

## Three- Dimensional Design of Terry Fabrics

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#### Abstract:

Woven terry fabrics are of the most popular fabrics that are used for home textiles. Although the fabrics popularity, they have a classical view in textile market. This is owing to their conventional methods of production. The classical view of terry fabrics may affect their ability to compete other fabrics in local and international market. With developing novel techniques in the production of terry fabrics, innovative vision can be obtained. The innovative vision of terry fabric design can raise its ability to compete other fabrics and flourish the market of exports. This research concerns with developing a novel method in the production of terry fabrics. Designing of three- dimensional terry was developed in this research. The three- dimensional effect in the produced fabrics was obtained by the designing of 3-D artwork terry. While the produced fabrics have two dimensions, they give an illusion of three- dimensions by creating a visual deception of space or shallow depth. The produced fabrics in this research were evaluated by using a qualitative methodology. A questionnaire was employed, and data were collected and analyzed to assess whether there is a difference of opinions among participants. The results of the questionnaire showed that the three- dimensional effect was obtained in the produced fabrics, and hence, a novel vision of terry fabric design with novel aesthetical values was accomplished.

#### Keywords:

*terry fabrics*  
*three dimensional design*  
*3d artwork terry*  
*visual deception*  
*loop piles.*

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#### Introduction

Pile fabrics represent a major sector of textile products. [1] They are distinguished in their finished condition by having a large number of threads protruding from the surface of the fabric to give a distinct appearance. [2], [3] The pile is supported by a closely woven ground cloth, the face of which is usually entirely hidden through being covered by the pile.

In the production of terry fabrics, warp ends are divided into two series of threads; the ground and the pile which are separately beamed and tensioned, while, weft threads consist of only one series.[1],[4]

#### Research Problem

Using conventional techniques in the production of terry fabrics and, the resulted terry fabrics have –consequently- a classical view which may affect their ability to compete other fabrics in local and international market.

#### Research Importance

Enriching the aesthetic characteristics of terry

fabrics by using novel visions in the fabric design in order to compete other fabrics in markets.

#### Research objectives

Designing of three- dimensional terry fabrics to accomplish aesthetical values, and obtaining novel vision in terry towel design that is different from the current traditional view of terry products on the markets.

#### Theoretical Framework

##### Theory of Pile Formation

When manufacturing terry fabrics, without the aid of wires, it is absolutely essential to observe a specific order of shedding in relation to the action of the reed as governed by the terry motion, otherwise the loops of pile will either be imperfectly developed, or they may not appear at all. This order is clearly indicated in figure (1) and figure (2). Figure (1) represents a longitudinal section of a 3-pick terry fabric while figure (2) indicates weave structure of three-pick terry.[1], [5], [6]

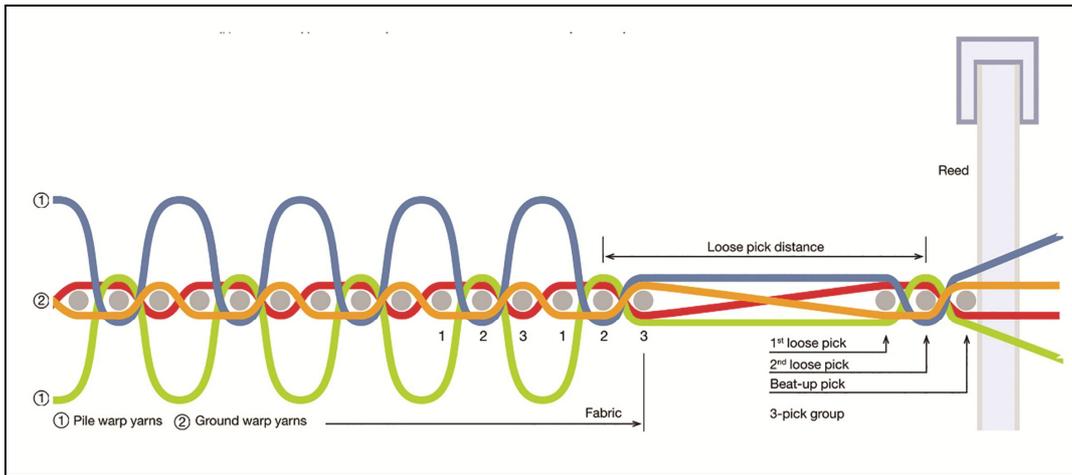


Figure (1) Longitudinal Section of Pile Formation of Three-Pick Terry

F	■	●	■	3
L	●	■	■	2
L	●	■	■	1
	G	FP	G	FP
■	Face Pile Threads (FP)			
x	Back Pile Threads (BP)			
●	Ground Warp Threads (G)			

