

# An Artistic Vision of Using Polyurethane Foam in Drapping Fictional Costumes Designs to Achieve Sustainable Development

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**Abstract:** One of the aspects of the modern era is leaving more room for imagination and experimentation. Costumes design in general and fictional costumes design in particular are among the areas that need a lot of experimentation, especially with new, non-traditional materials. This is what encouraged the researchers to choose the polyurethane foam as a non-traditional material to design fictional costumes in order to achieve sustainable development goals. The research aims at clarifying the characteristics of the polyurethane foam and its Forming instead of plastic capabilities in the field of Costumes design, and providing proposals for fictional costumes designs with this material, in addition to achieving the sustainable development goals; such as, adopting sustainable production and consumption patterns, and stimulating innovation. The research findings state the possibility of achieving new visions of using the polyurethane foam to design and create fictional costumes in order to achieve the goals of sustainable development.

**Keywords:** polyurethane foam - fictional costumes - sustainable development.

## 1. Introduction

Expressive costumes play an important role in embodying dramatic and imaginary characters, as they make the viewer convinced to the point of interaction through the creative processes of fictional costumes designers. Costumes design in general and fictional costumes design in particular has become a field for experimenting with innovative, non-traditional materials that are used as innovative solutions that can provide the opportunity for the artist to achieve new formulations that clarify the modeling instead of plastic concepts of fictional costumes [1].

Fictional costumes designers were not only interested in design, but they were also into using new materials and modern techniques, which provided a huge amount of unconventional resources that strongly contributed to use instead of forming a new modeling instead of plastic concepts that helped the Designer not the artist to be liberated from the limits which imposed by traditional standards and raw materials. Such new materials were varied and characterized by aesthetic and functional properties, distinguished performance of high quality, as well as various techniques for formation and expression [2,3].

All countries of the world are making great efforts to achieve the goals of sustainable development, with its three dimensions: the economic, social, and environmental dimensions; and believing in this vision, adopting its goals in a competitive and diversified economy of building creative capabilities, stimulating innovation and environmental sustainability [4].

As such, and as a contribution to achieving sustainable development goals as economic and environmental dimensions through the use of the polyurethane foam in fictional costumes design, the research problem was identified in the following question: -

### Research Problem

How to take advantage of the forming potentials the polyurethane foam as a non-traditional cheap material in fictional costumes design to achieve sustainable development goals? The need for more explanation for the relation between sustainable and forming with foam. Where the main point, may be the flexibility and strength of material, may be the material is friendly to the environment, may be economically, so the problem not in general should be specific.

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## Research Objectives

1. Clarifying the properties of the polyurethane foam and its plastic capabilities in the field of costumes design with the use of the mannequin.
2. Achieving sustainable development goals by adopting sustainable production and consumption patterns and stimulating the creations.

## Research Importance

- 1- Opening new horizons for costumes designers in general and fictional costumes designers in particular to use non-traditional materials away from stereotypes and simulations.
- 2- Embracing sustainable development and achieving its goals.
- 3- Using this study as a reference when using the polyurethane foam in shaping costumes on the mannequin.
- 4- Finding alternative, new, low-cost materials to be used in fictional costumes design.

## Research Methodology

The research followed the descriptive and applied approaches.

## Research Hypotheses

1. There are statistically significant differences between the implemented designs in achieving the design elements according to the opinions of specialists.
2. There are statistically significant differences between the implemented designs in achieving the design principles according to the opinions of specialists.
3. There are statistically significant differences between the implemented designs in achieving the innovative process of fictional costumes according to the opinions of the specialists.
4. There are statistically significant differences between the implemented designs in how to take advantage of the plastic potentials and usage techniques of the polyurethane foam according to the opinions of the specialists.
5. There are statistically significant differences between the implemented designs in achieving the sustainable development according to the opinions of specialists.
6. There are statistically significant differences between the ten implemented designs according to the opinions of specialists.

## Research Tools

A rating scale to measure the assessors' opinions of the implemented designs.

## 2. Theoretical Framework

Costumes play an important role in the life of the individual throughout the ages, and they are considered a cultural entry to study the changing reality of societies. Thus, man has taken care of them, developed them, and observed their different features, as well as the related artistic and social contexts. There are many types of costumes and various functions, including fictional costumes [1].

