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The aesthetics of decorative iron art as an experimental approach to creating contemporary metalwork

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Abstract---The current research aims to shed light on the aesthetics of decorative iron art styles in Europe and study its artistic features and most important techniques in an attempt to employ these features artistically to enrich the performance of art education students in the field of metalworking. The research follows a descriptive methodology in describing and analyzing the different models of decorative iron and their relationship to architecture, with the analysis of the most important aesthetic values of each model and the techniques used in it, as well as using the experimental method in designing and implementing the student experience on the research sample. The applied aspect of the research was based on the design and application of research tools, the most important of which is a teaching unit that aims to benefit from the technical features of selected styles of decorative iron art in enriching the skillful performance of female students in the Department of Art Education - King Faisal University in the hanged metalwork. The students also underwent a test Applied, before and after, and the test was evaluated and the data were processed statistically and then analyzed to reach the results, the most important of which are: There are statistically significant differences between the mean scores of the technical performance of the students of the research sample in the pre and post performances of the metalwork inspired by the characteristics of decorative iron art, and the difference is in favor of the post-performance.

Keywords---decorative iron, metalworking, experimentation, aesthetics.

Introduction

At the beginning of the twentieth century, some artistic trends prevailed, which called for looking at craft arts as content that combines various colors of crafts in a manner that suits the environmental and social conditions that the artist is contemporaneous with, as well as the necessity of linking artistic work with the needs of the age and environment. Herbert Reid), as well as the books of the German Bauhaus School, which clarified the new doctrine in the art that links the aesthetic side with the functional side, that side that has long been ignored by art critics, and towards those works that included the problems of the history of art and art crafts, this awareness of the value of Applied aspects and craftsmanship for the objectives of art education.

(Alkorety, 1987) indicates that “the language of plastic art is a language that belongs to the formal content, and therefore it needs a permanent vision of the plastic artistic production in its various schools, forms, and colors, and for the various natural and manufactured forms, and therefore it needs a visual vision of different works through Ancient, modern, and contemporary artistic heritage. The art of decorative iron is one of the craft arts that has not received sufficient attention from the study, analysis, and understanding despite the richness of this art and its originality, and its passing through many developments and changes that affected and shaped its various styles throughout the ages. Is one of the rich heritage arts that must be taken care of, studied, and used in various fields of plastic art. Among the studies and research that dealt with the topic:

In A study by (Abdelrahman, 2021), the researcher aimed to take advantage of the plastic dimensions and aesthetic values of decorative iron as one of the rich arts with its various plastic styles and methods, to make artistic works suitable to be the nucleus of a small production project, and then the researcher chose polystyrene slices This is due to its plastic and formal features and characteristics that can mimic the appearance and not the function of the decorative iron, where many elements and decorative units can be implemented easily and quickly, and produce crafts that are suitable as a small production project for young graduates, and the problem of research lies in shedding light on the possibility of simulating fine dimensions and values The aesthetic of decorative iron art through polystyrene to produce artifacts suitable as a small production project for young people to face the challenges of the labor market.

(Almandarawy, 2016) he conducted a research aimed at studying the methods of using decorative iron employed by modern art designers in architecture (stairs, balconies, doors,...), to develop a conceptual vision for the integration of the foundations of decorative iron design with architecture, It is based on the modern art style. It also examined ways to activate the integration between modern art and the design thought of the designer of decorative iron products. And he reached to benefit from the foundations and principles of modern art in developing a simplified approach to design education that relies on organic motifs inspired by plants. Luxury and originality, in addition to the possibility of its application to all classes (high-middle-low), where technology provided economic value with high quality. In the same regard, (Hamed, 1996) presented a study aimed at analyzing the aesthetic values of the different iron models and their

relationship to the architectural openings, as well as tracking the historical, geographical, and aesthetic influences that helped the development of the art of decorative iron with the analysis of the most important iron decorative models in the buildings of ancient Egypt.

The researcher used a historical methodology in following the research problem historically, and an analytical descriptive method in the study of stylistic relations and a description of the ironworks associated with architectural openings. Among the most important results of the study: The decorative ironworks in Egypt were affected by the artistic and architectural styles that spread in Europe, as well as the connection of ironworks and their models with the forms of architectural openings executed in them. In the Light of the foregoing and through previous studies and reading the subject's data, the researcher saw that it is possible to study and extract the plastic and aesthetic capabilities of the decorative iron art models and use them as a rich source to develop the skills of students' performance in the implementation of innovative metal works. By employing the data of this art and its plastic features in a proposed teaching unit in the metalworking course for a sample of female students at King Faisal University.

