Utilizing Pattern Magic Skills in Preparing 3D Outerwear for Adolescent Girls"

Bothaina Hossam El-Din Mohammed

Assistant Teacher in the Department of Home Economics

Faculty of Quality Education - Aswan University

Prof. Mohammed Abdul Khaleq Dabis

Professor of Home Management and Vice-Chancellor for Education and Student Affairs

Faculty of Quality Education University of Minya

Prof. Samiha Ali Ebrahim Basha

Professor of full-time clothing technology

And the former head of clothing department

Faculty of Applied Arts - Helwan University

Prof.Wesam M oustafa Abd-Elmogod

Professor of Clothing and Textile

And head of home economics.

Faculty of Quality Education University of Minya

Prof. Doaa Nabil Ali

Professor of Clothing and Textile

Faculty of Specific Education Minia University

مجلة البحوث في مجالات التربية النوعية

معرف البحث الرقمي DOI: 10.21608/JEDU.2025.397969.2269

المجلد الحادي عشر العدد 59 . يوليو 2025

الترقيم الدولي

E- ISSN: 2735-3346 P-ISSN: 1687-3424

موقع المجلة عبر بنك المعرفة المصري https://jedu.journals.ekb.eg/

موقع المجلة http://jrfse.minia.edu.eg/Hom

العنوان: كلية التربية النوعية . جامعة المنيا . جمهورية مصر العربية

Abstract

"Utilizing Pattern Magic Skills in Preparing 3D Outerwear for Adolescent Girls"

The research aims to implement three-dimensional (3D) outerwear using *Pattern Magic* to satisfy the needs of adolescent girls aged 14–16. The **significance of the research** lies in presenting new ideas for 3D outerwear designs for girls in this age group, and in shedding light on a new method for producing 3D garments using *Pattern Magic*. The research also aims to encourage ready-to-wear clothing manufacturers to benefit from *Pattern Magic* in producing 3D outerwear for girls aged 14–16. The **study sample** consisted of (11) specialists in the field of clothing and textiles, and (45) adolescent girls aged 14–16. The **research methodologies** applied were the **descriptive analytical method** and the **quasi-experimental method**. The **most important results** indicated the presence of statistically significant differences among the five executed 3D outerwear designs using *Pattern Magic* for girls aged 14–16 in achieving the **functional aspect**, according to the opinions of specialists. Statistically significant differences were also found among the five designs in achieving the **aesthetic aspect**, as well as the **technical aspect**, according to the evaluations of specialists. Moreover, there were statistically significant differences among the five designs according to the opinions of **both the specialists** and the **consumers (girls aged 14–16)**.

Keywords: Adolescence – Outerwear – Pattern Magic

ملخص البحث

الاستفادة من مهارات (Pattern Magic)

في إعداد ملابس خارجية ثلاثية الأبعاد للفتيات المراهقات

يهدف البحث الى إلى تنفيذ ملابس خارجية ثلاثية الأبعاد باستخدام Pattern magic لتشبع حاجة الفتيات المراهقات في هذه المرحلة من (14–16) سنة وتكمن أهمية في تقديم أفكار جديدة للملابس الخارجية ثلاثية الأبعاد للفتيات في المرحلة العمرية (14 – 16) سنة وإلقاء الضوء علي أسلوب جديد لإنتاج قطع ملبسية ثلاثية الأبعاد باستخدام Pattern magic للفتيات في المرحلة العمرية (14 – 16) سنة وأيضا تشجيع مصانع الملابس الجاهزة للاستفادة من Pattern magic في تنفيذ ملابس خارجية ثلاثية الأبعاد للفتيات في المرحلة العمرية (14 – 16) سنة وتكونت عينة البحث من (11) من الأساتذة المتخصصين في مجال الملابس والنسيج و(45) فتاة من الفتيات المراهقات في المرحلة العمرية من (14–16) سنة والمنهجي المتبعين في هذا البحث هو (المنهج الوصفي التحليل . المنهج الشبه تجريبي) ومن أهم النتائج وجود فروق ذات دلالة إحصائية بين التصميمات الخمس المنفذة للملابس الخارجية ثلاثية الأبعاد باستخدام Pattern magic للفتيات من (14–16) سنة في تحقيق الجانب الوظيفي وفقا لأراء المتخصصين" ، وأيضا وجود فروق ذات دلالة إحصائية بين التصميمات الخمس المنفذة للملابس الخارجية ثلاثية الأبعاد باستخدام Pattern magic للفتيات من (14–16) سنة في تحقيق الجانب الجمالي وفقا لأراء المتخصصين" ووجود فروق ذات دلالة إحصائية بين التصميمات الخمس المنفذة للملابس الخارجية ثلاثية الأبعاد باستخدام Pattern magic للفتيات من (14–16) سنة في تحقيق الجانب التقني وفقا لأراء المتخصصين" ، كما توجد فروق ذات دلالة إحصائية بين التصميمات الخمس المنفذة للملابس الخارجية ثلاثية الأبعاد باستخدام Pattern magic للفتيات من (14–16) سنة وفقا لأراء المتخصصين" ، وأيضا يوجد فروق ذات دلالة إحصائية بين التصميمات الخمس المنفذة للملابس الخارجية ثلاثية الأبعاد باستخدام Pattern magic وفقا لآراء المستهلكات (الفتيات من (14–16) سنة.

الكلمات المفتاحية : Pattern magic . الملابس الخارجية . المراهقة .

Introduction

Adolescence is a pivotal stage in human development where personality begins to solidify. It is a time of physical, social, and deep psychological changes - arguably the most challenging stage in a person's life. The rapid development experienced during adolescence influences the physical, social, mental, and emotional dimensions, thereby shaping one's identity and social orientation **(Salah El-Din Al-Omariyah, 2011).** Researchers divide adolescence into three key phases based on age: early, middle, and late adolescence **(Abdel Rahman Al-Eisawy, 2005).**

The **middle adolescence phase**, spanning ages 14 to 16, is one of the most crucial periods for girls. It is characterized by a surge of youthful energy and independence and is marked by rapid physical and emotional changes. Girls at this age become more harmonious in their movements and increasingly interested in their appearance, body image, and self-love **(Salah El-Din Al-Omariyah, 2011).**

Women's fashion is often considered a silent language, eloquently reflecting one's mindset and inner personality. Fashion design is among the most expressive art forms in the fashion industry (Nabila Al-Farraj, 2016). Clothing plays a significant psychological role in a girl's life — reflecting identity, enhancing presence, and boosting confidence. The way clothing is styled, designed, and worn can either elevate or diminish a person's image **(Nancy Mohamed Khairat et al., 2019).**

