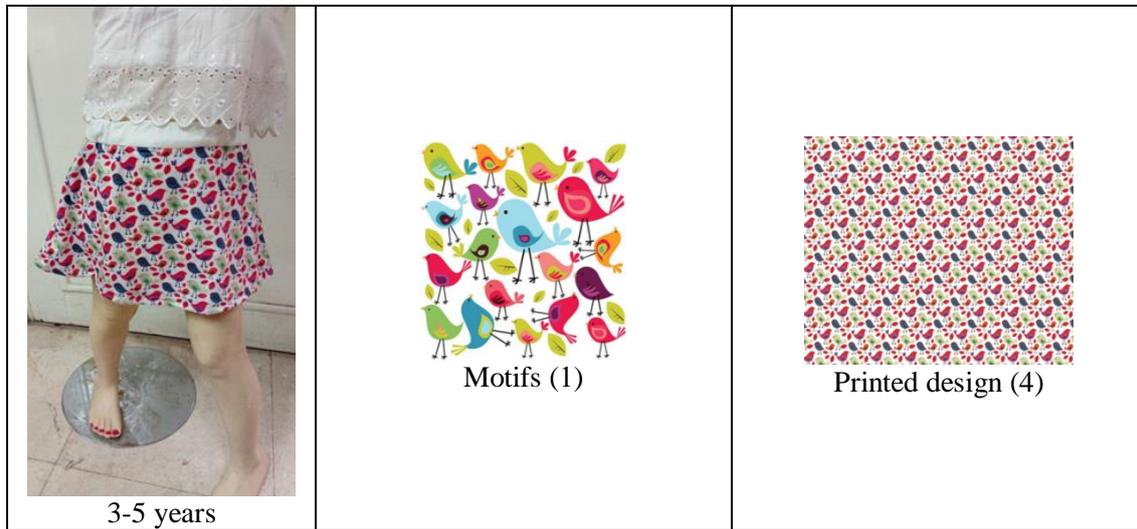
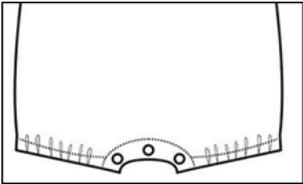


Table 9: The difference between three and five ages of the child of product no. 5

Photo No.	The product for age 3-5 years	Extendable functional techniques	The difference between ages (3- 5 years)
5.a		The fabric used in the skirt is (Cotton 100% - 2\2 (jersey) knitted fabric that is stretched to suit the different sizes between 3 and 5 ages.	The length of the skirt matches with the different lengths and ages because skirts remove the necessity for separate bottoms under a short skirt.
5.b		and a double row of buttons and buttonholes in the crotch of the shorts to control the changing of length. 	2.5 cm The difference of the crotch length between the two sizes
5.c		ribbon inside the waistband with buttons and buttonholes to control the waist size. 	2.9 cm The difference between the two sizes in half waist circumference

3.2.6. Product (6):

Product (6) consists of a jacket used for the sizes between 4 and 6 years as shown in table (10) with a collar and kimono sleeve made from gabardine fabric; at the end of the sleeve there is a cuff made from knitted fabric (Derby) that can be folded at a younger age. The jacket has two fronts: the upper front is made of cotton \ polyester 70\30 (gabardine) fabric dyed with the tie and dye

method, and it has a facing with buttons and button holes. The below (under) front is made from cotton 100% knitted fabric (Derby), dyed with light blue colour and has a zipper at the center front line. In terms of aesthetics, the use of a monochromatic colour scheme for the jacket - a single colour scheme that incorporates a variety of tints, shades, and intensities - resulted in a sense of unity and restfulness, while the use of blue for an outer

garment makes it versatile and easy to pair with any colour of clothing.

<p>Product (6)</p>  <p>4-6 years</p>	<p>Fabric: Cotton\Polyester 70\30 (Gabardine), twill 1\3, and Cotton\ polyester 75\25 knitted (Derby). Technique: tie and dye. Design: Randomly design with circle shapes using a light blue colour. Colour: Remazol Brilliant Blue BB 133% ®. Wash fastness* = 5 Light fastness* = 6 Notice: (*) is according to the schema in ref. no. (17)</p>
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Table 10: The difference between four and six ages of the child of product no. 6