Figure (2) Weave Structure of Three-Pick Terry

On examining these figures it will be seen that the reed is loose for the first and second picks, termed 'Loose' picks, and fast for the third pick, termed the 'Fast' pick.[5] It is important to insert loose picks in reverse pile warp sheds, but in the same ground warp sheds. With this order of shedding in relation to the reed motion, pile warp threads make two intersections, and ground warp threads only one intersection with the picks, before the latter are beaten up to the fell of cloth. Hence, the picks easily slide along ground warp threads, which are held taut, whereas their better grip of pile warp threads, which are slack, causes the latter to be drawn forward and thus form loops of pile.[1], [5]

**Terry Weave Structures**

When observing figure (2), it will be seen that consecutive ground warp threads interweave in a contrary manner to each other, as do the consecutive pile warp threads. [1] Both series of threads form a 2/1 rib weave, every series with each other. The rib weaves which is formed by the pile warp ends is one pick ahead of the rib weave which is formed by ground warp ends.[4] Pile warp ends that are over two picks and under one pick form pile on the face of the fabric, whilst those that are under two picks and over one pick will form pile at the back of cloth when in the loom.[5]

As seen from the weave structure, the shedding of the ground warps are not synchronized with that of

the pile warps. By this, the number of interlacing increases and this strengthens the fabric throughout the warp. [4]

The number of picks inserted for each horizontal row of loops, in terry pile fabrics produced by the aid of terry motions, varies in different fabrics from three to six picks or more.[7] Figure (3) indicates the repeat unit of three-pick terry fabric. [8]

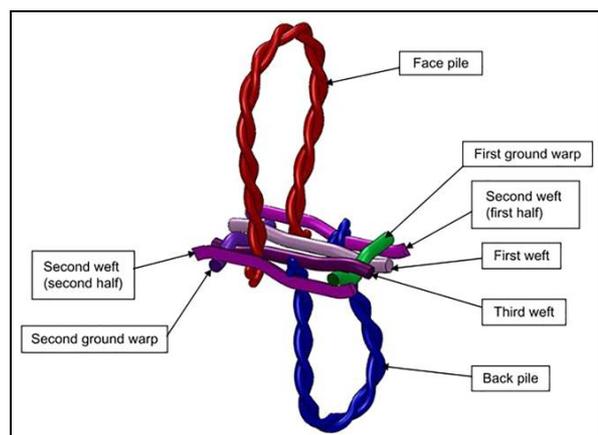


Figure (3) Repeat Unit of Three-Pick Terry Fabric

**Three-Pick Terry Weave**

Figure (4) indicate the production of the pile effect on three picks, and on examining weaves of the figure, it could be noticed the following points:

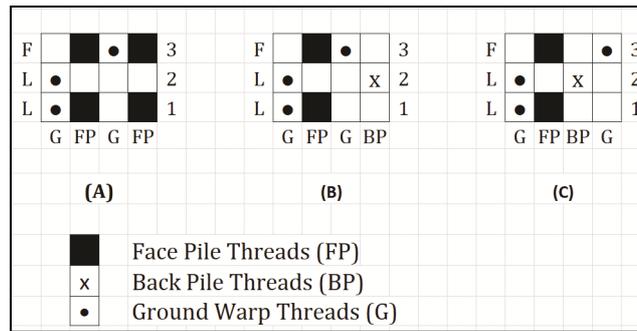


Figure (4) Three-Pick Terry Weaves

- Weave structure (A) forms the loops uniformly on the face side of the cloth only, whereas the remaining designs (B) and (C) are for producing a pile surface on both sides of the cloth.
- In the weave structure (A), the warp threads are arranged (1 ground: 1 face pile), while in plan (B), (1 ground: 1 face pile: 1 ground: 1 back pile).
- The weave structure (C) produce corresponding effect to the design (B), but in the arrangement of (1 ground: 1 face pile: 1 back pile: 1 ground).[7], [9]

**Experimental Work**

This research concerns with achieving novel vision in terry towel design that is different from the traditional view of current terry products on

the markets. The production of three- dimensional terry fabrics was developed in this research. The three- dimensional effect in terry fabrics can be created by the designing of 3-D artwork terry. The produced fabrics were evaluated by a questionnaire filled by textile experts to assess their opinion on the innovative fabrics.

