INTERNATIONAL JOURNAL OF
DESIGN AND FASHION STUDIES

Print ISSN
2735-5357

VOLUME 5, ISSUE 1, 2022, 133 –160.

Online ISSN
2735-5365

"The space sculptural forms of crystalline constructivism systems and benefiting from them in the field of science simplification"

Dr/ Mahmoud Mostafa el Sayed Mohamed
Assistant Professor of Sculpture, Department of Art Education, Faculty of Specific Education, Alexandria University

mahmoud.mostafa.elsayed@alexu.edu.eg

Research Background:

The beginning of the twentieth century has witnessed many changes in science and technology that have invaded all fields, and these changes have largely captured the imagination of many plastic artists, which has provided them with new horizons for artistic creativity, and provided them with many modern methods and tools of performance through which they are experimented with traditional and new materials for the artist to use in various fields of arts, and Contemporary scientific and technical research has been associated with the search for the laws of growth in nature, the external manifestations and their proportional relationship is a reflection of internal logic that translates the systems of nature into constructive laws that grow along the lines of natural elements, which include very accurate systems, and crystallography of science that has the lead in explaining the structural law on which the geometry of solid bodies is organized, the mathematician Andres Spicer was able to develop a geometric basis for drawing those geometric shapes that non-specialists in mathematics can draw.

This research discusses the relationship between arts and scientific theories through the constructivism and aesthetics of crystal formation, and inspiration from them in the work of spatial sculptures and provides some models that can be applied in scientific lessons in the departments of arts in the faculties of specific education, as well as sheds light on the aesthetic aspects resulting from that relationship and how to employ this in building his sculptural works.

The preparation of the student in the field of art education requires general preparation to develop his scientific and artistic skills and provide him with a set of knowledge and techniques to reach the creative preparation of his artistic and personal abilities in general, and the field of art education is one of the most interested fields in studying the technical aspects of artistic work and the study of plastic art in general and stereoscopic expression sculpture in particular, where the student needs a special preparation related to specialized concepts in this field, so the student deals with three-dimensional bodies that he sees from all sides and through several Systems of overlapping angles of vision require a great awareness of real space issues as well as technical and performance issues through aspects of thinking and artistic ability. (Abdul Wahab Abu Zeid, 2001, p . 2 The concept of nature for the artist varies from era to era, as the concept of nature was related to what the naked eye sees or the senses perceive from the various manifestations of nature (Iman Ahmed Mahmoud Abu Dorra, 2002, p. 2).

With the tremendous scientific development in the second half of the twentieth century and with the development of techniques for microscopic vision methods, scientists and artists have discovered a strange world under the microscope unfamiliar to the naked eye that could be identified and inspired by its forms in the fields of architecture and arts, where invisible microscopic forms are a rich source that can be used in the field of sculptural formation. Sculptural work in three-dimensional space requires the sculptor's awareness of the nature of the

Print ISSN
2735-5357
VOLUME 5, ISSUE 1, 2022, 133 –160.
Online ISSN
2735-5365

material used and the blocks it forms that confine the space, whether the space (internally or externally).

Therefore, the current research tended to address the element of the point as a structural basis in achieving plastic values through selections from thebodies of nature to crystals, in order to achieve innovative plastic values using some of the new performance methods, which is to rely on the forms and bodies of crystals as one of the natural phenomena that are characterized by the uniqueness and richness of their bodies, their diversity, where there are crystals represented in seven factions, each of which contains its own structural systems, which in turn differ from one crystal to another, which It increases the telepathy of sculptural ideas in accordance with the plastic possibilities, which is achieved by diversity in one element, which is the point, and the point as an element may appear in the surface texture of some crystals, and others may appear in the point where the construction of these crystals depends on the gathering of points of different shapes and sizes.

A crystal can be defined as "a homogeneous solid body bounded by surfaces formed by natural factors under appropriate conditions of pressure and temperature" (Abdel Karim, 2003, p. 3).

Crystals can be divided according to the completion of crystal faces into three sections as follows)

Section I: Full-faceted crystal when all crystal faces are present Section II: A crystal is incomplete when only some of these faces are present without others, Section III: A crystal is faceless when it is not possible to identify the crystal faces that border it, and in the latter case the crystals exist in the form of aggregates Faceless The shapes of natural crystals depend on the nature of the crystal's surfaces or levels and on the way they are formed (Muhammad 'Izz al-Din Helmy, p. 11). The crystal may be too small to be visible to the naked eye, or it may be a few centimeters in dimension, depending on the natural and chemical conditions prevailing during its formation.

Crystals are also found in nature in several species known as the seven crystal species, and this factional division is based on the existing analogue axes as follows: (equilateral cube family - hexagonal family - quadrilateral family - trio family - rhombic family - one-mile family - three tendencies family).

It is worth noting that this research is not interested in finding the lengths, proportions and angles of natural stereoscopic crystals, but the main interest is on the external form of crystals and images on which crystals are located in nature, including the bodies of the point and the point may also exist as a texture for the surfaces of many crystals in nature, and the point may appear microscopic examination of the crystal surface, where its structural structure consists on the basis of adjacent points and different in the body, size and strength of cohesion and in the case of cohesion it is clear that the surface texture For a point-based crystallization with its sizes and roll-shaped bodies.