### 2.1. Fictional Costumes

The word *costume* refers to clothes, dresses, and outfits [5].

*Fictional Costumes* mean every garment worn by artists in order to express the character that they perform. These costumes bear interpretable connotations that artists try to evoke during their embodiment of a particular character [6,7].

They are those costumes that actors use in the fields of theatre, cinema, television ... etc., their goal in the first place is the expressive aspect; and the role of the designer is to plan the final look of the performer, which is an effective medium to represent the content of the dramatic artwork or performance [1,4].

The importance of fictional costumes is evident in the various artistic performances (theater, cinema, and television) as

they represent an essential element of the presented story. Their great value is also evident in increasing the clarification of the actor's movements and expressions. Fictional costumes have evolved until they became a conceptual revolution that interacts with lights and movements to represent the author's idea of the nature of the story. They go in harmony with the spirit of the artistic show. Fictional costumes help the actor in becoming one with the character they perform, and also help the viewer in understanding such character.

Fictional costumes are considered one of the most important elements of the image in fantasy films, and participate in the realization of the ideas that the artwork aspires to; accordingly, the interest in designing these costumes is no longer limited to the design solely, but extends to using modern techniques and materials through which the design is realized [1].

As a result of the technological revolution in the field of raw materials and tools production, the costume designer has got a wide range of interesting new tools and materials for artistic expression. Designers' plastic abilities were liberated to express their feelings and emotions away from the restrictions imposed by different traditional fabrics and materials. In experimenting with traditional and non-traditional materials, artists often prefer certain materials over others and use them in expression. This requires that they determine the appropriate technique to use in expressing their inner thoughts. The first stage of dealing with the material is a stage of discovering its expressive potentials through various formation systems, and the artist's ability to deal with it. Thus, the designer has got access to a whole new industrial materials that differ in their characteristics and shapes, in addition to the other traditional natural materials [8].

The materials of a special nature means those that require special designs as well as special care and treatment in all stages of their production; in other words, special treatments and processes when they are cut, sewed, and finished (due to their natural and mechanical properties of special nature) [9].

The materials of a special nature include natural or artificial types, such as, wood, foil, paper, glass, and plastics of all kinds, as well as foam, that is the subject of the current research. Foam or compressed cork (low density polyurethane) is a compressed sponge resin material made of petroleum-derived polymers that have formation properties of easy bending and cutting with scissors. It is found in the form of panels of multiple thicknesses and colors, and is used in many industries [8].

## 2.2. Polyurethane Foam

The scientific name for foam is *Polyurethane*, which is abbreviated to *pu*. It is one of the four basic types of products that can be made from liquid polyurethane raw material. It consists of two chemicals when mixed and heated form liquid polyurethane. These chemicals are *polyol*, a type of complex alcohol, and *di-isocyanate*, a petroleum by-product that is made of large and very complex molecules produced by combining a large number of simpler molecules called *monomers*. It has a wide range of industrial uses [10].

### Chemical Composition

For more than half a century, the polymerization method and multiple condensation processes were used to produce plastics until 1937, when the German scientist Otto Bayer discovered the *polyurethane polymer*. As the poly chain consists of organic molecular units linked to each other by *urethane linkage* or *Uarbamate-(NHC00)*. It is formed by the reaction between a monomer containing two isocyanate functional groups ( $-N=C=O$ ) - and another monomer containing at least two alcohol groups ( $-OH$ ) - in the presence of a UV-catalyst, as shown in the Figure (1):