According to **Jones, S. J. (2002)**, clothing is not merely a body covering - it serves purposes such as modesty, adornment, and protection. It also fulfills psychological, physical, and social needs. Successful fashion designers must consider three essential dimensions in their work: the functional, aesthetic, and structural aspects, all of which contribute to a high-quality final design **.**

The middle adolescence phase is marked by significant physical development, leading girls to become more conscious of fashion, appearance, and social perception **(Sayed El-Tawab, 2002)**. This phase also introduces new interests and ambitions, including a strong attraction to trendy clothing and the desire to stand out. Girls want to express themselves through fashion and gain attention and admiration - especially from the opposite sex **(Alya Abdeen, 2010).**

Adolescents' clothing must therefore meet their evolving needs. Fashion becomes a vital tool for emotional and social expression. Hence, fashion designers must consider fabric, color, and design choices that resonate with teenage girls **(Alya Abdeen, 2002).**

Several studies have explored teenage girls' clothing, such as:

- Wafaa El-Shafie & Maha Al-Zahrani (2013), which aimed to guide teenage behavior and train them in fashion design principles through a practical program.
- Yasmin Shaaban (2010), which investigated the link between teenage girls' clothing choices and their religious values.
- Mona Ali Ibrahim (2007), which focused on factors influencing teenage girls' fashion preferences across various environments.

Ruth Ross (2005) emphasizes that teenage girls are highly responsive to fashion trends and accessories. They strive to wear stylish clothes that align with the latest trends and express their identities.

While earlier studies addressed various aspects of teenage fashion, the current research focuses on **producing 3D outerwear** using **Pattern Magic** for adolescent girls.

The study underlines the importance of fashion in the lives of middle adolescents. Clothing represents freedom, confidence, emotional and social fulfillment, and self-expression.

Researchers believe that 3D clothing is a promising technology in the fashion world - offering great flexibility in design and production. As technology evolves, even more creative applications of 3D fashion are expected to emerge.

Problem

- What is the potential of utilizing **Pattern Magic** to implement 3D fashion designs for girls aged 14–16?
- How can Pattern Magic be employed to enhance the **functional aspect** of 3D outerwear for girls in this age group?
- How can Pattern Magic contribute to improving the **aesthetic aspect** of such garments?
- How effective is Pattern Magic in enhancing the **technical aspect** of 3D outerwear for adolescent girls?
- To what extent do girls aged 14–16 (as consumers) accept the produced 3D outerwear garments?

Objectives

- Utilize **Pattern Magic** to create 3D clothing designs for girls aged 14–16.
- Improve the **functional performance** of 3D outerwear garments using Pattern Magic.
- Enhance the **aesthetic value** of these garments through the Pattern Magic approach.
- Employ various techniques to produce **3D outerwear** using Pattern Magic for this age group.
- Measure the **level of acceptance** among girls (aged 14–16) for the executed 3D outerwear garments.

Significance of the Research

- This study introduces **new design concepts** for 3D outerwear garments tailored to girls aged 14–16.
- It sheds light on a **novel approach** for producing 3D clothing pieces using Pattern Magic.
- The research encourages ready-to-wear clothing manufacturers to adopt **Pattern Magic** techniques in the design and production of outerwear for adolescent girls.

Methodology

The researcher applied the following:

- **Descriptive Analytical Method**
  To review and analyze prior studies, build the theoretical framework, and interpret the findings.
- **Quasi-Experimental Method**
  To design and produce **five 3D outerwear garments** using **Pattern Magic** for adolescent girls aged 14–16.

Limitations

1. **Time Limitations:** The 3D designs using Pattern Magic were executed during the academic year 2023/2024.
2. **Geographical Limitations:** Minya Governorate – New Girls' Secondary School.
3. **Human Limitations:** 11 experts in the field of clothing and textiles, and 45 adolescent girls aged 14–16.
4. **Topical Limitations:** Implementation of five 3D outerwear designs for adolescent girls within the specified age range.

Tools

1. **Expert Evaluation Questionnaire:**
   Designed to assess the 3D outerwear designs created using Pattern Magic from functional, aesthetic, and technical perspectives.
2. **Consumer Evaluation Questionnaire:**
   Targeted at adolescent girls (ages 14–16) to evaluate the produced garments based on their preferences and acceptance.

Hypotheses

- There are statistically significant differences among the five executed 3D outerwear designs using Pattern Magic for girls aged 14–16 in terms of the **functional aspect**, according to expert evaluations.
- There are statistically significant differences in the **aesthetic aspect** of the same designs, based on expert opinions.
- Statistically significant differences exist among the designs regarding the **technical aspect**, according to experts.
- Overall, statistically significant differences are present in the expert evaluations of the five Pattern Magic outerwear designs.
- There are statistically significant differences in consumer evaluations (girls aged 14–16) of the five 3D Pattern Magic designs.

Procedures

First: Theoretical Procedures

- Reviewing relevant literature and previous studies addressing:
    1. Middle adolescence phase
    2. Outerwear garments for adolescent girls aged 14–16
    3. The Pattern Magic technique

Second: Practical Procedures

1. Designing and executing five 3D garments using **Pattern Magic** that are appropriate for girls aged 14–16 .
2. Having the designs evaluated by **experts in clothing and textile** design.
3. Gathering evaluations from **adolescent girl consumers** in the target age group.

Third: Statistical Procedures

- Analyzing and interpreting the collected data statistically.
- Presenting results and providing a set of practical recommendations.

Terminology

Adolescence

- Defined by **Stephen Hard (2009)** as the transitional phase toward maturity, encompassing physical, social, mental, and behavioral growth. It begins with puberty and ends with social maturity.
- **Middle adolescence** is the core of adolescence, marked by emotional turbulence, psychological struggles, and a search for identity and independence **(Amal Khattab & Yathrib Habib, 2022).**
- **Operational Definition (Researcher's Definition):** Middle adolescence is the phase where girls experience rapid physical changes and thus require fashion that aligns with their development and current trends.

Outerwear

- Defined by **Rasha Abbas El-Gohary et al. (2016)** as garments that cover the body, conceal flaws, protect from external factors, and reflect one's cultural and social status.
- According to **Amani Abdel-Maqsoud et al. (2022)**, outerwear is a visual communication tool involving a thoughtful arrangement of elements that balances creativity and societal tradition.
- **Ibtisam Mosbah et al. (2024)** describe it as any clothing worn by adolescent girls outside the home (dresses, skirts, t-shirts, pants, blouses, jackets), significantly influencing how others perceive them.
- **Operational Definition (Researcher's):** Outerwear refers to garments used by adolescent girls outside the home, produced using **3D models** that accommodate physical changes and current fashion trends.