Photo No.	The product for age 4 years	Extendable functional techniques	The difference between ages (4- 6 years)
6.a		The inner stretched front piece (under) is made from knitted fabric (Derby), and the stretching of this piece provides the desired circumference based on the age.	4 cm The difference in total circumference between the two sizes
6.b		The style of kimono sleeve addresses the slight variations in shoulder line, neck line, and armhole between the two sizes.	1 cm The difference in Shoulder length 1 cm The difference in Sleeve width 1 cm The difference in Upper arm
6.c		Cuffs are folded up at a younger age and remain unfolded at an older age to give an extra length to the sleeve. The elasticity of knitted fabric in the wrist area contributes to the size's flexibility.	5 cm The difference in sleeve length between the two sizes. 0.5 cm Wrist circumference

3.2.7. Product (7):

Product (7) is suitable for children from 3 to 5 years old as shown in table (11). The dungaree trousers consist of two pieces: trousers and a separate strappy top with a pocket at the front, joined together with a double row of buttons and button holes. Therefore, the design can be worn in different shapes; it can be worn as trousers by removing the upper strappy top or as dungaree trousers by adding it. The strappy top and the waist line band have two rows of buttons and buttonholes which allow to adjust the overall length of the product and the length of the trousers' crotch. Additionally, the buttonholes on the side of the

waist band aid in adjusting the circumference of the waist band to suit the child's body size or age. Printed cuffs at the hemline of the trousers can be folded or released according to the child's length. Aesthetically, the harmony between colours that are used in this model is generally attractive because they don't have equal areas of light and dark due to the tie and dye effect, and the mixing of the light purple colour (the colour of spirituality) with the pink colour (that is associated with love) of the design, as well as adding the printed folded piece at the end of the trousers with colourful birds, gives the product a product a feeling of movement, vitality, typing, and aesthetics.

Product (7)	Fabric: Cotton\Polyester 70\30 (Gabardine) twill 1\3.
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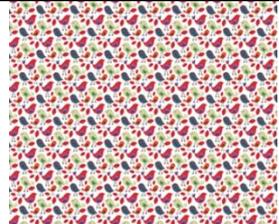
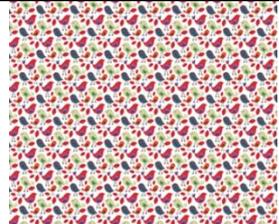
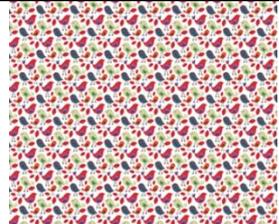
	<p>Technique: tie and dye technique used on the dungaree trousers; inkjet printing technique used in the folded pieces at the hemline of the trousers.</p> <p>Design: Randomly design of tie and dye using light purple and pink colours and the folded part is printed by design 4</p> <p>Colour: for tie and dye: -Remazol Brilliant Blue BB 133%® Wash Fastness* = 5, Light fastness* = 6 -Remazol Br Red 3Bs 150%®: Wash Fastness* = 5-6, Light fastness* = 6 and CMYK for the inkjet printing on folded pieces.</p> <p>Notice: (*) is according to the schema in ref. no.(17)</p>		
<p>3 – 5 years</p>	<table border="1"> <tr> <td data-bbox="566 660 949 907">  <p>Motifs (1)</p> </td> <td data-bbox="949 660 1316 907">  <p>Printed design (4)</p> </td> </tr> </table>	 <p>Motifs (1)</p>	 <p>Printed design (4)</p>
 <p>Motifs (1)</p>	 <p>Printed design (4)</p>		

Table 11: Control the difference between the children ages 2 & 4 years of product no. 7

Photo No.	The product for age 3 years	Extendable functional techniques	The difference between ages (3- 5 years)
7.a		<ul style="list-style-type: none"> - The sleeveless style is one of the design's growth features, and it is easy for the child to wear. - A strappy top can lengthen or shorten with buttons and buttonholes for the upper piece, depending on age. 	<p>2.5 cm The difference in length till the waist line.</p>
7.b		<ul style="list-style-type: none"> - The difference in crotch length of the trousers was compensated with two rows of buttons and buttonholes at the waist line according to the child's length or age. - It can be worn as trousers by removing the upper bodice or as a dungaree. 	<p>2.5 cm The difference in crotch length of the trouser.</p>
7.c		<ul style="list-style-type: none"> - Using buttons and buttonholes at the waistband's side helps to control the difference between the two sizes in the waistline's circumference, which can be wide or narrow depending on the child's body size or age. 	<p>3 cm The difference in waist circumference of the trouser</p>

7.d		Cuffs at the hemline of the trousers can be folded up or released down according to the age or length of the child.	8.8 cm The difference in length of the trouser
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3.3. Evaluating of the seven designs using evaluating scales:

Three scales (questionnaires) were evaluated; the first one (jurors' evaluation scale) was applied to measure the validity of the other two questionnaires, and the second one (specialists' evaluation scale) was evaluated by specialists in the field of textiles and clothing (16 members); it consists of 3 ratings and 13 questions. And the third one was evaluated by mothers\consumers (103 mothers); it consists of it consists of 3 ratings and 11 questions.