- Search problem:

The artist and the art student deals with works of art through the three dimensions that include length, width and height, while there are natural materials through which additional processes can be perceived, such as transparency between the interfaces, which achieve a sense of the fourth dimension through the time it takes for the eye to move between the interstitial surfaces in natural crystals, which can be invested in the field of sculptural formation, and nature includes laws, systems and details that control its growth, and those laws are formed according to the same laws

INTERNATIONAL JOURNAL OF
DESIGN AND FASHION STUDIES

Print ISSN
2735-5357

VOLUME 5, ISSUE 1, 2022, 133 –160.

Online ISSN
2735-5365

Which governs creatures and other things, and the concept of the study of nature has changed according to the change in the nature of scientific studies and the perception of things is no longer limited to their external appearance, but the field of perception has expanded to include specific systems within the forms and since the manifestations of nature and the systems and laws they contain are one of the basic sources from which the artist draws his creations and ideas and did not receive the part that is not perceived with the naked eye enough attention and research, which can be explored through modern scientific studies, the problem may It consisted in two axes: -

- The shapes resulting from the processes of morphology and biomorphism of crystals, and polyhedral forms in nature are a rich resource that can be used to create stereoscopic sculptures.
- The field of stereoscopic vacuum sculpture can be enriched by tracing the systematic study of scientific theories in the field of materials science.

The research problem lies in the following questions:

- How can the structural systems of natural crystals be used to devise compositions with structural formulas that contribute to the enrichment of stereoscopic spatial sculptures in which the movement of student teachers in technical colleges is achieved and contributes to the field of simplification of science?
- Is it possible to achieve innovative formative formulations of body and point relations through the study of selections of natural crystals?

Research Objectives:

The research aims to:

1. Linking the fields of arts and modern scientific theories to contribute to the simplification of science.
2. Utilizing microscopic shapes resulting from the movement ofcrystalline morphology and polyhedral shapes in the creation of stereoscopic space sculptures.
3. Take advantage of the structural systems and interfaces of natural crystals and invest them in seeing the fourth dimension in space as a source of simplification of science.

Research hypotheses:

From the above, the researcher assumes that it is possible:

1. Crystals in nature include structural systems and interfaces through which the fourth dimension is achieved and can be invested in the field of sculptural formation.
2. Structural systems in natural crystals can contribute to the construction of stereoscopic space sculptures for art education students and contribute to the simplification of science.
3. Achieving innovative formative formulations of the shapes resulting from crystal morphology through the relationship of crystal bodies to the point in the field of stereoscopic sculptural formation.

- Importance of Research:

-The study of the structural systems of crystals in a scientific manner illustrates the importance of the technical aspects associated with the work of the teacher and the necessary methods, methods and

Print ISSN
2735-5357
VOLUME 5, ISSUE 1, 2022, 133 –160.
Online ISSN
2735-5365

tools, which affects the technical requirements in the field of sculpture of ideas, materials and advanced techniques.

-Using the scientific method to study the structural systems and interfaces inherent within natural crystals to enrich the field of sculptural formation.

-Availability of various plastic solutions and treatments provided by the performance methods developed through the variables of the relationship between the body and the point through the forms of natural crystals.

-Search terms:

1. **Crystal:**

The origin of the word crystal dates back to the ancient Greek language, which meant snow, and that word was used in the Middle Ages to denote rock crystals, which were once thought to be heavily frozen ice, and then this name was used to denote all solid natural materials that have crystalline forms (Perry, L.G. & Mason, B, 1982, p. 12).

Abdel Aal Abdel Karim defines a crystal as "any naturally homogeneous solid body with a tight atomic structure arranged in three dimensions" (Abdel Aal Abdel Karim, op. cit., p. 3) and Mohamed Ezz El-Din Helmy defines it as "a homogeneous solid body bounded by flat surfaces formed by natural factors under appropriate conditions of pressure and temperature" (Mohamed Ezz El-Din Helmy, op. cit. , p. 10).

2- Body of crystals:

"The shape and size of the crystal differ as a result of two factors: the internal compatibility of the crystal The relative rate of growth along the different axes in the crystal, for example, we assume that we have perpendicular axes x, y, z, and that the crystal grows at an equal rate along each of x, y, z, the shape of the crystal in this example will be an equilateral cube. If growth occurs rapidly in the direction of x, y, but at a slow speed in the direction of z, the crystal will grow thinner in the direction perpendicular to z. (Tony Linden, 2001)

The shape of the crystal may be described as flat, lamellar, prismed, needle or blade on the basis of the relative growth of certain faces in the crystal (Zaki Muhammad Zaghloul, Amina Muhammad Abd al-Rahim, 1965, p. 20).

3- Structure:

Michel Foucault defines structure: "It is from the building and the structure of the thing in the language is its composition, and it also means how this building was built on it, the building is an organized picture of the sum of the coherent elements and therefore this initial definition of the building or structure is based on a set of fixed relationships between changing elements, on the model of which an infinite number of models can arise." (Michel Foucault, 1989, p. 2)

4- Microscopic vision:

Seeing the shapes of different organic and inorganic matter that are not visible to the naked eye magnified through a microscope, after minimizing them in the form of thin sections that facilitate the vision and study of their optical qualities (Lewis, R, 1974).