Pattern Magic

- Defined by **Zeinab Razeek & Shadia Salah (2018)** as a Japanese technique involving drawing flat patterns with specific curves and measurements, folding them to create 3D garment shapes.
- Described by **Rasha Yehia & Doaa Nabil (2021)** as a method of modifying the basic women's pattern (Aldrich) to produce 3D fashion pieces.
- **Operational Definition (Researcher's):** A process of transforming a flat base pattern into 3D fashion pieces using **Pattern Magic** techniques.

Applied Framework

The researchers developed a collection of **five proposed 3D garment designs** using **Pattern Magic**. These were selected based on the highest evaluation scores from experts in the fields of **textile and fashion design**.

Each design was executed and described in detail, including its structure, inspiration, and 3D construction technique.

These 3D outerwear garments were created specifically for adolescent girls aged 14–16 and evaluated through both **expert** and **consumer (teen girl)** perspectives to assess their functional, aesthetic, and technical success.

First Executed Design

The second design is a knee-length dress with a round neckline and no sleeves. At the front, the design features expansion panels extending from the side seam, both above and below the waistline, shaped like half-circles. These panels include a drawstring mechanism, allowing for adjustment in this area to suit the waist development of adolescent girls aged 14–16 years. At the back, the dress continues with a round neckline, and similar expansion panels appear above and below the waistline, with the half-circle shapes aligning with those at the front. A zipper is included for easy wearability, extending from mid-neckline to mid-armhole.	

Second Executed Design

The third design is a **sleeveless dress** that extends **below the knee**. At the front, it features a **deep round neckline** and a set of **distinctive curved lines** positioned at the bust level. The front panel is divided into **two sections** at the bust line: • The **upper section** includes multiple **curved cuts above and below the bust**, designed to **conceal bust projection**. • The **lower section** is connected to the upper via smoothly curved seams and incorporates **gathered expansions at the bottom** to form a **flared skirt tail**. The back of the dress has a **wide round neckline** and is divided into **two sections**. The **lower back** is designed with a **half-circle (half-cloche) cut**, enhancing the garment's flow and volume.	

Third Executed Design

The first design is a **sleeveless (strap-style) dress** that extends **below the knee**. From the front, the dress is divided into **two sections**, with a **slit at the hip line** featuring several **expansion pleats**. A **drawstring** is inserted through this section, allowing the wearer to **tighten or loosen** the fit, thus accommodating the **physical growth** of girls in the age group **14–16 years**. At the back, the design is divided into **three sections**, forming the overall silhouette as illustrated in the accompanying sketch.	

Fourth Executed Design

The fourth design is a **sleeveless dress** that falls **above the knee**.

At the front, the design is divided into **two main sections**:

- The **upper section** includes **two fabric ties** that can be fastened into a **bow** at the bust. This allows for **adjustability in fit**, accommodating the **growth and development of the bust area** during the adolescent stage (**ages 14–16**).
- The **lower section** features a **gathered flare (kalona)** that extends from the **bust line to the hem**, adding fullness and ease of movement.

At the back, the dress has a **round neckline**, and a **small expansion** is added along the **shoulder dart line** for improved fit and comfort.

Fifth Executed Design

The fifth design is a **simple dress** that extends **below the knee** and features **long sleeves**. At the **upper arm level**, specifically at the **center of the sleeve cap**, there is a **slit** containing several **expansion folds**. These folds can be **adjusted using a drawstring**, applying the **Pattern Magic** technique to allow for **customizable expansion and contraction**, thus accommodating the **rapid arm growth** typical among adolescent girls aged **14–16 years**.	

Validity and Reliability

1- Expert Evaluation Questionnaire for the Executed Designs:

This questionnaire was designed to collect the opinions of professors specialized in the field of clothing and textiles regarding the executed designs that received the highest agreement rates from the previously proposed models. The questionnaire consisted of **15 statements**, including:

- **6 statements** related to the **functional aspect**,
- **5 statements** related to the **aesthetic aspect**, and
- **4 statements** related to the **technical aspect**.

Validity of the Questionnaire:

Validity refers to the questionnaire's ability to measure what it is intended to measure.

Internal Consistency Validity:

1. Calculating the correlation coefficients between each item score within a given dimension and the total score of that dimension.
2. Calculating the correlation coefficients between the total score of each dimension and the total questionnaire score.

Dimension One: Functional Aspect

The validity was assessed using internal consistency by calculating the **Pearson correlation coefficient** between the score of each item and the total score of the functional aspect. The following table illustrates this:

Table (1): Correlation Coefficients Between Each Item and the Functional Aspect Score

No.	Correlation	Significance Level
1	0.914	0.01
2	0.797	0.01
3	0.634	0.05
4	0.608	0.05
5	0.832	0.01
6	0.748	0.01

It is evident from Table (1) that all correlation coefficients are statistically significant at the (0.01 – 0.05) levels, indicating the validity and internal consistency of the questionnaire items related to the functional aspect.

Dimension Two: Aesthetic Aspect

The validity was assessed using internal consistency by calculating **Pearson correlation coefficients** between each item and the total score for the aesthetic aspect. The following table shows the results:

Table (2): Correlation Coefficients Between Each Item and the Aesthetic Aspect Score

No.	Correlation	Significance Level
1	0.782	0.01
2	0.849	0.01
3	0.907	0.01
4	0.725	0.01
5	0.622	0.05

It is clear from Table (2) that all correlation coefficients are statistically significant at the (0.01 – 0.05) levels, confirming the validity and consistency of the questionnaire items regarding the aesthetic aspect.

Dimension Three: Technical Aspect

Validity was assessed through internal consistency by calculating **Pearson correlation coefficients** between each item and the total score for the technical aspect. The results are shown in the following table:

Table (3): Correlation Coefficients Between Each Item and the Technical Aspect Score

No.	Correlation	Significance Level
1	0.641	0.05
2	0.939	0.01
3	0.816	0.01
4	0.767	0.01
1	0.641	0.05

It is evident from Table (3) that all correlation coefficients are statistically significant at the (0.01 – 0.05) levels, indicating the validity and internal consistency of the questionnaire items related to the technical aspect.

Internal Consistency Validity Between Each Dimension and the Overall Questionnaire Score

Internal consistency validity was calculated using Pearson correlation coefficients between the total score of each dimension (functional, aesthetic, and technical) and the overall questionnaire score. The results are presented below:

Table (4): Correlation Coefficients Between Each Dimension and the Overall Questionnaire Score

Dimension	Correlation	Significance Level
Functional Aspect	0.871	0.01
Aesthetic Aspect	0.753	0.01
Technical Aspect	0.824	0.01

It is clear from Table (4) that all correlation coefficients are statistically significant at the 0.01 level, indicating strong validity and consistency across all questionnaire dimensions.