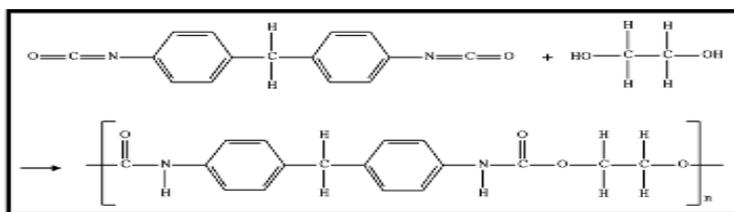
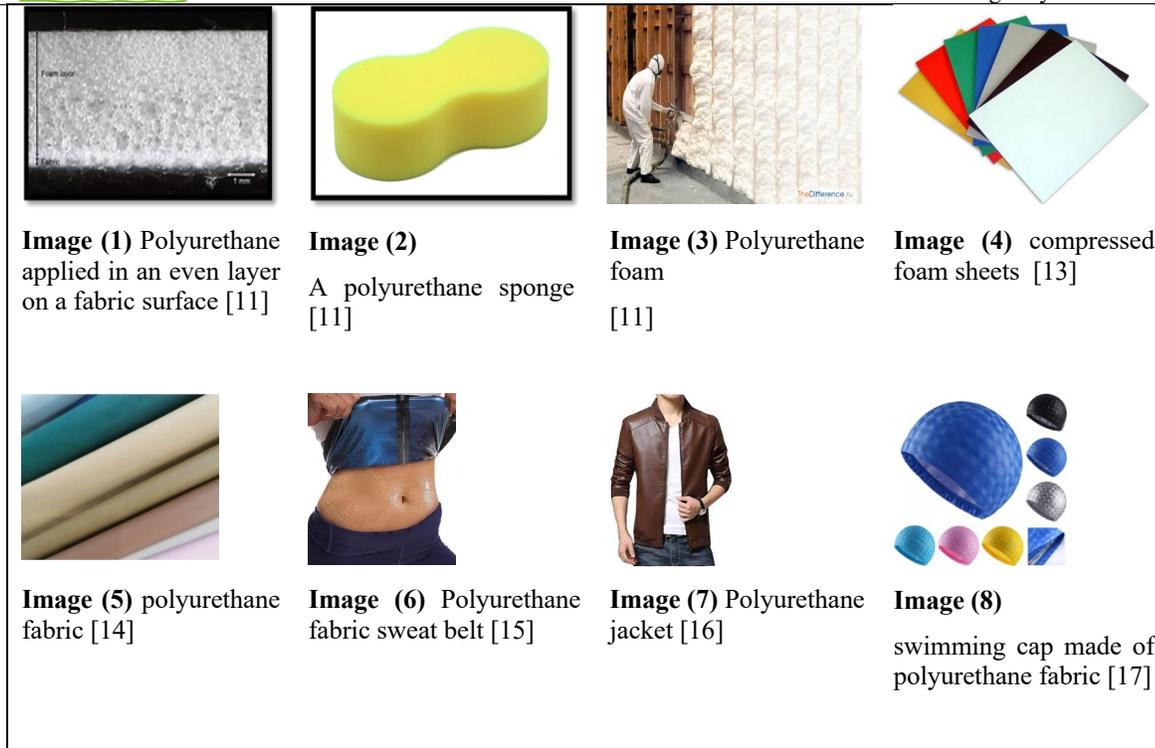


Fig. 1. Polyurethane polymer [11]

### Polyurethane Shapes

Polyurethane takes the form of a liquid, foam, or solid, and each has certain advantages and limitations. Polyurethane may be solid, such as fiberglass, spongy (flexible) such as upholstery foam, rubber such as rubber wheels, or a viscous liquid such as glue, which is suitable for manufacturing by casting and extrusion methods, and pressure [12].

The following pictures show some of the uses of polyurethane foam.



**Fig. 2.** has 8 images showing some uses of polyurethane foam.

### Polyurethane Foam Properties

Polyurethane foam has received great attention due to its unique properties. Polyurethane polymer is a chemically inert material. It is a unique material that has the flexibility of rubber with the hardness and durability of metal, and due to the properties of the foam polymer blend such as low density, high hardness, good strength-to-weight ratio and excellent ability to absorb energy; in addition to ductility, resistance to heat and cold, and various corrosion factors with different causes, and due to the presence of vacuum pores in its composition, it improves the properties of the material and reduces its production costs at the same time. All of these desirable properties make foam polymer a versatile material, including the following [18,19]:

### The Most Important Uses of Polyurethane Foam

- Structural and non-structural uses in space, the deep sea, the automotive industry, building materials, boats and caravans, parking floors, auto parts and also the interior decoration of facilities, where the pigments made of it are characterized by resistance to weathering.
- Insulating heat out of the facades of houses and roofs of buildings, in addition to isolating refrigerators and pipes for various factories, and helps to avoid water leaks to a large extent, in addition to isolating against moisture in hospitals, schools, residences, etc., as well as sound insulation.
- Various industries related to furniture; such as, sleeping mattresses, seats and upholstery due to its production in different densities, and some of them are formed by the heat of the human body for more comfort. It is also used in the manufacture of shoes.
- Medical industries; such as, the manufacture of prosthetics and medical stents, as well as biomedical applications in the fields of heart and blood vessels [10,20,21].