3.3.1. Jurors' evaluation scale:

The percentage of agreement between the jurors for the first questionnaire, which is related to

specialists, was 97%, and for the second questionnaire, which is related to mothers\consumers was 99%, thus, both percentages are extremely high, which proves that they are true and valid for execution.

The jurors gave their opinions related to rephrasing some phrases and adding others, which was taken into consideration by the researcher, and thus, both questionnaires were in their final stage to be executed.

3.3.2. Specialists' evaluation scale:

According to the specialists' questionnaire, thirteen statements addressed three main axes: function, aesthetics, and economics were evaluated and the results are shown in table (12).

Table (12) Shows the evaluation percentage of the seven implemented designs from specialists' point of view regarding statement designs in percentage

Design No. Statements of Evaluation scale	1	2	3	4	5	6	7
1. The design idea is able to increase the consumer life of the child.	66%	69%	63%	65%	67%	61%	66%
2- The design considers the overall child's needs (mobility, psychological, aesthetics, and functional)	69%	69%	62%	62%	66%	60%	67%
3- The used technique is relevant to control the breadth and length of the finished piece with design.	66%	70%	65%	64%	65%	62%	66%
4- The materials used are compatible with the applied designs.	69%	71%	67%	66%	67%	63%	65%
5- The integration of the functional, aesthetic, and economic purpose of the proposed design is achieved.	67%	70%	64%	65%	64%	60%	66%
6- The implemented design contributes to rationalization of expenditure and alleviation of the economic burden on the family budget.	67%	71%	66%	65%	66%	63%	64%
7- The ideas of applied techniques add aesthetic touches to the clothing.	66%	72%	64%	65%	60%	61%	64%
8- The design concept is a good addition in the field of children's clothing manufacturing.	63%	71%	65%	63%	64%	60%	65%
9- Extent of applicability of the applied piece as an industrial product.	67%	72%	63%	64%	65%	63%	64%
10- Excellence and implementation ideas contribute to the promotion of the product.	65%	71%	63%	62%	64%	62%	64%
11- The shapes of the decorative units (printed or	73%	74%	60%	65%	74%	56%	64%



dyed) compatibility with their distribution in the model of the finished garment.							
12- There is a colour harmony and compatibility between the colours used in constructing the units of the designed garment.	76%	75%	62%	71%	74%	55%	61%
13- using dyeing and printing techniques to give a beautiful value to the design.	74%	73%	57%	68%	73%	53%	62%
Average of evaluation percentage for each design	68%	71%	64%	65%	66%	61%	64%
The acceptable percentage for all the seven designs	66%						

The overall evaluation percentage of specialists' opinions as illustrated in table (12) showed that design no. 2 came in first regarding the three main axes, with an average evaluation percentage (71%) while design no. 1 came in the second degree with an average evaluation percentage (68%), design no. 5 came in the third degree (66%) and design no. 4 came in fourth (65%). Additionally, designs no. 3 and 7 secured the fifth position with an average evaluation percentage (64%), while design no. 6 finished last with an average evaluation percentage (61%). According to specialists' opinions, the average evaluation percentage for all designs was 66%.

From the specialists' point of view, the second design is the most suitable one to achieve its

purpose of increasing the longevity of a child's wear as it looks unique with creative features (zippers in different places), which make it comfortable for different sizes and also suitable for overweight children. Also, both the colors and the printing used in the design make it more attractive for consumers, that is why it came first in all proposed evaluations.

3.3.3. Mothers\Consumers' evaluation scale:

According to the questionnaire of mothers \consumers, eleven statements addressing three main axes: function, aesthetics, and economics, were evaluated and the results are shown in table (13).