5- Structural system:

The total organized and complex entity that includes a gathering of things or parts that make up an integrated unit and these things and their parts have proportional relationships and network exchange that work according to active attraction forces (Abdul Rahim Ibrahim - Mervat Sharbas, 1992),

INTERNATIONAL JOURNAL OF
DESIGN AND FASHION STUDIES

Print ISSN
2735-5357

VOLUME 5, ISSUE 1, 2022, 133 –160.

Online ISSN
2735-5365

and means the presence of crystal structures that explain the division and cracking that there is a previous way of arrangement and coordination on the division and cracking, and this method is the one that explained the division and cracking in a certain way, which is responsible for the presence of minerals in nature in the like, as we find in the form of Veins or cavities, the structural system in crystals is those distinctive geometric relationships resulting from the interconnection of crystal shapes or their different parts in space or from the relations of lines (crystal letters and different geometric angles).

6- Construction and Construction:

Construction is the creation or assembly of buildings of different or similar sizes. Constructivism is the totality of the relationships between philosophy, logic, order and style in a given field, provided that this constructivism has a special feature resulting from the connection of each to the other in a superimposed and successive construction so that one cannot be separated from the other (The New Encyclopedia Britannica, 1985, pg. 576).

7- Technical Vision:

There is a difference between the ordinary visual vision and the artistic vision, the artist with his aesthetic experience is aware of relationships and understands the language of formation and practices it, and next to that he can express what he sees, he performs two processes:

First: - It is affected by the many natural stimuli that nature crowds with, so it interacts and moves within it to express what it feels.

Second: to influence, through works of art, using its tools and plastic means, aesthetic relations and the values and meanings it contains, and this influence means that he is excited by these values, integrates into them, and becomes part of his being (Mohamed El-Desouky, 1990, p. 127).

Mahmoud Bassiouni defined artistic vision as an emotional response to an external situation in which the seer is influenced by the artist's view of the world around him and his own vision of what he perceives in it.

- Research Limitations:

The study is limited to:

-Detection of shapes resulting from crystal morphology and plastic formation processes in the construction of stereoscopic sculptural formations to simplify science.

-Design a practical experiment by studying the microscopic shapes resulting from the movement of crystal morphology to produce vacuum sculptures.

-Implementing the experiment on a sample of Fourth -year students in the Department of Art Education, Faculty of Specific Education, Alexandria University, in cooperation with the Institute of Graduate Studies and Research, Alexandria University.

- Carrying out the experiment using new materials such as various plastics (plastic and acrylic) , metal wires, wood, ready-made and consumed materials.

-Research Methodology:

In the theoretical framework, theresearcher followed the descriptive analytical approach.

In the applied framework, the researcher followed the semi-experimental approach through a set of practical applications.

First: Theoretical Framework:

-A study of the concept of crystalline morphology.

INTERNATIONAL JOURNAL OF
DESIGN AND FASHION STUDIES

Print ISSN
2735-5357

VOLUME 5, ISSUE 1, 2022, 133 –160.

Online ISSN
2735-5365

-An analytical study of crystals as one of the elements of nature in terms of (types - factions - structural system - their presence in nature in its various forms)
-The study of structural systems and interfaces in nature.
-A study of the concept of vacuum and its types.
-Analysis of the structural dimensions associated with the phenomenon of the fourth dimension.

- Crystallography:

This science was an integral part of mineralogy and as a result of progress in research and scientific studies, its activities and research fields expanded, as it consists of various sciences such as chemistry, engineering, vacuum, trigonometry, physics, biochemistry, mineralogy, rocks and geochemistry (Nagwa Muhammad Ahmed Al-Masri, 1993 AD, p. 86), which enabled it to completely separate from mineralogy and become an independent science.

It was also defined as "the science that studies everything related to crystallized solid bodies in terms of" (Abdel Karim, op. cit.) (method of growth of crystals - external shape of crystals - internal atomic structure of crystals).

- Internal structure of crystals:

The crystal consists of accurate units that are repeated regularly in the three dimensions and these units from which the crystal is built are only positive atoms of which are called cations and the negative ones are called ions and the crystal structure of these units depends on three-dimensional repetition.

The internal structure of the crystal depends on the following:

- "The spatial arrangement of atoms, ions or ionic groups in a crystal.
- The nature of the chemical bonds that bind these ions to each other.
- The strength of chemical bonds." (Abdel Karim, op. cit., p. 7)

- What is crystallization:

The term crystalline materials is used to define the way atoms are arranged in an internal structure.

The process of "crystallization" is defined as the method of arranging atoms in the internal crystal structure of a solution, molten or vaporous state with a certain system" (Abdel Aal Abdel Karim, op. cit., p. 4) It is also defined as "the process of crystal formation, and before the process of forming molecules or ions that make up the crystal is in a state of permanent movement and the distances between these molecules or ions are relatively large and difficult to hold together, but with the change of natural conditions of pressure and temperature of the melt and steam The solution has increasing forces between them, converging and spacing in a regular order, resulting in a coherent crystal of matter" (Zaki Mohamed Zaghloul, Amina Mohamed Abdel Rahim, op,cit, p. 14)

- Crystal parts:

A - Face: It is the outer surfaces that determine the crystal and are usually flat, but they are sometimes curved, as in some samples of cidrite and diamond, and the faces in one crystal may be similar, as in the crystal of the metal fluspar, which crystallizes in the form of a cube similar to any face in which the other faces or not similar, as in the crystal of Galena metal.
B - Crystal letters: resulting from the correspondence of two levels or two adjacent faces and the direction of any letter in the crystal is determined by the direction of the opposite faces in this letter.
C - Stereoscopic angles: They are the angles resulting from the correspondence of more than two faces.
D - Angles between the faces: The angle between any two faces is known as the angle of their face.