Research problem

The research problem is determined by the following main question:

- What is the possibility of benefiting from the aesthetics of decorative iron art in enriching the skillful performance of students in contemporary metalwork?

From this main question, the following sub-questions are derived:

- What are the aesthetic and technical features of the decorative iron art models?
- How can a teaching unit be prepared that aims to benefit from the aesthetics of decorative iron art to enrich the skillful performance of students in contemporary metalwork?

Research aims

- Study and analysis of the aesthetic features and technical methods of selected styles of decorative iron art in European heritage.
- Experimenting in employing the artistic and technical features of decorative iron art to enrich the performance of art education students in the course of metalworking.

Research importance

- Develop the students' aesthetic sense and encourage them to innovate by linking their aesthetic values to the surrounding environment's heritage, such as metal crafts.
- Maximizing the use of decorative iron art styles as a heritage that must be preserved and a rich field for artistic creativity.

Research hypotheses

- It is possible to benefit from the aesthetic and technical features of decorative iron art in enriching the skillful performance of students in contemporary metalwork.
- There are statistically significant differences between the mean scores of the technical performance of the female students of the research sample in the pre and post performances of the metalwork inspired by the characteristics of decorative iron art, and the difference in favor of the post-performance.

Research Methodology

The current research follows the following methodology:

- The analytical descriptive approach: in describing and analyzing the different styles of decorative iron and their relationship to architecture, and also analyzing the most important aesthetic values of each model and the techniques used in it.
- The Experimental approach: in designing and implementing a student experiment on a sample of female students of the Department of Art Education at King Faisal University to benefit from the plastic capabilities of decorative iron styles in enriching the performance of students to create innovative metal artifacts.

Research limits

- Objective limits: The decorative iron models (Romanesque - Renaissance) were identified as objective limits for experimentation due to the clear and appropriate characteristics of these models for experimentation with light materials in the workshops of the Art Education Department.
- Human limits: the research sample was determined by a group of (15) female students from the seventh level in the Department of Art Education - College of Education - King Faisal University.
- Time limits: the first semester of the academic year 2021-2022.

Research procedures

- Reviewing previous studies and collecting research literature related to the styles and features of decorative iron art.
- Sorting and selecting images from the selections of the decorative iron models understudy and making an analytical study of the features, plastic and aesthetic characteristics.
- Preparing the research tools:
 - teaching unit based on making use of the aesthetic and technical features of decorative iron art models to enrich the skillful performance of students in contemporary metalwork
 - a (pre-post) test for students in the skills of implementing metalwork inspired by the models of decorative iron.

- an assessment card for the metalwork inspired by the models of decorative iron (the product of the experiment)
- Judging the research tools by a group of specialists.
- Applying the pre-test to the study sample.
- Teaching proposed teaching unit to the students (the research sample) according to its steps and the sequence of its topics.
- Applying the post-test to the students in the research sample after the end of teaching the unit.
- Arbitration of the metal works of the students (the research sample) in the pre and post-tests by a group of specialists, using the assessment card.
- Making the necessary statistical treatments for the arbitrators' scores contained in the assessment cards.
- Interpreting the statistical results in light of the hypotheses and research objectives to determine the research results and make recommendations.

Research terms

- Ornamental iron: “It is the iron for general construction supplies in buildings for external gates, openings, fences, balustrades, and others. Saving time, effort, and material consumption. (Hamouda, 1972)
- The researcher also defines it procedurally as: “the iron that is processed by various forming methods such as hammering, bending, cutting And others, with the aim of decoration in the first place in addition to the functional aspect.”
- Metalwork: “It is the artifacts that are made of metal as basic material, in which the raw material of the metal is adapted according to the design placed in metal formations or what is called artifacts that combine the functional side and the utilitarian side (Rehan, 2015)
- Artistic styles: “they are the unifying artistic character of the various arts and crafts alike, either for an era or for a group of artists or craftsmen”. (Fuilauime, 1966).

Theoretical Framework

The origin and development of the art of decorative iron

“Ornamental iron appeared in Europe as a craft during the period when the ancient Roman state prevailed at the hands of some tribes that inhabited the countries of France, the British Isles, and some other European regions. Artistic, and the first widespread artistic contributions to a technical level of iron came in the period following the collapse of the Roman state with its technical restrictions, and different trends appeared in the countries of France, Denmark, Anglos, and the countries of central and northern Europe in general. It came in succession from the Middle Ages to the advanced and late Renaissance and to after the Renaissance”. (Yousef & ashour. 1995).