Reliability

Reliability refers to the accuracy, consistency, and stability of the questionnaire in measurement and observation. It indicates how consistently the tool measures the actual performance of the respondents. Reliability was assessed using:

1. **Cronbach's Alpha Coefficient**
2. **Split-Half Method**

Table (5): Reliability Coefficients for the Expert Evaluation Questionnaire of the Executed Designs

Dimension	Cronbach's Alpha	Split-Half Reliability
Functional Aspect	0.904	0.863 – 0.945
Aesthetic Aspect	0.763	0.721 – 0.808
Technical Aspect	0.821	0.784 – 0.869
Overall Reliability	**0.856**	**0.810 – 0.893**

All values shown in Table (5) are statistically significant at the 0.01 level, confirming the high reliability of the questionnaire.

2- Consumer Evaluation Questionnaire (Girls aged 14–16) for the Executed Designs

This questionnaire collected the opinions of adolescent girls (aged 14–16) regarding the executed designs that received the highest agreement from expert evaluators. The questionnaire consisted of **13 statements**, using a **binary scale** (Agree – Disagree).

Validity of the Questionnaire

Validity refers to the tool's ability to measure the concepts it was intended to measure.

Internal Consistency Validity

Pearson correlation coefficients were calculated between each item and the overall questionnaire score. The results are presented in the table below:

Table (6): Correlation Coefficients Between Each Item and the Overall Questionnaire Score

No.	Correlation	Significance
1	0.776	0.01
2	0.617	0.05
3	0.921	0.01
4	0.707	0.01
5	0.635	0.05
6	0.887	0.01
7	0.915	0.01
8	0.745	0.01
9	0.603	0.05
10	0.624	0.05
11	0.802	0.01
12	0.640	0.05
13	0.937	0.01

It is evident from Table (6) that all correlation coefficients are statistically significant at levels (0.01 and 0.05), indicating a high level of validity and internal consistency of the questionnaire items.

Reliability:

Reliability refers to the accuracy of the test in measurement and observation, its consistency with itself, and its stability and regularity in providing information about the examinee's behavior. It represents the ratio of the variance in the scale score that indicates the actual performance of the examinee. Reliability was calculated using the following methods:

1. **Cronbach's Alpha Coefficient**
2. **Split-Half Method**

Table (7): Reliability Coefficient Values for the Consumer Evaluation Questionnaire (Girls aged 14–16) of the Executed Designs

	Cronbach's Alpha	Split-Half
Reliability of the Consumer Evaluation Questionnaire (Girls aged 14–16) for the Executed Designs as a Whole	**0.934**	**0.891 – 0.972**

It is clear from Table (7) that all reliability coefficient values—Cronbach's Alpha and Split-Half—are significant at the 0.01 level, indicating the reliability of the questionnaire.

Results

First Hypothesis:

"There are statistically significant differences between the five executed 3D outerwear designs using *Pattern Magic* for girls aged 14–16 in achieving the functional aspect, according to the opinions of specialists."

To verify this hypothesis, an analysis of variance (ANOVA) was conducted for the mean scores of the five executed 3D outerwear designs using *Pattern Magic* for girls aged 14–16 in achieving the functional aspect, based on the specialists' evaluations. The following table illustrates this:

Table (8): ANOVA of the Mean Scores of the Five Executed 3D Outerwear Designs Using *Pattern Magic* for Girls Aged 14–16 in Achieving the Functional Aspect According to Specialists' Opinions

Functional Aspect	Sum of Squares	Mean Square	Degrees of Freedom	F-Value	Significance
Between Groups	**1006.726**	**251.681**	**4**	**30.803**	**Significant at 0.01**
Within Groups	**326.828**	**8.171**	**40**		
Total	**1333.554**		**44**		

It is evident from Table (8) that the F-value was (30.803), which is statistically significant at the 0.01 level. This indicates that there are significant differences among the five executed 3D outerwear designs using *Pattern Magic* for girls aged 14–16 in achieving the functional aspect, according to the opinions of specialists.

To determine the direction of these differences, the LSD (Least Significant Difference) test for multiple comparisons was applied, and the following table illustrates the results:

Table (9): LSD Test for Multiple Comparisons *Functional Aspect*

Functional Aspect	D.M= 29.533	D.M= 22.276	D.M= 27.546	D.M= 18.330	D.M= 21.393
Design 1	–				
Design 2	7.256**	–			
Design 3	1.986	5.270**	–		
Design 4	11.203**	3.946**	9.216**	–	
Design 5	8.140**	0.883	6.153**	3.063**	–

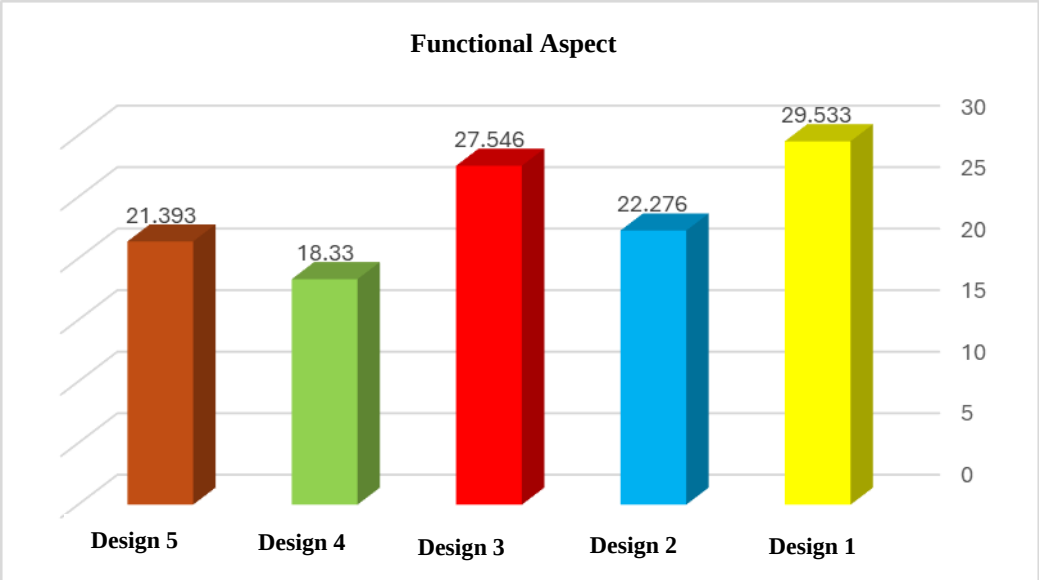

Figure (1) illustrates the mean scores of the five executed 3D outerwear designs using *Pattern Magic* for girls aged 14–16 in achieving the functional aspect, according to the opinions of specialists.

Based on Table (9) and Figure (1), the following can be concluded:

1. There are statistically significant differences among the five executed 3D outerwear designs using *Pattern Magic* at the 0.01 significance level. Design "1" was the most effective in achieving the functional aspect according to specialists' evaluations, followed by Design "3", then Design "2", then Design "5", and finally Design "4".
2. No significant differences were found between Design "1" and Design "3", as well as between Design "2" and Design "5".