**Designing of Three- Dimensional Artwork Terry Fabrics**

In this technique, the terry fabric has the one pile height, but the three- dimensional effect is resulted from the method of drawing shapes and spraying of the terry piles in a way of some sort that achieves the illusion of three-dimensional form. The three-dimensional artwork is depicted in designs (1), (2) and (3) in figures (5), (6) and (7).

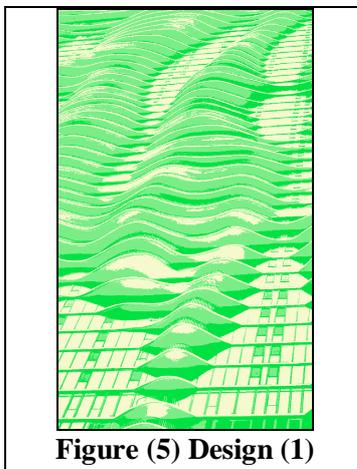


Figure (5) Design (1)

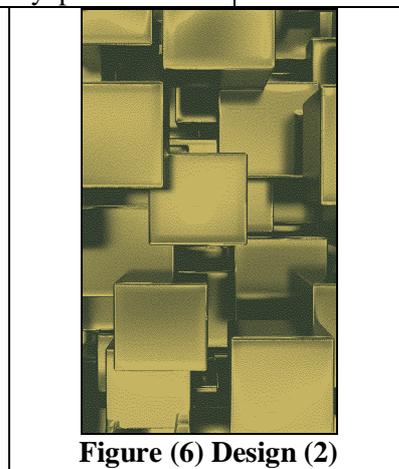


Figure (6) Design (2)

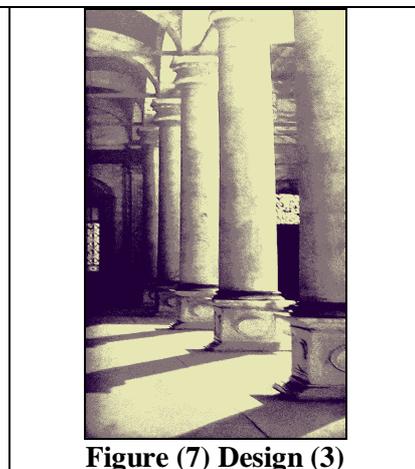


Figure (7) Design (3)

**Specifications (Machine and Fabrics)**

**Specifications of the Machine Used in Producing Samples under Study**

The production of terry towel fabrics was carried out in Textile Design Center in Faculty of Applied

Arts, Helwan University, and in Nile Textile Industries Company in Kafr Hakim, Kirdasa. The specifications of the loom used for producing the terry fabrics are shown in table (1).

Table (1) Specifications of the Loom Used in Producing the Samples under Study in Textile Workshop

No.	Item	Specifications in Textile Design Center	Specifications in Nile Textile Industries Company
1	Loom Type	ITEMA	SMIT
2	Loom Model	R9500 Terry	GS900F
3	Manufacturing Country	Italy	Italy
4	Manufacturing Year	2016	2008



5	Machine Width (Reed Width)	220 cm	260
6	Machine Speed	300 Picks/ Min.	350 Picks/ Min.
7	Weft Insertion Method	Rapier	Rapier
8	Weft Selector	8 Fingers	8 Fingers
9	Reed Used (Dents/ cm)	12 Dents/ cm	11.2 Dents/ cm
10	Denting	2 Ends/ Dent	2 Ends/ Dent
11	No. of Colors of Pile Threads	2	2
12	Warp Threads Arrangement	2 Ground Yarns: 2 Pile Yarns	2 Pile Yarns: 2 Ground Yarns

Specifications of the Jacquard Used in Producing Samples The specifications of the jacquard used for producing the terry fabrics are shown in table (2).