### Where the uses in fashion like in fig. 2. which shown 8 images

#### 2.3. Sustainable Development

Sustainable development is an economic term that means developing means of production in ways that do not lead to the depletion of natural resources to ensure the continuation of production for future generations (meeting the needs of the current generation without wasting the rights of future generations).

Sustainable development can be defined as continuous, equitable, balanced and integrated development that takes into account the environmental dimension in all its projects and that does not reap the fruits for the current generations at the

Sustainable development is also defined from the point of view of the industrialized countries as a deep and continuous reduction in the consumption of energy and resources by these countries and making radical transformations in the prevailing lifestyles and their refusal to export the natural, industrial development model globally. However, from the point of view of the developing countries, sustainable development means using resources in order to raise the standard of living of the poorest population [22].

### **The Sustainable Development Goals Stated by the United Nations Are**

- 1- Achieving economic growth.
- 2- Achieving social and economic justice.
- 3- Rationalizing the use of all kinds of resources.
- 4- Preserving natural and environmental resources for future generations.
- 5- Social development.

One of the goals of sustainable development is also to work on creating an integrated and sustainable ecosystem. The sub-goals are to confront the negative effects of climate change, enhance the ability of environmental systems to adapt, enhance resilience and the ability to face risks and natural disasters, increase reliance on renewable energy, preserve nature, protect its resources and biodiversity, adopt sustainable consumption and production patterns, and make the best use of natural resources [4].

### **The Importance of Sustainable Development**

The importance of sustainable development appears as being a way to reduce the gap between developed and developing countries, and plays a major role in reducing economic dependence on the outside, distributing production, protecting the environment, social justice, improving the standard of living, raising the level of education, reducing illiteracy, saving capital, and raising the level of national income [22].

The areas of sustainable development are defined in three main dimensions: economic development, social development, and environmental development [4].

In line with the global trend towards sustainable development and the adoption of achieving its goals of knowledge, innovation, building creative capabilities, stimulating innovation, spreading culture, and supporting scientific research, foam was used because of its plastic capabilities and techniques that open the field for innovation and scientific research, as well as being a non-traditional non-expensive material. Moreover, the costs of producing fictional costumes are not high, as the sewing machine was not used in any of the cutting, execution, or finishing stages (saving electrical energy); and it is replaced by low-priced adhesives.

## **3. The Application**

Using the material, i.e., controlling, experimenting, and innovating in it according to a new and unfamiliar perspective is the real goal of the designer who uses the mannequin. The designer who has an innovative spirit is the one who reveals something new and distinct that the eye has never seen in this new form before. One of the advantages of this process is to identify many unconventional materials. However, evaluating the use of the material and measuring the extent of success in using it in shaping on the mannequin, is achieved by two important factors:

- 1- Using the materials logically, showing their character, and beauty.
- 2- Using the materials should show an unconventional shape in the designs.

If these two factors were taken into consideration, it can be said that the material has achieved the desired purpose.

Accordingly, polyurethane foam, the subject of the research, was chosen because it is one of the unconventional materials in the field of clothing and is characterized by its light weight, it does not degrade or crack easily, it is easy to be shaped, it is light in weight and low in cost, and it is available in the form of plates in libraries specialized in handicrafts. Lately, compressed foam is used in many works of art; such as, sculptures, decorations, and in painting, and it is also used in many industrial applications.

### **First: The Materials and Tools Used**

1. Polyurethane foam was used, which is in the form of flexible sheets similar to paper and has a trade name (foam paper), multi-colored, length 30 cm x width 25 cm / thickness 1-2 mm, as shown in the Image (9).