INTERNATIONAL JOURNAL OF
DESIGN AND FASHION STUDIES

Print ISSN
2735-5357

VOLUME 5, ISSUE 1, 2022, 133 –160.

Online ISSN
2735-5365

- **Crystal axes :**

These axes are imaginary axes that intersect in the center of the crystal and extend to the center of the crystal faces, crystal letters, or symmetrical interfacial angles in the crystal, and these axes are used to determine the position of the crystal in space, as is the case in determining the positions of the different planes in spatial geometry relative to three intersecting axes at a central point. (Figure 1) (Zaki Muhammad Zaghloul, Amina Muhammad Abd al-Rahim, op,cit, p. 30).

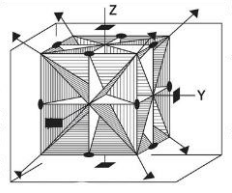


Figure (1) Axes of symmetry in crystals
https://www.bing.com

- **Elements of symmetry:**

A noticeable phenomenon on many crystals is the orderly distribution of crystal faces. We find that all crystalline faces, as well as atoms and ions that make up matter, are arranged according to a specific system and format that are subject to certain rules known as symmetry elements. And the essence of symmetry is repetition. We can see that the face of a crystal, for example, or one of its letters, is repeated several times – that is, it is found in identical places a number of times – according to a fixed law. Symmetry is the basis for the study of crystals.

Symmetry in a crystal can be defined as processes that result in a given set of crystal faces taking the same place as one of them. Known analogue processes are:

1. Rotation of the axis (axis of rotational symmetry).
2. Reflection through the level (level of symmetry).
3. Inversion around the center (center of symmetry).
4. Rotation around an axis accompanied by an inversion (axis of inversion symmetry).
   The axis and plane are known as symmetry elements. (Crystallography https://www.marefa.org)

- **Structural and engineering systems in natural crystals:**

In crystallography, crystallography is a system that contributes to the classification of minerals and crystals according to their geometric symmetry in three-dimensional space and the distribution of ions from the bottom up of the same thing, that is, the atoms of matter or their ions are arranged according to a repeating regular pattern, and can be divided into the smallest cell, which is a cell unit, and the cell unit carries the geometric characteristics of a large crystal (crystallography / http://ar.wikipedia.org/wiki).

Crystal lattices are made up of seven species that are similar in shape, but different. in its content. They were scientifically divided according to the axes and angles between those axes at their intersection. These systems contain triangular axes in a certain geometric arrangement that gives each system its shape and physical properties. The science that examines crystal systems is called crystallography and is sometimes called the crystal family or crystal lattice system and spatial systems**, and there are several crystal systems:** Table (1)

- **Trigeant system: It is the** crystal system that is formed by three axes intersecting together at fixed and correct angles, two of those axes have the same length on the same plane and the third main axis is either longer or shorter than the other two axes.

INTERNATIONAL JOURNAL OF
DESIGN AND FASHION STUDIES

Print ISSN
2735-5357

VOLUME 5, ISSUE 1, 2022, 133 –160.

Online ISSN
2735-5365

- **Monoclinic system:** The crystal system formed by three vectors. A monoclinic crystal system has vectors of different lengths, two of which are perpendicular to the third forming an angle other than 90, so the crystals have a prismatic shape.
- **Rhobic system:** It has three right angles, but it has axes of different lengths, which are three perpendicular axes and a mirror symmetry.
- **Quadrilateral system:** A system that arises as a result of attracting a cubic crystal lattice towards a vector so that the space field becomes a rectangular prism with a square base.
- **Regular hexagonal prismatic system: It is considered one of the seven crystal systems** or the seven crystal lattice systems and one of the six crystal family systems, and these two systems are similar in shape and different content and structure, but scientifically they are not the same system, and graphite is the best evidence of crystallization than the hexagonal crystal system.
- **Hexagonal system: It is a crystal** system with three to four axes on one plane and the same length, intersecting with each other at an angle of 605 degrees, and the fourth axis has a different length and is located at a right angle from the other axes and has a crystal shape.
- **Cubic system: The system is** called isometric or equal perspective system and has three equal axes of the same length and intersect at the same angles and is considered the ideal system among all systems in addition to the holographic octagonal cube.

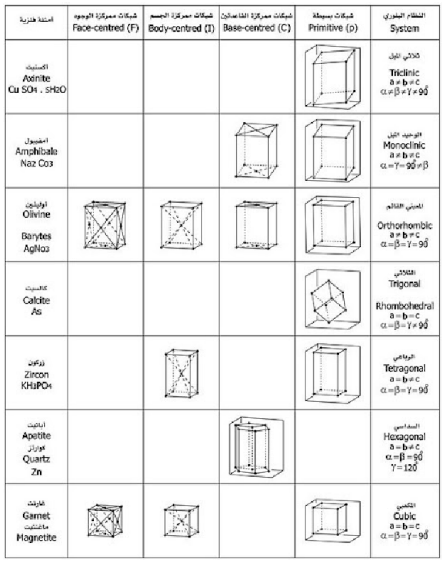


Table (1) Bravia Networks
https://www.marefa.org

Based on the above, this study deals with the structural systems and interfaces in natural crystals through their study and analysis to determine the possibility of seeing and defining the fourth dimension, with the aim of benefiting from them in the production of spatial sculptural works.