Table (2) Specifications of the Jacquard Used in Producing the Samples under Study in Textile Design Center and in Nile Textile Industries Company

No.	Item	Specifications in Textile Design Center	Specifications in Nile Textile Industries Company
1	Jacquard Model	BONAS	STUBLI
2	Number of Hooks	2688 Hooks	6144
3	Design Hooks	2400	1216
4	No. of Repeats	2	2
5	Repeat Width	100 cm	101 cm

Basic Specifications of the Produced Samples are represented in table (3).  
The basic specifications of the produced samples

Table (3) Basic Specifications of the Produced Samples

No.	Property	Specifications in Textile Design Center	Specifications in Nile Textile Industries Company
1	Warp Yarn Material	Cotton	Cotton
2	Weft Yarn Material	Cotton	Cotton
3	Count of Warp Yarns	24/2	24/2
4	Count of Weft Yarns	16/1	16/1
5	Warp Sett (Ends/ cm)	24	22.4
6	Weft Sett Picks/ cm)	21	22

Weave Structures Used for Produced Samples

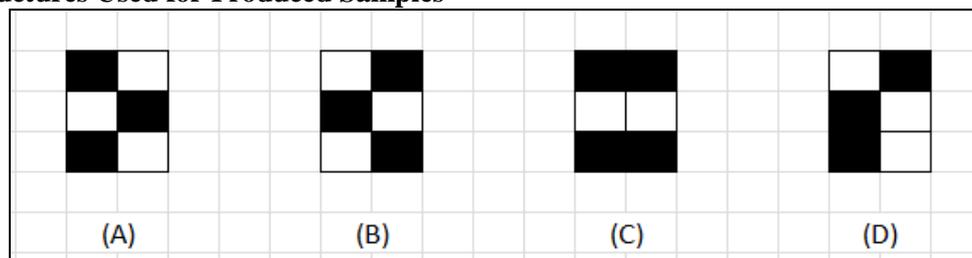


Figure (8) Weave Structures Used for Produced Samples

Figure (8) indicates three- pick terry weave structures used for Produced Samples, where;

- 1- Weave Structure (A) represents the formation of pile loops for the first color on the face side of the cloth while the second color appears in this area on the back side of the cloth.
- 2- Weave Structure (B) depicts the formation of pile loops for the second color on the face side of the cloth while first color appears in this area on the back side of the cloth.
- 3- Weave Structure (C) shows the formation of pile loops for both colors on the face side of the cloth while the back side of the cloth appears in this area without any pile loops.

4- Weave Structure (D) illustrates the weave Structure of the ground cloth.

It is worth mentioning that all weave structures are used for producing designs (1) and (3), while the weave structures (A), (B) and (D) are used for design (2).

**Story Board of the Produced Samples**

Figures (9), (10) and (11) depict the produced samples of Designs (1), (2) and (3).

**Story Board of Produced Sample (1)**

The design represents a side of a building seems to undulate like waves.

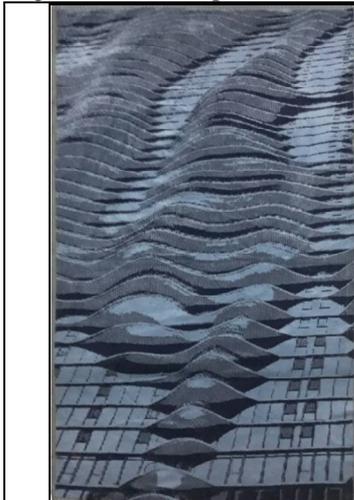
**Story Board of Produced Sample (2)**

The design consists of squares with different sizes that are repeated in a regular sequence.

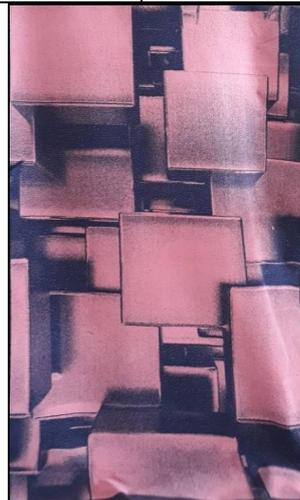
**Story Board of Produced Sample (3)**

The design illustrates a place where columns with

different sizes stand out, and recede throughout distance.