The different artistic styles of decorative iron contributed to confirming artistic values and features of specific features and decorative symbols that were adopted by almost all European countries... This did not prevent many countries from

having styles and characteristics that distinguish them from other countries that followed the same style, and in this regard, We find that the development of decorative iron models was not at the same level in the same country, but rather it was often different, and often there was a regression, a halt, or a deviation. In the current research, the researcher has resorted to choosing certain models over others, because the ironworks that were made in Europe in a certain period may not bear the distinctive characteristics of the model, just as all the works that may bear the features of the style may not all be worthy of study or analysis. Therefore, studying some as a sample may dispense with studying the whole, especially if the time, place, and artistic and social influences are united. In this regard, the current research will deal with the study of the technical features of two distinct styles of decorative iron models, as follows.

Romanesque Style

The term Romanesque style appeared concerning the Romans in Europe, especially in the countries that were subject to Rome, and iron appeared among the memories of Roman art, which was often influenced by Byzantine art and sometimes Islamic art. In some countries, the Romanesque era was characterized by the increasing victory of monasteries, and the monks were artists and architects who subjected the arts to their religious ideas, and Normandy (relative to a province in France) is the style of round arches that spread in Northern Europe, and it is the basis on which the Romanesque style can be known.” (Yousef & ashour.1995) The Romanesque style appeared first in Italy and then spread to most European countries, which were credited with the iron industry in those times. The characteristics of the Romanesque style in decorative iron vary according to the place of its origin as follows.

Italian Romanesque

There is a clear difference in the way the Italian manufacturers deal with iron ore from their counterparts in France, Spain, and England. The Italian school has a unique and distinctive form and style in the Romanesque iron works that have special features, and the most important features of the Italian Romanesque:

- Roundness and curves in the works of gates and iron barriers associated with architecture.
- Repetition (horizontal or vertical) of the decorative elements used in their designs.
- The use of plant decorative units represented in the branches and leaves of trees tend to be somewhat abstract, as well as the triple, quadruple, and five-section flowers and animals that varied between birds and some imaginary animals.

Among the most important techniques used in the Italian Romanesque: the use of belts and the vertical rivet in assembling the units, as well as the use of engraving methods on the surface.

French Romanesque

France was one of the countries that contributed to the progress of the Romanesque style, and it had a distinct style with not adhering to a certain character in all the produced works, which gave it a liberating character with the commitment to produce successive repetitions of artistic units derived from the elements of nature. The French Romanesque was distinguished by the spread of iron hinges with wings and decorative strips ending with a lily flower, in the field of door decoration. Among the most beautiful doors that represent this style: The door of Durham Cathedral, shown in Figure (1) (Hamed, 1996). Among the most important features of the French Romanesque:

- Coiled spirals within the decorative iron insert.
- Designing structural elements with human shapes, birds, and architectural spiritual elements.
- Using linear units whose shape is derived from the letters C and S, the units are assembled into vertical columns using laces that lead to strength and rigidity and reflect a stunning appearance when they are repeated and arranged within a frame formed from square iron sticks. Figure (2).
- The predominance of the security objective of the artifacts by narrowing the spaces and using thick sectors and strengthening the doors with decorative metal strips.
- The use of plant motifs such as grape leaves and three- and five-pointed flowers individually or paired with some tree leaves, taking into account the geometric arrangement of those elements.
- The central repetition of the decorative units so that many branches come out of these centers that go in divergent directions.

Among the most important techniques that characterize the French Romanesque:

- Making textures and effects on the surfaces of the decorative cells in the manner of regular roads along with the units.
- The use of belts decorative with different ornaments to highlight the decorative appearance.
- Formation of flowers by compressed form.

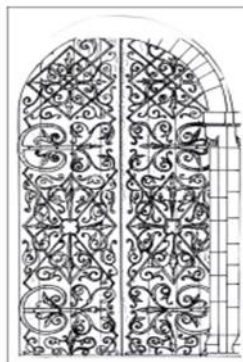


Figure 1. Schematic drawing of the door of Durham Cathedral, France



Figure 2. Assembling the modules using ligatures - Puyi Cathedral

English Romanesque

"The innovative English character of iron was concerned with durability, and did not rely entirely on its relationship to architectural style with its use of ornaments borrowed from animals and religious symbols" (Girald. 1929). "Social influences and military skirmishes had an impact on the Romanesque use in England throughout the thirteenth century. The basic forms of ironwork remained imposed by the nature of strengthening the doors to emphasize the security role. The English Romanesque works are especially evident in the barriers of shrines, which were often made up of hammered sticks from them. in the form of grape leaves and stamped". (Kamal-Aldine, 1971). Among the most important artistic features of the English Romanesque:

- The tendency to simplify and use geometric structures and abstract elements, such as the letters of Latin writing.
- The use of snails, roses, and quoting botanical motifs.
- the English Romanesque techniques, are characterized by the processes of stamping and molding, in the production of highly anthropomorphic decorations and flowers, as well as the use of laces and rivets in assembling the decorative cells, in addition to their decorative role.