1 - Crystal cube system:

It is one of the metal crystallization systems, and the most common and simplest of these systems, and there are three different types of cubic system as follows:

A - Simple Cube:

INTERNATIONAL JOURNAL OF
DESIGN AND FASHION STUDIES

Print ISSN
2735-5357

VOLUME 5, ISSUE 1, 2022, 133 –160.

Online ISSN
2735-5365

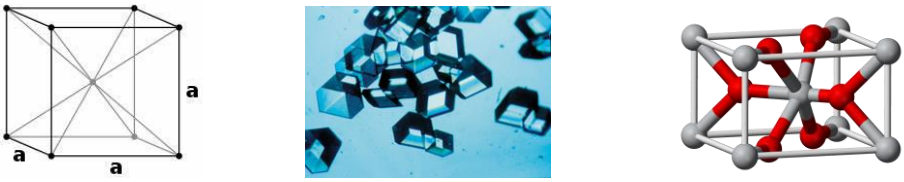
The simple cube system is characterized by containing one atom in the cell unit occupying one of these points, which is shared between eight cubes and each adjacent atom, so each cell unit is occupied by one atom (1/8 × 8). (Figure 2). A simple cube consists of one point on the three-axis grid.

(A)Simple Cube (B) Simple Cube System

Figure (2) The crystal system of a simple cube
https://www.bing.com

B - Central Cube Body:

We find that the center of the cell in the central cube system of the body is occupied by an atom in addition to each of the eight points on the vacuum grid occupied by a seed, so the unit of the cell of the central cube is occupied by two atoms (1/8× 8 + 1) and the iron crystallizes according to the system of the central cube (Figure 3)

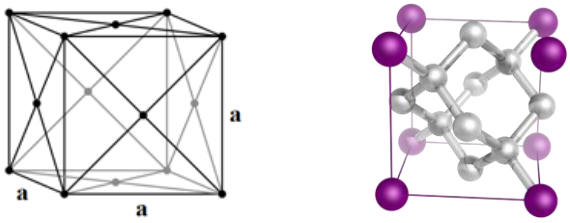


(A) Central cube Body (B) Insulin crystals (C) Iron(II) fluoride

Figure (3) Models of central body crystallization
https://www.bing.com

C - Central cube face:

In the case of a central cube, in that cube, an atom occupies each of the six faces of the cube, and each of them is shared by two adjacent cubes, so the number of atoms in the cell unit of the central cube is 3 atoms of the faces in addition to an atom that occupies the points of the grid, so the total is 4 atoms for the central cube (1/8) per angle × 8 angles + 1/2) per face) × 6 Faces and crystallizes copper and diamonds according to the centric cube system (Fig. 4) (crystallography/http://ar.wikipedia.org/wiki).



(A)Facial central cube (b) The structure of the crystal system of a central cube

Figure (4) The crystal structure of a central cube
https://www.bing.com

INTERNATIONAL JOURNAL OF
DESIGN AND FASHION STUDIES

Print ISSN
2735-5357

VOLUME 5, ISSUE 1, 2022, 133 –160.

Online ISSN
2735-5365

2- Quatrain crystal system:

The quaternary crystal system is one of the seven crystal systems to which crystals belong. The crystal system is described by three vectors. The quadrilateral crystal system results from the tension of a cubic crystal lattice towards a vector, so that the spatial shape becomes a rectangular prism with a square base of side A and the height of prismc Figure (5), there are two types of quadrilateral crystal lattices, a simple quadrilateral crystal lattice resulting from the tension of a simple cubic lattice , and a central quadrilateral crystal lattice resulting from the tension of a central cubic lattice Figure (6) (crystallography / http://ar.wikipedia.org/wiki)

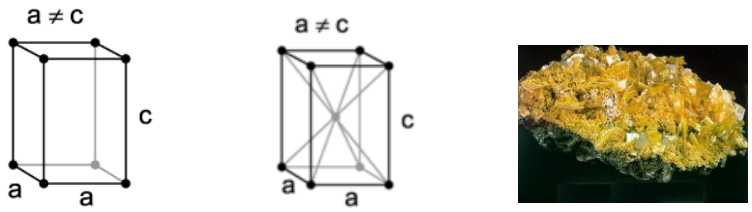


Figure (5) Simple quadrilateral Central Quadrilateral Fulvinite, an example of crystals that follow the quadrilateral crystal system Figure (6)

Figure (5-6) Patterns of Quaternary Crystal Lattices
https://ar.wikipedia.org/wiki/%D9%86%D8%B8%D8%A7%D9%85

3- Hexagonal crystal system:

The unit of the cell in this system is characterized by the equisides of the base b Usually the third side C is about twice the side of the base A. The angle between the sides of the base is 120 degrees, while the angle between A and C is a right angle (crystallography/http://ar.wikipedia.org/wiki) and graphite and braille crystallize according to the hexagonal system Figure (7).