**Figure (9) The Produced Sample (1)**



**Figure (10) The Produced Sample (2)**



**Figure (11) The Produced Sample of Design (4)**

**Collection and Analysis of Data**

An online questionnaire was used as a quantitative tool, and the survey participants were classified into two categories according to their specialization. On one hand there was a group of experts specialized in textile industry, whereas the second group were academic staff - members who were experts in textile design. After collection of data, analysis was done.

The questionnaire consisted of five questions as follows;

1. Does the innovative technique achieve an aesthetical value in design?
2. Does the innovative technique create an illusion of three- dimensional effect in design?
3. Does the innovative technique achieve creativity and modernism?
4. The influence of the innovative technique in creating an aesthetical effect in design.
5. Does the innovative technique increase the product marketing?

**Results and Discussions**

**Technical Analysis of the Implemented Designs**

**Technical Analysis of Produced Sample (1)**

1. The wavy pattern that is echoed creates a feeling of layering.
2. The undulated pattern gives a sensation of movement.
3. The overlapping of the wavy patterns behind each other creates an illusion of distance.

**Technical Analysis of Produced Sample (2)**

1. The use of value contrasts transforms the shape of squares into a cubic form.
2. Value contrasts also creates layering of cubes upon each other.
3. An illusion of space is created by using cubes

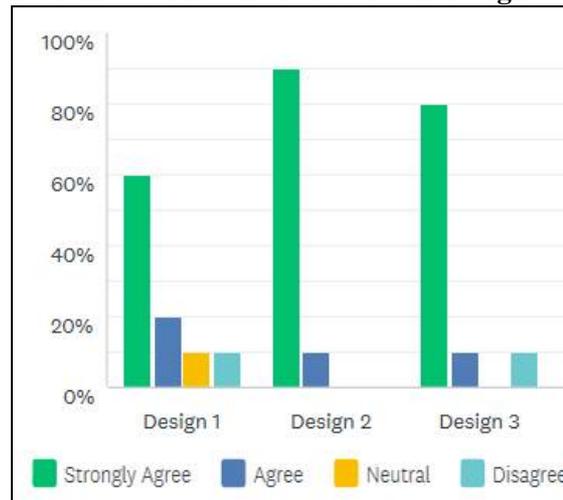
with different sizes, and also varying in value from very light to very dark.

**Technical Analysis of Produced Sample (3)**

1. The columns can be seen as a focal point through alteration in size from large into small.
2. The rhythmic sequence that is used in the columns unifies large surfaces.
3. The value change between light and dark shows a feeling of roundness of the pillars.
4. The change in the size of columns creates a visual deception of depth.
5. The shadow of the columns falling on the floor is used to emphasize space.

**Data Analysis of the Questionnaire**

**The Achieve of Aesthetical Value in Design**



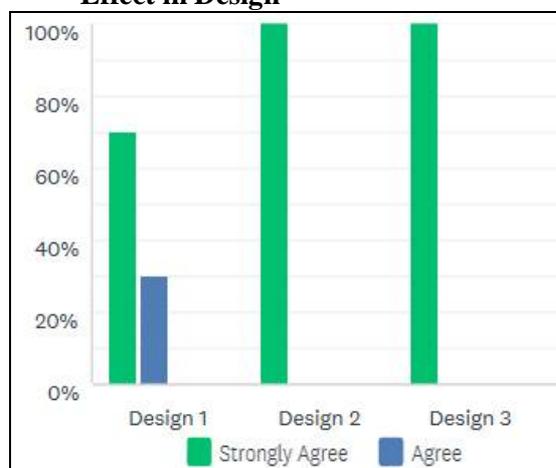
**Figure (12) The Achieve of Aesthetical Value in Design**

Figure (12) shows that 60% of participants believed that the innovative technique achieved an aesthetical value in design (1) whereas 100% were strongly agree with the statement in design (2),



and the ratio was 80% in design (3). However, about 10% of people thought that the innovative technique achieves an aesthetical value in all the produced samples.