From the above it is possible to deduce the general features of the Romanesque style

- The predominance of the round arch shape over the architectural openings, and the roundness dominated all the various Romanesque architectural details in various arts, especially decorative iron.
- The decorative ironworks tended to simulate archaeological manuscripts with soft vegetal decorations and rounded, leafy ends, and to be free from the directions of the row of units.
- Iron units include flowers, decorative animals, and birds, as in door hinges.
- The decorative ironwork in the protection barriers tended to repeat the units formed in the shape of the letter C, which was brought together by iron bands. figure (3)

- The iron forms were hammered from large blocks in the form of panels that were treated with hammering, slitting, bending, and pulling. The assembly methods were welding, tie and rivet.
- Technical methods developed in the thirteenth century, so the French blacksmiths invented the method of hammering through closed molds (minting - stamping), so the ends of the units were formulated in the form of flowers and ears.

Second: Renaissance style

The Renaissance style dates back to the fifteenth century when artists, scientists, writers, researchers, and thinkers appeared in Florence, Italy, who delved into the ancient Greek heritage, and were inspired by its decorative forms and classical artistic methods that were prevalent in the Greek and Roman civilization, in which art aimed to find things that mimic nature, out of a premise The view on nature is a scientific and intellectual view, and these perceptions have had a great impact on the decorative ironworks, and the features of this style spread in Italy, France and Germany, which are the countries that adopted and developed the concepts of the Renaissance style. (Allam, 1978)

Features of decorative iron in the Italian Renaissance

The Renaissance style was distinguished in the art of Italian decorative iron using the art of casting, as the castings met their needs for a plastic effect in their works, such as torch holders, door knockers, and other small metal accessories that included mostly human figures, animal heads, and birds. The early Renaissance stage was also characterized by combining the plastic character represented by the sculptural models and the linear character, which was represented by the quadruple flowers that began in the Gothic era and continued throughout the Renaissance. (Hamed, 1996). Despite the combination of the diagnostic and the linear character, the predominance in that period was for the diagnostic character, which appeared in the prevalence of stereotypes in the form of sharp-shaped birds or reptiles, which were characterized by a character of terror and ruggedness. Figure (4)



Figure 3. Units in the form of the letter c are gathered together with laces (Le secq des Tournelles Museum - Rouen - France)

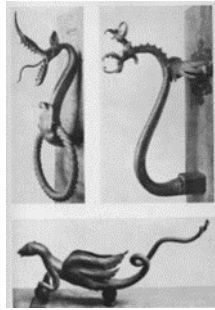


Figure 4. Knockers from Italy 5th century - Schloss Museum - Berlin

Then the Italian iron moved to a next stage called the prosperous Renaissance in the fifteenth century (1450-1500 AD), in which techniques for the implementation of Italian ironworks developed, and designs approached the nature of the raw material, and the transition to total dependence on linear units that adapted their formations to fit the round contracts appeared. for architectural openings. (Gardner, 1922). The designers in that period also liberated from using the four-flowered flower and turned to a more simple method, which is an attempt to fill the spaces inside the fillings with stylized geometric units of the letters S and C, as shown in Figure (5) for the gate of Bevilaco Palace.



Figure 5. Bevilaqu Palace gate session, Bologna

As for the sixteenth century, whose beginnings witnessed the golden Renaissance and then the grandiose Renaissance at the end, despite the wars and political conflicts, Italy gave birth to the geniuses of art such as Da Vinci, Michel Angelo, and Raphael, and this period was characterized by the emergence of the artist's subjective tendencies by trying to introduce modifications to the classical methods. During that period, the development of decorative iron appeared, and it became "the predominant aesthetic feature in iron decoration in the Renaissance era is simplicity in intersecting straight lines or curved overlapping and repeating in graded volumes that give the eye moments of rest and mental thinking within the occupied space" (Hamed, 1996). The decorative units varied between the uses of connected or branched units inside the fillings, with the absence of belts and rivets in a clear way, and the idea of placing braids around the posts in alternating positions". Figure (6) (Kamal-Aldine, 1971).