Table (13) Shows the evaluation percentage of the seven implemented designs mothers\consumers' point of view regarding statement designs in percentage

Statements of Evaluation scale	Design No.						
	1	2	3	4	5	6	7
1- The design contributes to the needs of the child in the age group (2–6) years (in terms of type and design).	98.4%	98.7%	98.4%	98.1%	98.4%	99.03%	99.03%
2- The design meets the continuous age-increase in terms of body roundness (chest, waist, neck, and arm).	98.7%	98.2%	98.3%	98.08%	98.5%	99.38%	98.9%
3- The design meets the continuous age increase in length (total length - length to waist - shoulder length - length of sleeve if does exist).	98.4%	98.7%	98.7%	97.4%	98.7%	99.03%	98.7%
4- The technique used to control the breadth and length of the piece is consistent with the proposed design.	98.4%	98.7%	98.7%	96.8%	98.7%	98.7%	98.4%
5- Ideas of applied techniques add aesthetic touches to clothing.	98.1%	98.7%	98.7%	96.8%	98.7%	98.7%	98.7%
6- The colour group corresponds to the child's age range (2–6 years).	98.7%	98.7%	98.7%	96.8%	98.7%	99.03%	98.1%
7- The materials used are compatible with the applied designs.	98.7%	98.7%	98.7%	96.12%	98.7%	99.03%	98.1%
8- The design achieves an innovative idea.	98.7%	98.7%	98.7%	96.8%	98.7%	99.03%	99.03%
9- The design achieves integration between functional, aesthetic, and	98.1%	98.7%	98.7%	94.17%	98.7%	99.03%	97.4%

economic purposes.							
10- The implemented design contributes to rationalization of expenditure and alleviation of the economic burden on the family budget.	98.4%	98.7%	98.7%	98.4%	98.7%	99.03%	98.4%
11- If you find a piece of clothing with a similar idea to the design in the Egyptian market, I will accept to buy it.	98.4%	98.7%	98.7%	97.7%	98.7%	99.03%	97.7%
Average of evaluation for each design	98.4%	98.6%	98.6%	97.0%	98.6%	99.0%	98.4%
The acceptable percentage for all the seven designs	98.40%						

The overall evaluation percentage of mothers\consumers' opinions, as illustrated in table (13), showed that the sixth design came first in all statements' evaluation regarding the three main axes with an average evaluation percentage (99%), while designs no. 2, 3, and 5 came in second with an average evaluation percentage (98.6%). Also, both designs no. 1 and 7 came in third with an average evaluation percentage (98.4%), and finally, the fourth design came in last with an evaluation percentage (97%). According to mothers\consumers' opinions, the average evaluation percentage for all designs was 98.4%.

From the perspective of mothers\consumers, the sixth design, the jacket, emerged first, offering numerous benefits such as having two front layers that help to fit different sizes, and also having two varying appearances. Additionally, since jackets tend to be expensive, investing in a jacket with adjustable features that can extend its lifespan significantly enhances its economic value. While, in their opinion, the second design that was chosen by the specialists is not as practical in use as the jacket, where it contains zippers that can be opened during children's activities and also can't be worn with different clothes.

3.4. Results of the study:

The current study presented seven implemented designs for children's clothing (2-6 years old) with different ideas of adjustable features and elements to help clothing 'grow' as the child does, fit and adjust size for a wider range of children's body shapes through child growth, and meet the needs of children with special sizes due to malnutrition or genetic problems, taking aesthetic and functional factors into account.

Designers also make children's clothes in classic styles and colors for reuse. Statistics were used to evaluate the seven models from the perspectives of experts and mothers\consumers. Evaluation results showed:

1- The hypothesis no.1 has been verified: All seven products were accepted by specialists and mothers\consumers in general with different values. However, the degree of acceptance of the

implemented designs varied between specialists and mothers\consumers. Mothers\consumers showed a very high level of acceptance, with an average acceptance score of 98.40% for the seven implemented designs. On the other hand, specialists' acceptance of the implemented designs was somewhat acceptable, with an average acceptance score of 66% for the seven designs.

The overall evaluation of specialists' opinions showed that the second design, no. 2 came first with average overall (71%), and the sixth design came in last with average overall (61%), while the overall evaluation of mothers\consumers' opinions showed that the sixth design, the jacket, came first in all statements' evaluation with average overall (99%), and the fourth design came in last with average overall evaluation (97.02%). In addition, their opinions in question no. 8 revealed that the designs achieve an innovative idea with an average acceptance between (96.8% to 99.03%).