From the above, it is evident that there is a high level of acceptance and success for the sustainable 3D designs using *Pattern Magic* for girls aged 14–16. This is confirmed by the evaluation of specialists regarding the functional aspect, where the executed designs received high ratings, indicating their suitability for adolescent girls in this age group from a functional perspective. They also accommodate the rapid physical changes girls experience at this stage, and they fulfill the principle of sustainability by extending the usable life of the 3D sustainable designs created with *Pattern Magic*. These designs also help enhance self-confidence among the girls. This result is consistent with the findings of **(Tahani Al-Ajaji & Tahani Al-Qadeeri, 2017) and (Rania Hekal, 2022)**. **Based on the above, the First hypothesis was accepted.**

Second Hypothesis:

"There are statistically significant differences between the five executed 3D outerwear designs using *Pattern Magic* for girls aged 14–16 in achieving the aesthetic aspect, according to the opinions of specialists."

To verify this hypothesis, an analysis of variance (ANOVA) was conducted for the mean scores of the five executed 3D outerwear designs using *Pattern Magic* for girls aged 14–16 in achieving the aesthetic aspect, based on the specialists' evaluations. The following table illustrates this:

Table (10): ANOVA of the Mean Scores of the Five Executed 3D Outerwear Designs Using *Pattern Magic* for Girls Aged 14–16 in Achieving the Aesthetic Aspect According to Specialists' Opinions

Aesthetic Aspect	Sum of Squares	Mean Square	Degrees of Freedom	F-Value	Significance
Between Groups	931.720	232.930	4	53.754	Significant at 0.01
Within Groups	173.330	4.333	40		
Total	1105.050		44		

It is evident from Table (10) that the F-value was (53.754), which is statistically significant at the 0.01 level. This indicates that there are significant differences among the five executed 3D outerwear designs using *Pattern Magic* for girls aged 14–16 in achieving the aesthetic aspect, according to the opinions of specialists.

To determine the direction of these differences, the LSD (Least Significant Difference) test for multiple comparisons was applied, and the following table illustrates the results:

Table (11): LSD Test for Multiple Comparisons *Aesthetic Aspect*

Aesthetic Aspect	D.M=24.646	D.M=22.373	D.M=19.770	D.M=14.633	D.M=16.466
Design 1	–				
Design 2	2.273*	–			
Design 3	4.876**	2.603*	–		
Design 4	10.013**	7.740**	5.136**	–	
Design 5	8.180**	5.906**	3.303**	1.833	–

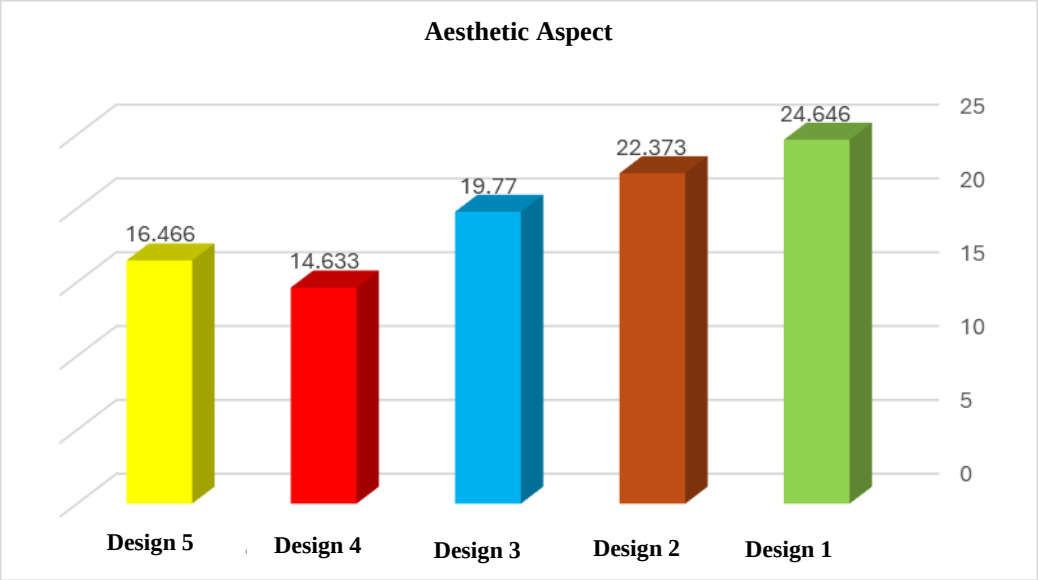

Figure (2) illustrates the mean scores of the five executed 3D outerwear designs using *Pattern Magic* for girls aged 14–16 in achieving the aesthetic aspect, according to the opinions of specialists.

Based on Table (11) and Figure (2), the following can be concluded:

1. There are statistically significant differences at the 0.01 level among the five executed 3D outerwear designs using *Pattern Magic*, with Design "1" being the most effective in achieving the aesthetic aspect according to the specialists' evaluations, followed by Design "2", then Design "3", then Design "5", and finally Design "4".
2. There are also statistically significant differences at the 0.05 level between Design "1" and Design "2" in favor of Design "1", and between Design "2" and Design "3" in favor of Design "2".
3. No significant differences were found between Design "4" and Design "5".

From the above, it is evident that there is a high level of acceptance and success for the sustainable 3D designs using *Pattern Magic* for girls aged 14–16. This is supported by the evaluation of specialists regarding the **aesthetic aspect**, where the executed designs received high ratings, indicating that the sustainable 3D designs created with *Pattern Magic* align with modern fashion trends for girls in the 14–16 age group. The designs are characterized by variety, innovation, and elegance, and they provide

flexibility, drape, and harmony suitable for girls at this developmental stage. Moreover, these sustainable 3D designs help girls accept the physical changes they experience during this age. This result is consistent with the findings of **(Naglaa Tuaima et al., 2024) and (Ola Al-Husaini, 2024). Based on the above, the Second hypothesis was accepted.**

Third Hypothesis:

"There are statistically significant differences between the five executed 3D outerwear designs using *Pattern Magic* for girls aged 14–16 in achieving the technical aspect, according to the opinions of specialists."