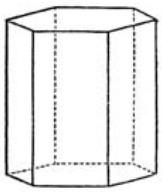


Figure (7) Hexagonal crystal system
https://ar.wikipedia.org/wiki/%D9%86%D8%B8%D8%A7%D9%85

4- Direct specific crystalline system:

In crystallography, it is a standing crystal system that has three right angles, but its sides are of different length, it can be likened to a box as in Table (2), this crystal system has distinct symmetry elements, which are three axes of perpendicular symmetry that meet in the center and a mirror of symmetry.

INTERNATIONAL JOURNAL OF
DESIGN AND FASHION STUDIES

Print ISSN
2735-5357

VOLUME 5, ISSUE 1, 2022, 133 –160.

Online ISSN
2735-5365

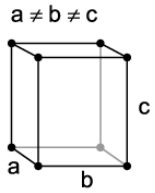
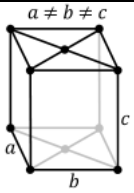
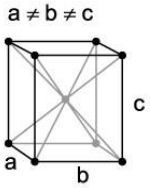
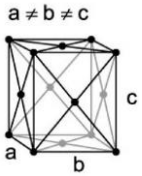
Definite Direct Basit	rhombus rectal central base	Specific Direct Central Object	Rhombic straight central face
			
A	B	C	D

Table (2) Models of the Rectilinear Rhobic Crystal System by Bravé Crystallization Network
https://www.bing.com

5 - Monoclinic crystal system:

The crystal system is described by three vectors in a monoclinic crystal system, vectors have different lengths, two of which are perpendicular, while the third forms an angle other than 90, so the crystals have a prismatic shape. According to the model of Bravé networks, there are two types of monoclinic crystal lattices, a simple monoclinic crystal lattice, and a central monoclinic crystal lattice. Figure (8)

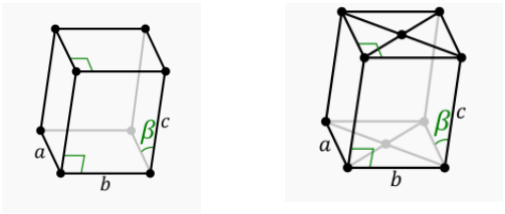


Figure (8) Simple monoclinic (P) Central monoclinic (C)
/https://ar.wikipedia.org

6 - Triplex crystal system:

The crystal system is usually described by three vectors in the triplex crystal system, the crystal is determined by three vectors of different lengths, provided that it is not perpendicular (Figure9).

The triplex crystal system is the least symmetrical of the fourteen Braveh networks, as the symmetry element in this system is an inversion center, while it does not have its mirror planes.

(http://ar.wikipedia.org/wiki/ علم البلورات)

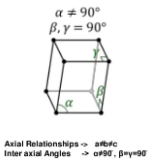


Figure (9) Trigeant Figure (10) Microclin System About crystals that follow the trigeal system.

https://www.bing.com

7. Regular hexagonal prismatic system:

The hexagonal system is one of the seven crystal systems or the seven crystal lattice systems and one of the six crystal family systems and these two systems have a documented link and are similar in a different form guaranteed and constructive, but scientifically they are not the same system, the general hexagonal system has a unified crystal network and one, but the difference is that the crystal lattice

INTERNATIONAL JOURNAL OF
DESIGN AND FASHION STUDIES

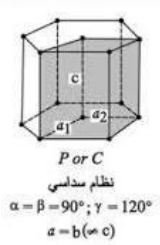
Print ISSN
2735-5357

VOLUME 5, ISSUE 1, 2022, 133 –160.

Online ISSN
2735-5365

system contains seven spatial point groups and this makes the crystal lattice an undernet The crystal family system contains 12 point groups Spatial in its field to make the crystal lattice of the hexagonal system appear underneath (11), as if it were a union between the triple crystalline system and the hexagonal crystalline system, and graphite is the best evidence of crystallization than the hexagonal crystal system(12). (https://ar.wikipedia.org)

Figure (11) Hexagonal system for crystals that follow the hexagonal system.



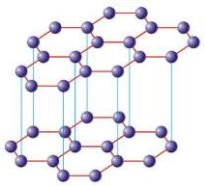


Figure (12) AGraphite system

https://minhaji.net/printlesson/16646

- **Crystal form :**

The shape consists of a set of similar crystal faces (shape and size) on the crystal model, for example:

It takes only one crystalline form or two crystalline forms, but in the case of natural crystal, where it is often deformed, the crystal form consists of all crystalline faces that have one symbol.

- **Division of crystalline forms:**

Many studies have presented more than one division of crystalline forms, including: The division of Abdel Karim Abdel Aal (Abdel Aal Abdel Karim, op. cit., p. 17)

It divides crystal forms into:

A - simple shape: where the crystal has one simple crystalline shape consisting of several similar facets.
B - Composite shape: where the crystal consists of a set of different faces
C - Open shape: It is the crystal shape whose constituent faces do not close the space on their own, such as the two faces that make up the surface.
D - closed shape: It is the crystal shape that closes the constituent faces in the space alone, such as the six faces that make up the cube

- Description of crystalline forms:

Below we will present a group of crystal forms that we are exposed to through our study of crystals, including:

1 - Bidoon: a crystalline shape consisting of one face.
2- Surface: An open crystal shape consisting of two similar parallel faces and a complete position around a plane of symmetry separating them.
3- Roofed: An open crystal shape consisting of two similar, non-parallel and symmetrical faces around the plane of symmetry.
4- Prism: An open crystalline shape consisting of 3, 4, 6 or... Or... Faces all parallel to the vertical axis (h) (Abdel Aal Abdel Karim, op. cit., p. 18)
5- Pyramid: An open crystal shape consisting of 3, 4, 6, 8 or 12 non-parallel faces and all meet at an upper or lower common point in the crystal.
6. Double pyramid: A closed crystal shape consisting of 6, 8, 12, 16 or 24 faces, and a double pyramid consists of two inverse pyramids.
7- Trabezzo Hydron: A closed crystalline shape consisting of 6, 8, 12 or 24 similar faces, each face forming a trapezoid.