The main features of the Italian Renaissance style

- Combining the two plastic types: (sculptural models and hollow sheets) and calligraphy (the quadruple flower units and the decorations of the letters S and c.
- Adapting the formations of the linear units in a way that suits the round arches of the architectural openings, which are represented in the works of windows and semi-circular sails. Figure (7)
- Simplicity in the iron decoration is represented by intersecting straight lines and curved overlapping and repeating in graduated volumes.

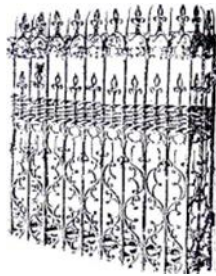


Figure 6. Italian wall of the 16th century Lasc de Tournel Museum - Rouen – France



Figure 7. Semicircular sail - Luke's Cathedral, Italy - 16th century

As for the most important iron techniques of the Italian Renaissance, the technical directing of Italian works reveals the strength and technical efficiency, and this is evident in the works of bending, pressing, half-slitting, belts, and rivets, which reveal technical and industrial competence.

The French Renaissance

The entry of the Renaissance to France did not change the basic direction of the art of blacksmithing. “It was concerned with door accessories such as locks, keys, latches, and shields with insignia, and it had specialized designers who made them works of art that made them great works of art. The level of designs and methods of implementation were artistic and intertwined, and they came in a sculptural form tending to study The blocks and spaces were shaped in the form of human figures, reptiles, or animal faces, which were sometimes modified plant elements that follow decorative abstract methods that appear as if they were cast” (Abdelgawad, 1969). Among the most important features of French ironworks in the Renaissance:

- The spread of small spiral units whose center begins with a stereoscopic flower.
- Simplicity, sobriety, and grace result from the use of ornaments with curves that create calm tones.
- Partial distribution of decorations in the sense that they are satisfied with publishing them in separate places within the general framework and often concentrated in the lower and upper parts, leaving the center area without decorations, contentment with fences, and balanced lists.
- The use of plant motifs such as leaves and bunches of grapes is characterized by ease of implementation and simplicity of processing.
- Attention to beauty and luxury at the expense of strength and durability.
- The common use of vertical columns and horizontal beams, which have a role in strengthening the delicate decorations.

The most famous techniques of French decorative iron in the Renaissance, it was represented in creating superficial effects of iron using iron wings and foil in the implementation of plant motifs. The French artist also took care to hide the riveting process behind the decorations.

German Renaissance

The German ironwork in the sixteenth century was distinguished by the multiplicity of methods between freedom and originality with exclusivity, and development along with the evident skill in execution, although it lacked imagination and design sense. Familiar with graphics and designs from previous famous models. Despite the foregoing, Germany had a distinct iron production in the Renaissance era, revealing their awareness of the theories of aesthetics, which is evident through the artistic distribution of forms within the works and what it contains toning and attention to blocks, spaces, and methods of repetition. Among the most important techniques used in the German Renaissance: The invention of the method of passing bars through holes in the places of exposure, as well as the use of elaborate interlocking helix work in what are called twisted centers.

From the above we can extract the most important common features in the ornamental ironworks in the Renaissance period

- The tendency to separate the areas of decoration, while surrounding the decorative units with spaces suitable for breadth, with attention to the proportionality between the decorative space and the void. Figure (8)
- The use of iron sticks with loose ends ended with spirals and leaves of plants and flowers.
- The repetition of the decorative units scattered within the work.

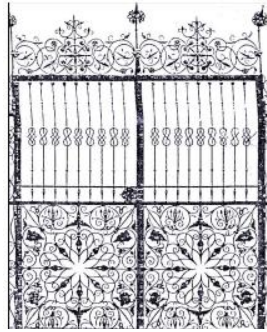


Figure 8. A barrier in the German Museum in Nuremberg, 16th century

Applied framework

The applied aspect of the research included the design and application of research tools according to the steps mentioned in the research procedures, ending with reaching the results through the statistical treatment of the students' scores in the research experience. The applied framework for the research followed the following sequence:

- Applying the pre-test form to the research sample:
- Before starting the teaching of the unit, and as a first step, the model of the technical performance test was applied to the students in the metalwork inspired by the models of decorative iron, and the test time took three hours.
- Steps to design and apply a teaching unit to benefit from the aesthetic and technical features of decorative iron models in enriching contemporary metalwork.