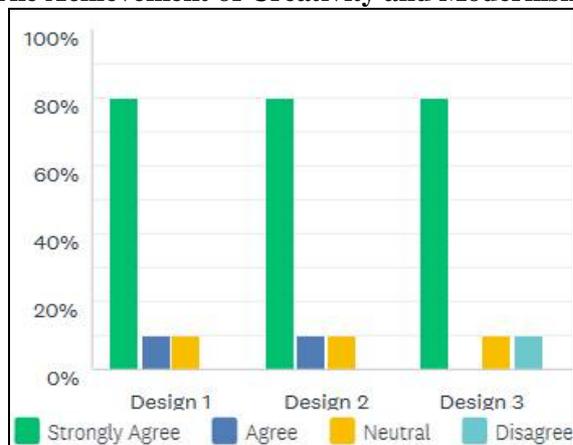
**Creating an Illusion of Three- Dimensional Effect in Design**



**Figure (13) Creating an Illusion of Three- Dimensional Effect in Design**

Figure (13) illustrates that 70% of people thought that the innovative technique created an illusion of three- dimensional effect in design (1) whereas 100% were strongly agree with the statement in design (2) and design (3). Conversely, 30% of participants thought that the innovative technique created an illusion of three- dimensional effect in design (1).

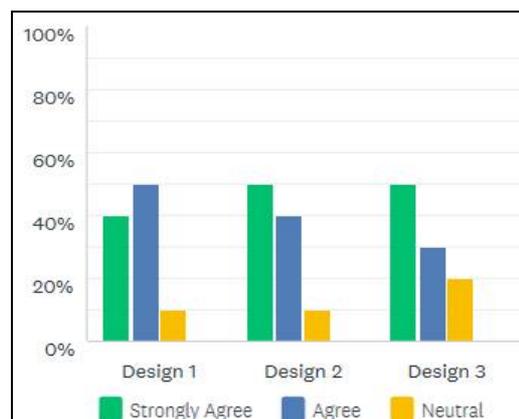
**The Achievement of Creativity and Modernism**



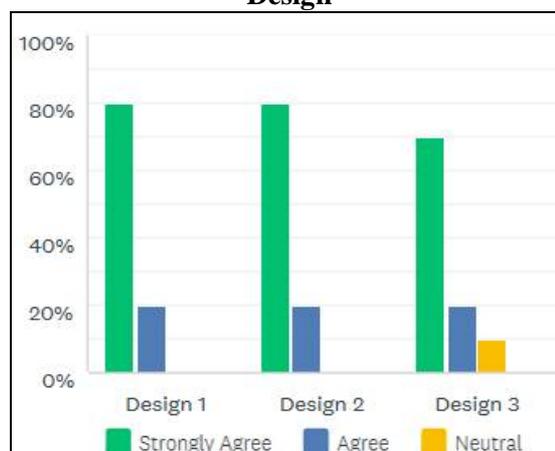
**Figure (14) The Achievement of Creativity and Modernism**

Figure (14) indicates that 80% of participants believed that the innovative technique achieve creativity and modernism in design (1), (2) and (3) whereas 10% were not totally agree with the statement in all designs. However, 10% of people thought that the innovative technique did not achieve creativity and modernism in design (3).

**The Influence of the Innovative Technique in Creating an Aesthetical Effect in Design**



**Figure (15) The Influence of the Innovative Technique in Creating an Aesthetical Effect in Design**



**Figure (16) The Increase in the Product Marketing**

Figure (15) shows that about 45% of participants were strongly agreed with the statement that the innovative technique has an influence in creating an aesthetical effect in designs (1), (2) and (3) whereas 10% of people contended that the innovative technique did not have an influence in creating an aesthetical effect in designs (1), (2). However the ratio was 20% in design (3).

**The Increase in the Product Marketing**

Figure (16) illustrates that about 75% of participants believed that the innovative technique increase the product marketing in the produced samples, whereas only 10% of people declined the statement that the innovative technique increase the product marketing in design (3).

**Conclusion**

This paper was carried out to produce terry fabrics with novel vision that leads it to compete other fabrics on the markets. Designing of three-dimensional terry was developed in this research. The three- dimensional effect was obtained by the designing of 3-D artwork terry. The produced fabrics gave a visual deception of three-dimensions by creating an illusion of space or shallow depth; however, the fabrics had only two

dimensions.

After careful analysis, the results were compiled and evaluated. The vast majority of textile experts who filled the questionnaire believed that;

1. The innovative technique of the produced samples achieved an aesthetical value.
2. The innovative technique of the produced samples created an illusion of space and shallow depth.
3. The innovative technique of the produced samples achieved creativity and modernism.
4. The innovative technique of the produced samples had an influence in creating an aesthetical effect in the produced designs.
5. The innovative technique of the produced samples increased the marketing of the produced samples.

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