**Image (9)**

The foam used by the researchers

2. Two types of adhesives were used:

- *Temporary adhesive (wide slot tape)*: It was used to fix the various parts of the foam design that were formed on the mannequin, and also to fix the decorative design in its place temporarily, in order to make sure that the place specified for it was suitable for the size of the design.

- *Final adhesive*: It is considered as a sewing method for the design, because when using the sewing machine, holes appeared. The parts also became loose. After several experiments, the researchers decided to use shoe adhesive, as shown in the Image (10), as an alternative to sewing, and eventually the experiment has succeeded.

**Image (10)**

The adhesive used by the researchers

#### 4- Scissors

Sharp scalpels are often used to cut this type of foam, Thermal scissors. There are thermal scissors of three sizes and shapes. In the research, small-sized thermal scissors were used in which batteries or electrical adapters are used. It is preferable to use this type of foam scissors in cutting small and delicate works such as writings or zigzags and many curves; because the heat of the scissors is not very high and therefore it is slow in the cutting process, but it is impractical in cutting large areas or using a lot of work, and it was used in each of the designs No. (1), (5), and (10).

#### 5- Hair Dryer

The hair dryer, works by electricity or by dry battery. It brings out hot or cold air to dry the hair and was used in the research because when the foam, formed on the mannequin, is exposed to a hot temperature, it takes the form of an embodiment of the chest without darts.

#### 6- Paper Puncher

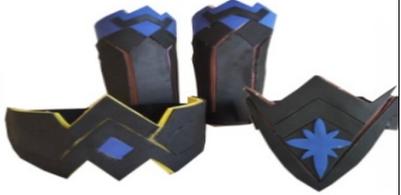
Since the foam did not accept sewing, the researchers resorted to using laces as a means to close and open the designs. Paper or leather punchers were used, depending on the thickness of the foam, as shown in the Image (11).

**Image (11)** Used paper punch By the researchers

## Second: Designs Implementation

The implementation of each of the designs in the research came after many experiments with foam material on the mannequin, leading to the final design as shown in the Table (1)

**Table 1:** Implementation Steps of Ten Designs and their Final Form

First Design				
Implementation Steps			Final design	
			Front 	Back 
Fixing the foam to form the front and back of the model on the mannequin, cutting the neck and armpits.	Cutting the decorations and fixing them with the adhesive in the specified place on the design.	Piercing the back center line in preparation for the laces to be a means of opening and closing the model when wearing.	<b>Accessories</b> 	
Second Design				
Implementation Steps			Final design	
			Front 	Back 
Fixing the foam to form the front and back of the model on the mannequin and cutting the cup.	Cutting the decorations and fixing them with the adhesive in the specified place on the design.	Continuing with the decorations and fixing them with the adhesive in the specified place on the design.		
Third Design				
Implementation Steps			Final design	

 <p>Fixing the foam to form the front and back of the model on the mannequin and cutting the cup.</p>	 <p>Adding the cut part to the model cup with foam of another color and fixing with the adhesive material.</p>	 <p>Completing the formation and adding the parts of the foam of the other color according to the design requirements.</p>	<p>Front</p> 	<p>Back</p> 
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**Fourth Design**

**Implementation Steps**

 <p>Fixing the foam to form the front and back of the model on the mannequin and cutting the cup.</p>	 <p>Adding the cut part to the model cup with foam of another color and fixing it with the adhesive and forming the skirt part.</p>	 <p>Completing the formation and adding the parts of the foam in the other color according to the design requirements.</p>
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**Final design**

<p>Front</p> 	<p>Back</p> 
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**Accessories**



**Fifth Design**

**Implementation Steps**

**Final design**

 <p>Forming the foam to form the front and back of the model on the mannequin, cutting the neck and armpits.</p>	 <p>Cutting the decorations and fixing them with the adhesive in the specified place on the design.</p>	 <p>Continuing with the decorations and fixing them with the adhesive in the specified place on the design.</p>	<p>Front</p>  <p>Back</p> 	
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**Sixth Design**