The teaching unit includes a set of meetings (five meetings), which, in total, aim to train students to benefit from the artistic and technical features of selected styles of decorative iron art in enriching the skillful performance of students in the Department of Art Education - King Faisal University (research sample) in metalwork .and to achieve this, the general objectives of the unit were defined as the following:

- Identifying the forms and models of decorative iron (Romanesque style - Renaissance style).
- Providing students with the necessary information, concepts, and skills for metalworking.
- Extracting an experimental approach to employ the plastic features of the decorative iron patterns in enriching the teaching of metalworking in the light of modern artistic foundations.
- Mastering the different techniques of decorative iron (bending - braiding - twisting - hammering...) in the implementation of metalwork and applying some textural effects using appropriate techniques.
- Providing students with the necessary design skills to produce innovative metalwork.

The general objectives were translated into a set of procedural objectives under each training meeting that is easy to monitor and measure, and the objectives were divided into knowledge, skill, and emotion. and among the examples of these objectives:

- Learn about the plastic and technical features of decorative iron models (Romanesque and Renaissance)
- Learn about the foundations and ingredients upon which the success of decorative ironwork depends.
- Designs hanging metal works are inspired by the plastic bases of the decorative iron art styles.
- Distinguish between the plastic characteristics of the different styles of decorative iron art.
- Mastered the use of tools in the implementation of the various techniques of decorative iron art.
- Achieve the basics of good design (unity - balance - movement - harmony...) in the design of metalwork.
- Achieving harmony between the decorative motifs selected from each style to serve the overall design.
- The student believes in experimental thought, as a method for solving problems.
- The student organizes his ideas and stages of work in sequential steps technically.

The Teaching unit content

The content of the unit is divided into five main and sequential teaching meetings, each of which achieves one or more of the procedural objectives of the teaching unit, as follows:

The first meeting

(Plastic features of decorative ironwork in the Romanesque style). In this meeting, topics will be discussed:

- Aesthetics of decorative ironwork in the Romanesque style.
- Techniques used in the Romanesque style
- Presenting some pictures and models that illustrate the plastic features of the decorative motifs of ironworks in the Romanesque style to stimulate the student's imagination and activate the mental processes to prepare for the subsequent design processes.

At the end of the meeting, each student can implement a preparatory design for metalwork inspired by the plastic characteristics of the Romanesque style in pencil, based on the plastic features that she got acquainted with during the meeting.

The second meeting

(The plastic features of the decorative ironworks in the Renaissance style). In this meeting, topics will be discussed:

- Aesthetics of decorative ironwork in the Renaissance style.
- Techniques used in the Renaissance style.
- Presenting some pictures and models that illustrate the plastic features of the decorative motifs of ironworks in the Renaissance style (French, Italian and German) and activating the mental processes related to discrimination and visual perception among the student to serve the design stage.

At the end of the meeting, each student can implement a preparatory design for metalwork inspired by the plastic characteristics of the Renaissance style in pencil, based on the plastic features that she got acquainted with during the meeting.

The third meeting

(the design stage of the metalwork inspired by the formal features of the Romanesque and Renaissance styles). In this meeting, the study focuses on training students to synthesize the formal characteristics and features gained from studying the decorative iron models in the two previous meetings (Romanesque and Renaissance) in creating a design for suspended metalwork, taking into account the aesthetic and functional characteristics of the design. To achieve this, the objectives of the meeting are:

- The student should choose the appropriate decorative units and motifs for each model to achieve homogeneity and integration within the design.
- That the student achieves unity with diversity in the design of metalwork.
- The student should plan the various relationships within the design (interconnection, interlocking, seam...) in a manner appropriate to the implementation techniques.
- Taking into account the formal characteristics of the metalwork inspired by the models of decorative iron which represent the formal features that must be taken into account when choosing the formal motifs used in the design of the work, the most important of which are:
 - The attractiveness and innovation of the element.
 - The sizes of shapes and the relationships between them to achieve ease of perception.
 - Priorities to arrange the elements in terms of their artistic value and importance to achieve the goal of the artwork and to give the most important of them a high attracting power so that there is no distraction of sight and disruption of perception.
 - Achieving harmony between shapes and elements to confirm the unity of design.

Fourth meeting

(Training on technical methods and skills for the implementation of metalwork). The meeting includes a set of practical exercises to crystallize and organize the initial and theoretical ideas that were studied in the previous meetings, and start training on the implementation of the various techniques of metalworking following the proposed design and methods inspired by the decorative iron models that were studied in the previous meetings. The content of the meeting deals with an explanation of the technical methods used in the metal form of the workpiece (plaiting - twisting - bending - welding - rivet - connecting with laces).