To verify this hypothesis, an analysis of variance (ANOVA) was conducted for the mean scores of the five executed 3D outerwear designs using *Pattern Magic* for girls aged 14–16 in achieving the technical aspect, based on the specialists' evaluations. The following table illustrates this:

Table (12): ANOVA of the Mean Scores of the Five Executed 3D Outerwear Designs Using *Pattern Magic* for Girls Aged 14–16 in Achieving the Technical Aspect According to Specialists' Opinions

Technical Aspect	Sum of Squares	Mean Square	Degrees of Freedom	F-Value	Significance
Between Groups	1062.125	265.531	4	22.917	Significant at 0.01 level
Within Groups	463.463	11.587	40		
Total	1525.588		44		

It is evident from Table (12) that the F-value was (22.917), which is statistically significant at the 0.01 level. This indicates that there are significant differences among the five executed 3D outerwear designs using *Pattern Magic* for girls aged 14–16 in achieving the technical aspect, according to the opinions of specialists.

To determine the direction of these differences, the LSD (Least Significant Difference) test for multiple comparisons was applied, and the following table illustrates the results:

Table (13): LSD Test for Multiple Comparisons *Technical Aspect*

Technical Aspect	D.M=19.926	D.M= 16.890	D.M= 13.040	D.M=11.583	D.M=8.896
Design 1	–				
Design 2	3.036**	–			
Design 3	6.886**	3.850**	–		
Design 4	8.343**	5.306**	1.456	–	
Design 5	11.030**	7.993**	4.143**	2.686*	–

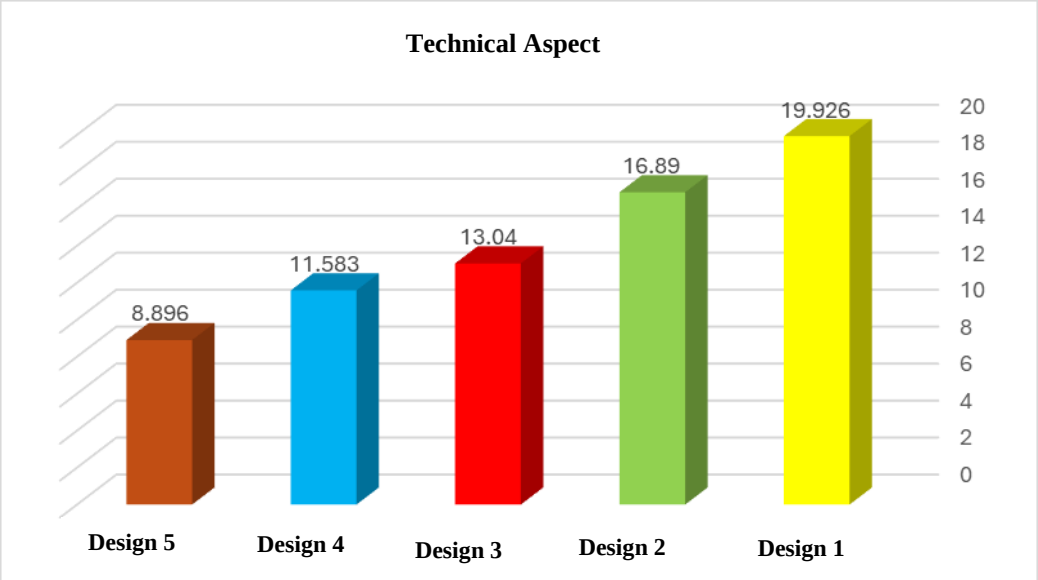

Figure (3) illustrates the mean scores of the five executed 3D outerwear designs using *Pattern Magic* for girls aged 14–16 in achieving the technical aspect, according to the opinions of specialists.

Based on Table (13) and Figure (3), the following can be concluded:

1. There are statistically significant differences at the 0.01 level among the five executed 3D outerwear designs using *Pattern Magic*, with Design "1" being the most effective in achieving the technical aspect according to the specialists' evaluations, followed by Design "2", then Design "3", then Design "4", and finally Design "5".
2. There are also statistically significant differences at the 0.05 level between Design "4" and Design "5", in favor of Design "4".
3. No significant differences were found between Design "3" and Design "4".

From the above, it is evident that there is a high level of acceptance and success for the sustainable 3D designs using *Pattern Magic* for girls aged 14–16. Based on the evaluation of specialists regarding the **technical aspect**, the techniques used in the sustainable 3D designs with *Pattern Magic* were found to be suitable for girls in this age group. These techniques support the accommodation of rapid physical growth in adolescent girls and contribute to the ease of wearing and removing the outer garments designed using sustainable 3D approaches with *Pattern Magic*. This result is consistent with the findings of **(Rania Attia, 2016) and (Heba Mahmoud, 2022). Based on the above, the third hypothesis was accepted.**

Fourth Hypothesis:

"There are statistically significant differences between the five executed 3D outerwear designs using *Pattern Magic* for girls aged 14–16 according to the opinions of specialists."

To verify this hypothesis, an analysis of variance (ANOVA) was conducted for the mean scores of the five executed 3D outerwear designs using *Pattern Magic* for girls aged 14–16, based on the specialists' evaluations. The following table illustrates this:

Table (14): ANOVA of the Mean Scores of the Five Executed 3D Outerwear Designs Using *Pattern Magic* for Girls Aged 14–16 According to Specialists' Opinions

Overall Score (Specialists)	Sum of Squares	Mean Square	Degrees of Freedom	F-Value	Significance
Between Groups	959.377	239.844	4	42.575	Significant at 0.01 level
Within Groups	225.338	5.633	40		
Total	1184.715		44		

It is evident from Table (14) that the F-value was (42.575), which is statistically significant at the 0.01 level. This indicates that there are significant differences among the five executed 3D outerwear designs using *Pattern Magic* for girls aged 14–16, according to the opinions of specialists.

To determine the direction of these differences, the LSD (Least Significant Difference) test for multiple comparisons was applied, and the following table illustrates the results:

Table (15): LSD Test for Multiple Comparisons *Overall Score (Specialists)*

Overall Score (Specialists)	Design D.M= 74.106	D.M=61.540	D.M=60.356	D.M=44.546	D.M=46.756
Design 1	–				
Design 2	12.566**	–			
Design 3	13.750**	1.183	–		
Design 4	29.560**	16.993**	15.810**	–	
Design 5	27.350**	14.783**	13.600**	2.210*	–