**Implementation Steps**

 <p>Fixing the foam to form the front and back of the model on the mannequin and cutting the cup.</p>	 <p>Cutting the decorations and fixing them with the adhesive in the specified place on the design.</p>	 <p>Continuing with the decorations and fixing them with the adhesive in the specified place on the design in a foam color that is different from the color of the corsage.</p>	<p>Final design</p> <p>Front</p>  <p>Back</p> 	
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**Seventh Design**

**Implementation Steps**

**Final design**

 <p>Cutting the parts of the model in the form of leaves.</p>	 <p>Fixing the foam to form the front and back of the model on the mannequin, cutting the cup, forming the skirt, and fixing the leaves on the skirt.</p>	 <p>Piercing the back center line in preparation for the laces to be a means of opening and closing the model when wearing.</p>	<p>Front</p> 	<p>Back</p> 
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**Eighth Design**

<p>Implementation Steps</p>			<p>Final design</p>	
 <p>Shaping the chest part as a lining.</p>	 <p>Adding silver foam on the lining, forming the skirt, and adding silver stripes on the skirt.</p>	 <p>Continuing with the silver foam on the lining, and adding silver strips on the skirt.</p>	<p>Front</p> 	<p>Back</p> 

**Ninth Design**

<p>Implementation Steps</p>	<p>Final design</p>
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 <p>Fixing the foam on the mannequin to include the front and back parts of the model.</p>	 <p>Adding silver foam in the form of strips on the blue front lining using mosaic and adhesive.</p>	 <p>Continuing with the silver foam in the form of strips on the blue front lining using mosaic and adhesive.</p>	<p>Front</p> 	<p>Back</p> 
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**Tenth Design**

**Implementation Steps**

 <p>Fixing the foam to form the front and back of the model on the mannequin and cutting the cup.</p>	 <p>Cutting the decorations and fixing them with the adhesive in the specified place on the design using silver foam.</p>	 <p>Continuing with the decorations and fixing them with the adhesive in the specified place on the design using the silver foam.</p>	<p>Final design</p> <p>Front</p> 	<p>Back</p> 
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**Designs have been done by the authors**

**Third: [Preparation of a questionnaire](#)**

To assess the presented designs by the (15) specialists. It was composed of five main assessing criteria to measure the extent to: (1) which design elements were achieved, (2) which design principles were achieved, (3) which innovative process was achieved, (4) which technical aspects were achieved, and (5) which sustainable development goals were achieved.

**Fourth: Conducting the Statistical Analysis to Verify the Research Hypotheses and results**

**4. Results and Discussion:**

To verify all research hypotheses, the variance was calculated for the average scores of the implemented ten designs according to the opinions of specialists and the following table illustrates this.

**First Hypothesis**

1. There are statistically significant differences between the implemented designs in achieving the design elements

according to the opinions of specialists.

**Table 2:** Variance analysis of the average degrees of implemented designs in achieving design elements according to the opinions of specialists

Achieving Design Elements	Sum of squares	average of squares	degrees of freedom	(p) value	Significance
Between Groups	7342.130	815.792	9	25.889	0.01 Significant
Within Groups	4409.855	31.449	140		
Total	11751.985		149		

Statistical treatments were prepared by the authors.

Table (2) illustrates that the value of (P) was (25.899), which is a statistically significant value at the level (0.01), which indicates that there are differences between the ten designs implemented in achieving the design elements according to the opinions of specialists.

### Second Hypothesis

2. There are statistically significant differences between the implemented designs in achieving the design principles according to the opinions of specialists.

**Table 3:** Variance analysis of the average degrees of implemented designs in achieving design principles according to the opinions of specialists

Achieving Design Principles	Sum of squares	average of squares	degrees of freedom	(p) value	Significance
Between Groups	6615.877	735.097	9	41.759	0.01 Significant
Within Groups	2464.475	17.603	140		
Total	9080.352		149		

Statistical treatments were prepared by the authors.

Table (3) illustrates that the value of (P) was (41.759), which is a statistically significant value at the level (0.01), which indicates that there are differences between the ten designs implemented in achieving the design principles according to the opinions of specialists.

### Third Hypothesis

3. There are statistically significant differences between the implemented designs in achieving the innovative process of fictional costumes according to the opinions of the specialists.