- basics of implementing decorative iron techniques.
- How to properly use the tools in implementing the techniques.

The meeting also includes the skills of drafting and forming wires in the implementation of the motifs and elements of metalwork inspired by the models of decorative iron.

Basic concepts: Techniques for implementing metal work - basics of using metal forming tools - metal welding techniques.

Fifth meeting

(Execution and finishing of the metalwork inspired by the decorative iron models): This meeting is the outcome of the crystallization of the skills and knowledge that were acquired in previous meetings, which corresponds to the stage of investigation in the creative process, which follows the stage of foresight, in which the innovator reconsiders his idea and evaluates it and sees if it requires some refinement. The content of the meeting is based on the application of the skills of executing and finishing metal works and taking them out in their final form after modification and development. And By the end of this step, the experiment will be completed. The meeting has the following objectives:

- The student chooses the appropriate implementation techniques for the design.
- Succeed in implementing the design motifs with the selected techniques.
- Proficient in the use of the joint, assembly, and welding techniques appropriate to the nature of the material and design.
- Verify the aesthetic and functional aspects of the workpiece, as well as the perfection and accuracy of finishing.

Basic concepts: foundations of metalwork construction - skills of finishing metalwork - plastic properties of the material.

Equipment and tools used in the teaching unit

- A Projector device.
- The equipped metalworking room with an area of 1 square meter for each student.

Teaching aids

Pictures of a variety of metal works related to architecture (doors - windows - balconies barriers -sails) representing Romanesque and Renaissance styles in Italy, France, England, and Germany. Illustrations and videos representing the methods of implementing some metal forming techniques.

Teaching unit time

Five (meetings), each lasting (3) hours, for a total of 15 hours.

Assessment

Done during unit teaching in two ways:

- (Individual evaluation): It is represented in the guiding role of the researcher to guide each student according to the instructions and directions he needs to continue performing as required.
- (Collective evaluation): when the researcher notices the existence of a common problem among the students that require re-explaining a specific concept or performing a specific skill performance, she does so to overcome the problem.

Teaching Unit application procedures

- In the context of preparing for the experiment, coordination was made to start teaching the meetings of the unit in the female section in the Department of Art Education over five meetings, which lasted five weeks, on the sample of the study (15 students) through the metal works course. And Teaching was carried out according to the previously described meeting order.
- During the meetings, the students were instructed to create a digital folder with their names on the computer to save the designs and images of the applications that they implement up to date until the last meeting.
- After the end of the teaching unit, the students discussed the points and problems they faced during the application of the unit, and the students' performance and designs were collected in separate portfolios.

Applying the post-test to the study sample

After completing the teaching of the unit, the researcher held the post-test form on the study sample, which is the same pre-test form that was applied to the same sample before teaching the unit.

Arbitration of artworks resulting from the experiment

After the post-test was completed, the metal works were collected as a result of the students' performance in the pre and post performances, photographed the works, and then encoded in preparation for their presentation for arbitration by specialists, using the assessment card previously prepared by the researcher and shown in Table (1).

Table 1
The metal works assessment car

	Card Themes and Items	marks (1-5)
artistic values	The harmony between the motifs is inspired by the styles (Romanesque - Renaissance).	
	The balance between design elements	
	Unity of design with diversity	
	Rhythm through (repetition - tracks - perspective)	
Shaping skills and techniques	Diversity in mineral ores (type - color - thickness - sector shape)	
	Diversity in shaping techniques (bending - knocking - cutting - braiding...)	
	The degree of skill in implementing the techniques	
innovation	The originality and uniqueness of the design	
	Using unconventional ideas in techniques and finishing	
Total		

Research results

After completing the evaluation of the metal works of the students as a result of the research experience, statistical treatments of the data were carried out, to reach the results of the research. To ensure the achievement of the research hypotheses, the mean scores of the study group were compared in the pre and post-performance of the metalwork. Linked to the same group. Then it is possible to clarify the differences and the value of (T) and its implications between the performances of the students of the study group in the case of technical performance (pre-and post-test) for all elements of the assessment card as shown in table (2)

Table 2
Means, standard deviations, t-value, and their significance for the study group in the pre and post-performance of the metalwork assessment card items