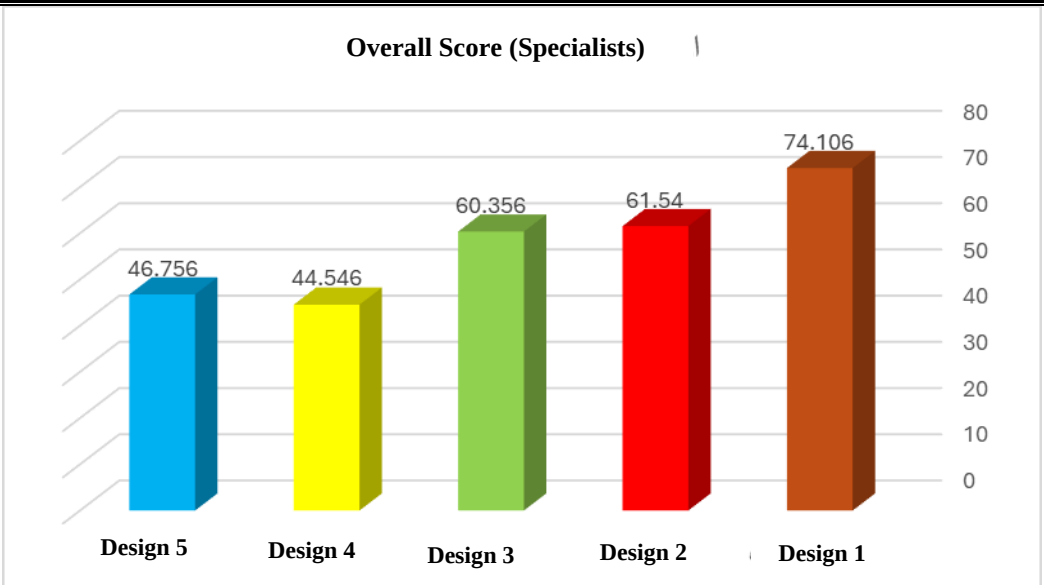

Figure (4) illustrates the mean scores of the five executed 3D outerwear designs using *Pattern Magic* for girls aged 14–16, according to the opinions of specialists.

Based on Table (15) and Figure (4), the following can be concluded:

1. There are statistically significant differences at the 0.01 level among the five executed 3D outerwear designs using *Pattern Magic*. According to the specialists' evaluations, Design "1" was the most favored, followed by Design "2", then Design "3", then Design "5", and finally Design "4".
2. There are also statistically significant differences at the 0.05 level between Design "4" and Design "5", in favor of Design "5".
3. No significant differences were found between Design "2" and Design "3".

From the above, it is evident that there is a high level of acceptance and success for the sustainable 3D designs using *Pattern Magic* for girls aged 14-16. According to the evaluation of specialists regarding the **functional aspect**, the executed designs received high ratings, indicating that the principle of sustainability was achieved, and the usable lifespan of the outer garments was extended. The designs were also suitable for the rapid physical changes experienced by girls in this age group. This result is consistent with the study of **(Tahani Al-Ajaji & Tahani Al-Qadeeri, 2017).**

From the **aesthetic perspective**, the designs received a high level of agreement in terms of their alignment with modern fashion trends, and they were characterized by variety, innovation, elegance, harmony, flexibility, and fluidity. These findings are consistent with the study of **(Ola Al-Husaini, 2024).**

As for the **technical aspect**, the executed designs received a high level of agreement regarding the appropriateness of the techniques used in implementing the sustainable 3D designs using *Pattern Magic*. These techniques also supported a rapid response to the physical growth of girls aged 14–16. This result is consistent with the study of **(Rania Attia, 2016).**

Based on the above, the fourth hypothesis was accepted.

Fifth Hypothesis:

"There are statistically significant differences between the five executed 3D outerwear designs using *Pattern Magic* according to the opinions of consumers (girls aged 14–16)."

To verify this hypothesis, an analysis of variance (ANOVA) was conducted for the mean scores of the five executed 3D outerwear designs using *Pattern Magic*, based on the evaluations of the consumers (girls aged 14–16). The following table illustrates this:

Table (16): ANOVA of the Mean Scores of the Five Executed 3D Outerwear Designs Using *Pattern Magic* According to the Opinions of Consumers (Girls Aged 14–16)

Consumers (Girls Aged 14–16)	Sum of Squares	Mean Square	Degrees of Freedom	F-Value	Significance
Between Groups	6133.441	1533.360	4	60.888	Significant at 0.01 level
Within Groups	5540.320	25.183	220		
Total	11673.761		224		

It is evident from Table (16) that the F-value was (60.888), which is statistically significant at the 0.01 level. This indicates that there are significant differences among the five executed 3D outerwear designs using *Pattern Magic*, according to the opinions of the consumers (girls aged 14–16).

To determine the direction of these differences, the LSD (Least Significant Difference) test for multiple comparisons was applied, and the following table illustrates the results:

Table (17): LSD Test for Multiple Comparisons *Consumers (Girls Aged 14–16)*

Consumers (Girls 14–16)	D.M= 64.418	D.M= 61.293	D.M= 57.901	D.M= 55.683	D.M= 50.538
Design 1	–				
Design 2	3.124**	–			
Design 3	6.516**	3.392**	–		
Design 4	8.735**	5.610**	2.218*	–	
Design 5	13.879**	10.754**	7.362**	5.144**	

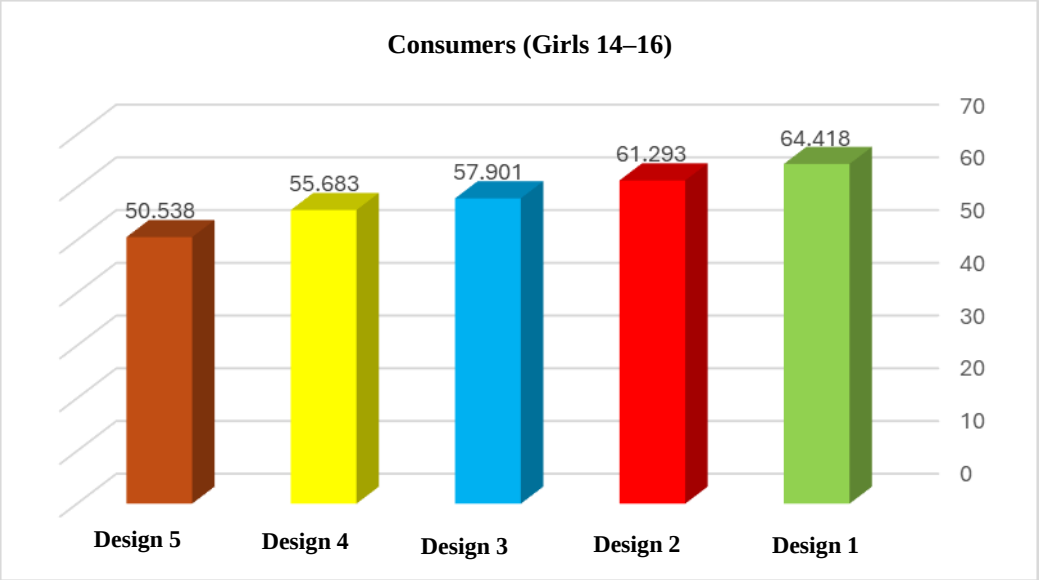

Figure (5) illustrates the mean scores of the five executed 3D outerwear designs using *Pattern Magic*, according to the opinions of the consumers (girls aged 14–16).