Print ISSN
2735-5357
VOLUME 5, ISSUE 1, 2022, 133 –160.
Online ISSN
2735-5365

8- Rumbo Hedron: A closed crystal shape consisting of 6 similar facets, each with a specific shape. (Abdel Aal Abdel Karim, op. cit., p. 17)

- **The fourth dimension and the chemical study of crystals:**

As for the science of "chemistry" of crystals, it includes theoretical and practical studies in the origin and growth of crystals, and examines the impact of internal structure and external factors on the speed of crystal growth, and studies the chemical composition of crystals, all these studies of the chemical composition of the crystal made the artist delve inside them and produce what is new, based on geometric shapes and formations through the study of their lattice chemical formations , The emergence of crystals in nature in their geometric forms was a mystery that began to be explained by "the Russian scientist Lomonosov 1711-1765", when he showed that the polyhedral external geometric shape of the crystal is only an expression and reflection of the existence of an internal arrangement at the atomic level in what was called the retinal structure that is determined by X-rays, and this arrangement may extend to be a large crystal that appears in the visible surfaces of satin, or clusters of very small crystals that stick to each other randomly and appear to the eye untidy (Muhammad Ghalib Sayda, 1983).

- **Structural systems of formal relationships of microscopic vision:**

There are many bodies and systems of formal relationships of cell shapes and crystals under the microscope, and each type is characterized by diversity and thus is a source of inspiration for aesthetic and plastic values, nature contains multiple systems and laws that control its growth, and it is latent in the most accurate cells and molecules, it is considered with its elements as a source of aesthetic and artistic values, and the invention of means and devices of visual vision such as microscopy of all kinds, and photography, microscopy has led to detection About the new laws of perception that contributed to the investment of structural systems, and the contact found in nature, helped insight into the systems, laws and relationships in nature that contributed to the richness of visual perceptions.

- **Structural geometric systems of natural forms under the microscope:**

"The beauty in art is the result of human love based on the sensory perception of the geometric system in nature, it contributes to the development of visions by finding applied approaches to scientific and engineering theories to find contemporary sculptural creations.

- **Flat Ratio:**

"The constant ratio of the most important numbers and constants, which is the ratio of the circumference of a circle to its diameter in Euclidean geometry, the definition of the fixed ratio (pi) that relates to circles is abundant in formulations of trigonometry and mathematical geometry, especially those related to circles and spheres, and fixed ratios are also present in forms from other fields of science, statistics, nature and art as well." (Mona Omar Mustafa Abdel Qader, 2018, p. 62)

- **Golden Ratio:**

It is assumed that everything has a law that governs it, a system that follows it, and laws that are clear and detailed relations and harmonious according to that system The golden ratio is known as the most logical way to divide, asymmetrical division, that is, to divide into non-halves If we have a measurable length AB, for a line that expresses proportionality in the golden ratio, the golden ratio represents its division into two unequal lengths GB, AG (Mona Omar Mustafa Abdel Qader, op. cit., p. 63)

- **Sequences:**

INTERNATIONAL JOURNAL OF
DESIGN AND FASHION STUDIES

Print ISSN
2735-5357

VOLUME 5, ISSUE 1, 2022, 133 –160.

Online ISSN
2735-5365

It is called sequential, consecutive and proportional, and it is a set of purposes, events or letters arranged in a linear pattern and has a meaning so that the appearance of the letter or event after the other has a significance and did not come in vain may be according to D for a specific God where the order of the successive parts is completely specific and distinctive. These parts are called the elements of a sequence or its limits, for example (a, b, c) sequence different from (b, c, a) and the difference is mainly in the order of the elements of the sequence. (Mona Omar Mustafa Abdel Qader, op. cit., p. 64), the sequence can be infinite like the sequence of natural numbers: 1, 2, 3 as it is found in the cortical nerve cells of the brain.

- **Modul:**

The modular is one of the most important artistic formulations on which the system relies in the works of art to move and build the work, and many artists have addressed their artworks based on mathematical systems and geometric foundations due to very accurate calculations and laws, so it is referred to as the proportional unit. (Jack Brenham, 1968, p72) Medial systems that are not perceived by the naked eye are divided into two parts: The first section: seen by man through the microscope, which is the structural structures of the cells of the organism such as plants, trees, leaves and other living organisms. The second section is the structural system of crystals, which was thanks to its discovery due to continuous scientific progress to reveal the components of each material and stand on its smallest components, which are the atom, and All these two sections include an infinite number of Medial forms, systems and constructions that are due to geometric and semi-geometric shapes, which are important sources in obtaining the modular bodies that are useful in the field of art (Hoda Ibrahim Ali Al-Nadi, 2015, p. 74).