Variable	app	μ	SD	T	Sig
1 The harmony between the motifs is inspired by the styles (Romanesque-Renaissance).	pre	1.5200	0.29930	-16.917	**
	post	3.1500	0.53064		
2 The balance between design elements.	pre	2.1000	0.53302	-11.395	**
	post	3.2800	0.45143		
3 Unity of design with diversity.	pre	2.0200	0.55023	-10.348	**
	post	3.0200	0.50680		
4 Rhythm through (repetition - tracks - perspective)	pre	1.9700	0.52425	-11.961	**
	post	3.0900	0.43818		
5 Diversity in mineral ores (type	pre	1.7100	0.38879	-15.945	**

	- color - thickness - sector shape)	post	3.0850	0.46555		
6	Diversity in shaping techniques (bending-knocking-cutting-braiding...)	pre	1.6400	0.45699	-18.119	**
		post	4.1000	0.40249		
7	The degree of skill in implementing the techniques	pre	1.5400	0.41549	-20.968	**
		post	4.2000	0.31439		
8	The originality and uniqueness of the design	pre	1.5500	0.52666	-14.175	**
		post	4.0300	0.46009		
9	Using unconventional ideas in techniques and finishing	pre	1.5600	0.49673	-13.624	**
		post	4.0400	0.46611		

It is clear from the table that there are statistically significant differences between the mean scores of the technical performance of the students of the research sample in the pre and post performances of the metalwork inspired by the characteristics of the decorative iron art, and the difference in favor of the post-performance at the level of significance 0.01 for all items of the evaluation card. The data indicate a clear improvement that occurred to the members of the research sample after the application of the proposed teaching unit. It also indicates the achievement of the objectives of the teaching unit and the effectiveness of its content, activities, and educational means in a way that supports the possibility of using them to enrich the skillful performance of students in contemporary metalwork inspired by the aesthetic and technical features of the art of decorative iron.

The next Figures (9&10) show the improvement in the performance of students in the post-performance compared to the pre-performance.



Figure 9. Samples of students' work in pre-performance



Figure 10. Samples of students' work in post-test

It is also clear from the pictures of the works that the members of the research group were able to achieve formal compatibility between the technical motif used in metal works and inspired by the different styles of decorative iron (Romanesque and Renaissance). For a particular model, it also shows harmony between motifs and the use of various implementation techniques suitable for design, which achieves the concept of artistic unity of the work, and this depended on the artistic sense of each student. The statistical data reflected the transfer of the students' performance from randomness in the selection and distribution of design motifs in the post-performance to the organization and noticeable compatibility in the dimensional performance in a way that raises the aesthetic value of the work.

The improvement that occurred in the performance of students in achieving balance, rhythm, and proportionality within the metal works is also evident through the consistency of the distribution of lines, shapes, and sectors of the metal materials used and the method of repetition within each work. The results also show that the students' use of various metallic ores such as wires and strips of iron, copper, aluminum, and some semi-manufactured elements (vegetal and geometric motif) with their various colors, shapes, and qualities achieved artistic and chromatic richness for the works and kept them away from the monotony that may arise from the use of one material in one color. The students also achieved skills in implementing different forming techniques and the diversity of those techniques within one work, which shows the success of the exercises, activities, and evaluation methods included within the teaching unit in enriching the students' experiences in implementing the techniques of decorative iron art in forming metal pendants by experience.

Finally, the results also showed the uniqueness and innovation of the designs, which indicates the dependence of the students on their artistic sense and independent ideas and not resorting to imitation. The students' work through the designs highlighted the sense of contemporary and modernity as well as originality. In addition to using the decorative iron motif that they studied in different models, the students used some geometric motifs, and sometimes two motifs were combined to produce a new model shape that serves the aesthetic shape of the workpiece and adds the required innovative dimension. From all of the above, it is clear that the research hypotheses and objectives have been achieved.

The results of the research can be summarized in the following points

- There are statistically significant differences between the mean scores of the technical performance of the students of the research sample in the pre and post performances of the metalwork inspired by the characteristics of decorative iron art, and the difference in favor of the post-performance.
- It is possible to benefit from the aesthetic and technical features of decorative iron art in enriching the skillful performance of students of contemporary metalwork.
- The patterns of decorative iron in the European heritage are considered a rich artistic source to enrich the teaching of metalworking with its special artistic

features and distinctive techniques that can add to the technical experiences of students in metal formation.

Research recommendations

- Continuous experimentation in heritage art, exploring its aesthetics, and employing it in a contemporary way without affecting its identity and originality.
- Conducting more research to benefit from the features of decorative iron art in the fields of architecture, decoration, and various fields of applied arts.

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