Based on Table (17) and Figure (5), the following can be concluded:

1. There are statistically significant differences at the 0.01 level among the five executed 3D outerwear designs using *Pattern Magic*. According to the evaluations of the consumers (girls aged 14–16), Design "1" was the most favored, followed by Design "2", then Design "3", then Design "4", and finally Design "5".
2. There is also a statistically significant difference at the 0.05 level between Design "3" and Design "4", in favor of Design "3".

From the above, it is evident that there is a high level of acceptance and success for the sustainable 3D designs using *Pattern Magic* for girls aged 14–16. Based on the adolescent girls' evaluations of the executed sustainable 3D designs, the designs received a high acceptance rate, indicating their success in providing suitable clothing. The designs align with modern fashion trends, help conceal areas of rapid physical growth, and are considered affordable for purchase.

Moreover, the executed designs are characterized by simplicity, elegance, vibrancy, energy, and uniqueness, making them suitable for wearing during various activities and occasions. This result is consistent with the studies of **(Samar Qanona, 2019) and (Sahar Zaghloul & Maha Al-Rashidi, 2023).**

Based on the above, the fifth hypothesis was accepted.

Recommendations

1. Academic focus should be directed towards proposing research ideas related to 3D outerwear in the field of clothing design and manufacturing.
2. Introduce a scientific course on 3D clothing within the ready-made garments curriculum at the academic level.
3. Fashion designers should be aware of the interests and needs of middle adolescence, as clothing represents a central concern for teenagers; it contributes to their self-satisfaction, appearance, and boosts their confidence.

References

1. Al-Ajaji, Tahani bint Nasser, & Al-Qadeeri, Tahani bint Abdullah (2017): ***Recycling Fabric Waste and Utilizing It in Fashion Design and Embellishment,***Published Research, *International Design Journal*, Faculty of Applied Arts, Helwan University, Vol. 7, No. 4, October.
2. Al-Husaini, Ola bint Salem Mohamed Saleh (2024): ***Designing and Producing Zero-Waste Outerwear for Adolescent Girls to Promote Sustainable Practice,*** *Journal of Studies and Research in Specific Education*, Faculty of Specific Education, Zagazig University, Vol. 10, No. 1.
3. Aliya Ahmed Abdeen (2010): ***"Studies in Clothing Psychology,***" Dar Al-Maseera, Amman, 2nd Edition.
4. Amal El-Sayed Abdel Salam Khattab, Waithrab Ali Mohamed Habib (2022): ***"Innovative Traits among Mothers and Their Relationship to Change Management and Achieving Compatibility with Their Adolescents in Middle Adolescence Stage (14–17 years),***" Journal of Research in Specific Education Fields – Minya University, Volume 8, Issue 39, March.

5. Amani Abdel Maksoud, Samah Helmy, et al. (2022): ***"Effectiveness of the Blended Learning Strategy in Developing Cognitive Achievement for Designing and Executing Outerwear and Its Impact on Improving Self-Esteem among Deaf and Mute Female Students at the Secondary Level,"*** Scientific Journal of the Faculty of Specific Education – Minya University, Issue 31, July.
6. Attia, Rania Nabil Zaki (2016). ***3D Techniques in Clothing Design and Production,*** *International Design Journal*, Scientific Society of Designers, Vol. 6, No. 4, October.
7. Hekal, Rania Hosny (2022). ***Using Evening Wear Fabric Remnants in Creating Separate Clothing Accessories***, Published Research, *Journal of Research in the Fields of Specific Education*, Faculty of Specific Education, Minia University, Vol. 8, No. 40, May.
8. Jones, S. J. (2002): ***Fashion Design (Portfolio Skills)***, Laurence King Publishing.
9. Nabila Farag Abdullah Al-Farag (2016): **"Innovative Designs for Women's Fashion Inspired by Surreal Art Using the Formative and Aesthetic Potentials of Fabric Scraps,"** Unpublished Master's Thesis, College of Design and Home Economics, Qassim University.
10. Nancy Mohamed Khairat, Mohamed Sherif Sabry, Abeer Hassan Abdu (2019): ***"Interactivity and Its Role in Supporting the Human Relationship Between Brand and Forum in Advertising Design,"*** International Design Journal, Vol. 9, No. 1.
11. Qanona, Samar Ahmed Mesbah (2019): ***Using Fashion Design Sketches to Innovate Clothing Designs via Heat Transfer Printing Suitable for Adolescent Girls,*** *Scientific Journal of Specific Education Sciences*, Issue 9, Tanta University.
12. Rasha Abbas Al-Johary, et al. (2016): "***The Feasibility of Utilizing Recycled Fabric Scraps to Enrich Women's Outerwear,"*** Journal of Specific Education Research, Faculty of Specific Education, Mansoura University, Issue 42.

13. Rasha Yehia Zaki Mustafa, Doaa Nabil Ali Salama (2022): "***Utilizing Skills of* Pattern Magic *in Enriching the Outerwear Execution Course," Journal of Research***, Faculty of Specific Education, Minya University, Volume 8, Issue 39.
14. Ross, Ruth (2005): ***Fashion and Textile Technolog,****Consumer Studies (Higher)*, Learning and Teaching Scotland
15. Salah El-Din Al-Omariyah (2011): ***Developmental Psychology,*** Arab Society Library for Publishing and Distribution, 1st Edition, Amman, Jordan.
16. Sayed Mahmoud Al-Tawab (2002): ***Psychology of Human Development,*** Anglo-Egyptian Library, Cairo.
17. Stephen Hard (2009): ***Childhood Problems and Adolescent Psychology,*** Treatment Methods," Translated by Joyce Academic, Cairo.
18. Tuaima, Naglaa Mohamed, El-Tossani, Amira Adel Abbas, & Zaghloul, Tarek Mohamed (2024): ***Achieving Sustainability in Teenagers' Clothing through Handicrafts***, *Journal of Applied Arts and Sciences*, Faculty of Applied Arts, Damietta University, January.
19. Yasmin Shaaban (2010): ***An Analytical Study of Clothing Behavior Among Adolescent Girls and Its Relation to Their Religious Culture,*** Published Master's Thesis, College of Home Economics, Menoufia University.
20. Zaghloul, Sahar Ali, & Al-Rashidi, Maha Mansour (2023): ***Innovating Zero-Waste Transformable Designs for Adolescent Girls' Evening Wear to Activate Sustainable Practice***, *Journal of Heritage and Design*, Vol. 3, No. 16.
21. Zeinab Razeeqa Suwayhi Al-Salmi, Shadia Salah Hassan Metwally Salem (2018): ***"Effectiveness of an Educational Program for Knowledge and Skills of Drawing* Pattern Magic *Using Multimedia,*** Published Research, International Design Journal, Scientific Association of Designers, Vol. 8, No. 2.