2- The hypothesis no.2 has been verified: The overall evaluation of specialists' opinions showed in question no.3 indicated that the second design (no. 2) ranked first with an average overall score of (70%), while the sixth design came in last with an average score of (62%). Similarly, the overall evaluation of mothers' and consumers' opinions in questions no. 2 and 3 revealed that the sixth design ranked first with an average overall score of (99.38% and 99.03%), while the fourth design came in last with an average score of (98.08% and 97.4%), respectively. Also, from the specialists' opinion in question no.1 "The idea of the design is able to increase the consumer life of the child", the overall evaluation showed that design no. 2 came first with average (69%), and the sixth design came in last with average (61%).

3- The hypothesis no. 3 has been verified: All the seven implemented designs achieved integration between functional, aesthetic, and economic purposes and considered the overall child's needs. The overall evaluation of specialists' opinions showed that in question no. 2 the designs 1& 2 came first with average overall (69%), and the sixth design came in last with average overall (60%). The

overall evaluation of mothers' \consumers' opinions showed in questions no. 1 that the 6 & 7 designs came first with average overall (99.03%), and the fourth design came in last with average overall (98.1%). Also, in the specialists' opinions point of view in question no. 5 as well as mothers' \consumers' opinions in question no. 9 about the integration of the functional, aesthetic, and economic purpose of the proposed design, the overall evaluation showed that design no. 2 in specialists' opinions and design no. 6 in mothers' \consumers' opinions came in first with average (70% and 99.3%), and designs no. 6 and 4 came in last with average (60% and 94.17%), respectively. While the opinions of mothers' \consumers' in question no. 6: The colour group corresponds to the child's age range (2–6 years) showed that design no. 6 came first with an average (99.03%), while design no. 4 came in last with an average (96.8%).

4- The hypothesis no. 4 has been verified: In specialists' opinions point of view in question no. 4 as well as mothers' \consumers' opinions in question no. 7, the overall evaluation showed that design no. 2 in specialists' opinions and design no. 6 in mothers' \consumers' opinions came first with average (71% and 99.03%), and designs no. 6 and 4 came in last with average (63% and 96.12%), respectively. Also, about whether the applied techniques add aesthetic value to the product in question no. 7 in specialists' opinions, it is obvious that design no. 2 came in first with average (72%) and design no. 6 was the last (61%), but in question no. 5 in mothers' \consumers' opinions, the overall evaluation showed that designs no. 2, 3, 5, 6, and 7 had the highest value (98.7%), and design no. 4 came at the last (96.8%). In specialists' opinions in question no. 11 about the compatibility of the decorative units with their distribution in the garment, designs no. 2 and 5 came first with an average (74 %) and design no. 6 came in last with an average (56%). In addition, about colour harmony and using dyeing and printing techniques to give a beautiful value to the design and its compatibility with the finished garment. The results of questions no. 12 and 13 in the opinions of the specialists showed that design no. 1 came first with average (76% and 74%), and design no. 6 came in last with average (55% and 53%), respectively.

5- The hypothesis no. 5 has been verified: In specialists' opinions in question no. 6, as well as mothers' \consumers' opinions in question no. 10, the overall results showed that the range of specialists' opinions came between 71% for design no. 2 and 63% for design no. 6, and the range of mothers' \consumers' opinions came between 99.3% for design no. 6 and 98.4% for designs no. 1,

4, and 7. About if these products will increase the demand for purchases; The overall results of question no. 10 of specialists' opinions came between 71% for design no. 2 and 62% for design no. 6, while the range of mothers' \consumers' opinions in question no. 11, came between 99.03% for design no. 6 and 97.7% for designs no. 4 and 7. The overall evaluation of specialists' opinions in questions no. 8, 9, and 10 showed that the design no. 2 came in first with average overall (71%, 72%, and 71%), and the sixth design came in last with average overall (60%, 63%, and 62%) for the three questions respectively.

Recommendations:

Further studies need to:

- 1- Design adjustable clothes with innovative ideas to accommodate children's rapid growth, and provide them with educational instructions for long-term use and potential reuse.
- 2- Choosing the appropriate designs and the fabrics for the children, along with further tests and treatments to ensure the degree of durability, tearing resistance of the material to staining, color fastness, and other important tests and treatments to maintain the product's quality for the longest possible period.
- 3- Designing multi-functional clothes that include features such as two-sided clothes, multi-dressing ways, and parts that can be worn with other clothes.
- 4- Using classic and simple designs that suit any time and last for a longer period of time.
- 5- Using suitable threads and sewing techniques, as well as performing tests for sewing durability.

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