**Table 4:** Variance analysis of the average degrees of implemented designs in achieving the innovative process of fictional costumes according to the opinions of specialists

Achieving Innovative Process	Sum of squares	average of squares	degrees of freedom	(p) value	Significance
Between Groups	5307.745	589.745	9	53.636	0.01 Significant
Within Groups	1539.344	10.995	140		
Total	6847.047		149		

Statistical treatments were prepared by the authors.

Table (4) illustrates that the value of (P) was (53.636), which is a statistically significant value at the level (0.01), which indicates that there are differences between the ten designs implemented in achieving the innovative process according to the opinions of specialists.

### Fourth Hypothesis

4. There are statistically significant differences between the implemented designs in how to take advantage of the plastic potentials and usage techniques of the polyurethane foam according to the opinions of the specialists.

**Table 5:** Variance analysis of the average degrees of implemented designs in how to take advantage of the plastic potentials and usage techniques of the polyurethane foam according to the opinions of the specialists

Technical Usages	Sum of squares	average of squares	degrees of freedom	(p) value	Significance
Between Groups	9302.553	1033.617	9	32.036	0.01

Within Groups	4516.992	32.264	140		Significant
Total	13819.545		149		

Statistical treatments were prepared by the authors.

Table (5) illustrates that the value of (P) was (32.036), which is a statistically significant value at the level (0.01), which indicates that there are differences between the ten designs implemented in how to take advantage of the plastic potentials and usage techniques of the polyurethane foam according to the opinions of the specialists.

**Fifth Hypothesis**

5. There are statistically significant differences between the implemented designs in achieving the sustainable development according to the opinions of specialists.

**Table 6:** Variance analysis of the average degrees of implemented designs in achieving the sustainable development according to the opinions of specialists

Sustainable Development	Sum of squares	average squares	of degrees of freedom	(p) value	Significance
Between Groups	9073.455	1008.162	9	66.590	0.01 Significant
Within Groups	2119.572	15.140	140		
Total	11193.027		149		

Statistical treatments were prepared by the authors.

Table (6) illustrates that the value of (P) was (66.590), which is a statistically significant value at the level (0.01), which indicates that there are differences between the ten designs implemented in achieving the sustainable development according to the opinions of specialists.

**Sixth Hypothesis**

6. There are statistically significant differences between the ten implemented designs according to the opinions of specialists.

**Table 7:** Variance analysis of the average degrees of implemented ten designs according to the opinions of specialists

Sustainable Development	Sum of squares	average squares	of degrees of freedom	(p) value	Significance
Between Groups	167073.042	18563.671	9	40.670	0.01 Significant
Within Groups	63901.993	456.443	140		
Total	230975.035		149		

Statistical treatments were prepared by the authors.

Table (7) illustrates that the value of (P) was (40.670), which is a statistically significant value at the level (0.01), which indicates that there are differences between the ten implemented designs according to the opinions of specialists.

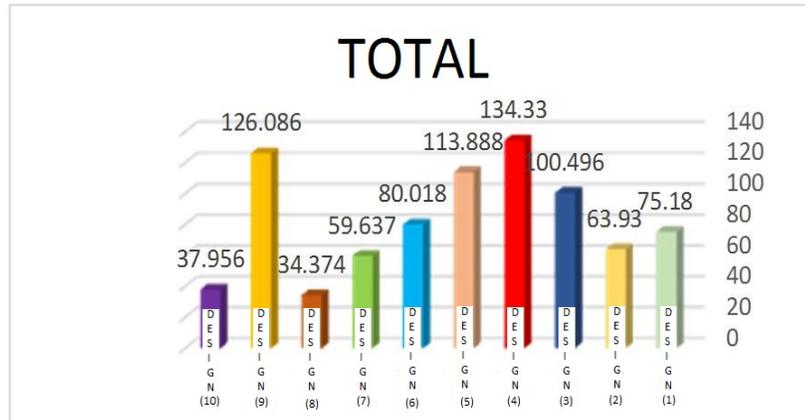
To find out the significance direction, the LSD test for multiple comparisons was applied, and the following table illustrates this:

**Table 8:** LSD Test for Multiple Comparisons

Total	Design "1" m = 75.180	Design "2" m = 63.930	Design "3" m = 100.496	Design "4" m = 134.330	Design "5" m = 113.888	Design "6" m = 80.018	Design "7" m = 59.637	Design "8" m = 34.374	Design "9" m = 1260.086	Design "10" m = 37.956
Design "1"	-									
Design "2"	11.250**	-								
Design "3"	25.316**	36.566**	-							
Design "4"	59.150**	70.400**	33.834**	-						
Design	38.708**	49.958**	13.391**	20.442**	-					

"5"										
Design "6"	4.838**	16.088**	20.478**	54.312**	33.870**	-				
Design "7"	15.542**	4.292**	40.859**	73.693**	54.250**	20.380**	-			
Design "8"	40.805**	29.555**	66.122**	99.956**	79.513**	45.643**	25.262**	-		
Design "9"	50.906**	62.156**	25.589**	8.244**	12.198**	46.068**	66.448**	91.711**	-	
Design "10"	37.223**	25.973**	62.540**	96.374**	75.931**	42.061**	21.680**	3.582**	88.129**	-

Statistical treatments were prepared by the authors.



**Fig. 3.** Average Scores of the Ten Implemented Designs According to the Opinions of Specialists

From Table (8) and Figure (3), it is clear that there are statistically significant differences between the ten implemented designs at a significance level of 0.01. We find that design "4" was the best design according to the opinions of specialists, followed by design "9", then design "5", then design "3", then design "6", then design "1", then design "2", then design "7", then design "10", and finally design "8".

### Summary of results:

1. There are statistically significant differences between the implemented designs in achieving the design elements according to the opinions of specialists; the (p) value was (25.899), which is a statistically significant value at the level (0.01), which indicates that there are differences between the ten designs implemented in achieving the design elements according to the opinions of specialists.
2. There are statistically significant differences between the implemented designs in achieving the design principles according to the opinions of specialists; the (p) value was (41.759), which is a statistically significant value at the level (0.01), which indicates that there are differences between the ten designs implemented in achieving the design principles according to the opinions of specialists.
3. There are statistically significant differences between the implemented designs in achieving the innovative process of fictional costumes according to the opinions of the specialists; the (p) value was (53.636), which is a statistically significant value at the level (0.01), which indicates that there are differences between the ten designs implemented in achieving the innovative process according to the opinions of specialists.
4. There are statistically significant differences between the implemented designs in how to take advantage of the plastic potentials and usage techniques of the polyurethane foam according to the opinions of the specialists; the (p) value was (32.036), which is a statistically significant value at the level (0.01), which indicates that there are differences between the ten designs implemented in how to take advantage of the plastic potentials and usage techniques of the polyurethane foam according to the opinions of the specialists.
5. There are statistically significant differences between the implemented designs in achieving the sustainable development according to the opinions of specialists; the (p) value was (66.590), which is a statistically significant value at the level (0.01), which indicates that there are differences between the ten designs implemented in achieving

the sustainable development according to the opinions of specialists.

6. There are statistically significant differences between the ten implemented designs according to the opinions of specialists; the (p) value was (40.670), which is a statistically significant value at the level (0.01), which indicates that there are differences between the ten implemented designs according to the opinions of specialists.
7. The order of the designs was according to the degree of acceptance of the designs; design “4” was the best design according to the opinions of specialists, followed by design “9”, then design “5”, then design “3”, then design “6”, then design “1”, then design “2”, then design “7”, then design “10”, and finally design “8”.

## 5. Research Recommendations

1. Continuous search for non-traditional materials that can be used in costumes in general and fictional costumes in particular.
2. Enriching the design by forming on the mannequin with unconventional materials as an inspiration for innovative design ideas.
3. Inclusion of fictional costumes design within the study plan of the clothes and textile programs in the specialized colleges.
4. Development of costumes design curricula in colleges and specialized institutes with topics that emphasize the importance of achieving the principles of sustainable development.
5. Conducting training courses for designers to spread the ideas and principles of sustainable development in terms of the environmental, social, and economic aspects.

## Conflict of interest

The authors declare that there is no conflict regarding the publication of this paper.

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