• The intellectual and philosophical concept of constructivism:

Constructivism has had a special and distinctive philosophical style and thought in all fields of plastic arts, it was aimed at exploiting all that is modern methods, techniques and plastic materials to reach the best possible thing, and those plastic methods are what made them unique and distinct among other artistic trends, and abstraction had a fundamental role to formulate the structural artwork through simple compositions and the relationship of parts to each other and the spaces resulting from the relationship of the whole to the part and touching surfaces, in addition to emphasizing the depth Spatial and transparency to highlight the element of place, and to emphasize the kinetic character, whether it is an actual or estimated movement to highlight the element of time.

Jabo also described the constructivist work as "an organic structure that resembles our own and is affected by the temporal and spatial changes that surround it and tries to embody the idea of movement in all his artworks, as modern artists do in their works that transport us visually and physically to other spaces and installations that give us a sense of movement and a sense of balance and emptiness.

- **Material in constructivism:**

The material has great importance and a positive role in the structural artwork, it helps to highlight the aesthetic sense of the structural composition, the luxury of the artwork is not just something from which that work is made, but it is an end in itself, because of its special capabilities that help the artist to form the aesthetic subject of that work, and to emphasize the creative aspects of it.

"If the raw material is described as a raw material, this does not imply that it is formless, but that it has not yet been formed in the form we obtain after it has been transformed into something produced (Robin George, 1966, p. 25).

INTERNATIONAL JOURNAL OF
DESIGN AND FASHION STUDIES

Print ISSN
2735-5357

VOLUME 5, ISSUE 1, 2022, 133 –160.

Online ISSN
2735-5365

The builder artist took it upon himself to exploit all available new materials provided to him by industrial technology, taking into account the possibility of each material and how to adapt it to serve his artistic work, emphasizing the aesthetic value and utilitarian aspect. "Constructivist artists paid special attention to the ready-made materials provided by modern technology, and helped them to confirm their plastic content in their construction work through their constructive goal formed from real materials in the real vacuum, and this was the main goal of the builders developed by the pioneers of the movement separately, starting with "Tatlin", the pioneer of the constructivist movement to serve the structural forms in the void" (Muhammad Radwan Khalil, 200-6, p. 118).

These materials resulting from the technological revolution "have a variety of mechanical properties, including cutting, gluing, bending and curving, which helped in shaping them in the form of geometric, curved, wavy and other shapes that the artist wants to formulate in expressing an idea in order to enrich the artwork " (The new Encycopedia, op.cit. p576).

- **Space in stereoscopic sculptural:**

The space is divided into two basic types, the outer space (surrounding the shape), and the internal space and is divided into (illusionary space - real space)

1- The external space (periphery): It is the space surrounding the external body of the anthropomorphic sculptural work from all sides, and it is not just a part of the cosmic space surrounding it only, but it is a material in itself in the sense that it is a compositional part of the form that has the ability to connect the parts of the artwork to each other as if it were a bonding force, just like any solid material that enters into the composition of the work.

2- Internal space: It is divided into:

A - Illusionary space: It is a type of internal space that penetrates the mass, but we do not realize this penetration with the sense of touch, but we realize it with the sense of sight through the transparency of the material, when passing a physical body in that space is not implemented, because this space is not real, but delusional, and the reason for our sense of its existence is to see beyond the stereoscopic sculptural shape implemented with a material of transparent materials such as transparent polyester, acrylic, and glass.

B- A real vacuum and is divided into:

- Permeable space: It is the space that the eye cannot track its end and allows light to pass through it and does not hit the parts of the stereoscopic sculptural shape, which reduces the transfer of masses and gives new dimensions to the shape, and the extension of its penetration in the shape allows seeing what is behind it, which confirms and deepens the perception of the third dimension in the artwork and increases the interaction of the shape with the surrounding atmosphere and is called the absolute space or the infinite extended space.

-Impermeable (negative) space: It is the space that is confined between two planes or forms a depth that has a beginning and an end, and the eye can follow it as it is a space with a tangible depth, but through which light does not penetrate and collides with a deeper surface than it.

-Four-dimensional space: Interest began with the influential school in terms of achieving the speed factor and the fourth dimension, but it became a basis and principle of the futuristic school, as it benefited from the studies of E. Newton (Isaac Newton) in motion or what is known as the dynamics of moving objects relative to space, and therefore the four-dimensional space "is a high-perception treatment of shapes that gives a sense of the distance of time and movement. (Ocrirk, O.C. and others, 1963, p88)

INTERNATIONAL JOURNAL OF
DESIGN AND FASHION STUDIES

Print ISSN
2735-5357

VOLUME 5, ISSUE 1, 2022, 133 –160.

Online ISSN
2735-5365

-Innovative space: Innovative space varies from one artist to another, depending on the place or environment in which the artist lives, and it is useful to develop the concept of how to employ our sense of space in expressive ways, and how to benefit from this space through the spatial values of what surrounds us (Duane and Sarah Preble, 1978, p 80).

-Spiral space: It is a type of vacuum, which takes a spiral shape, resulting from the movement of the surface around the axis of work in a spiral, but it is a movement that takes its form through its attachment to the body or the surrounding surface or its limiter.

- Vacuum in constructivism:

The structure of a thing means in the Arabic language its composition, and is derived from the Latin origin, which means the building or the way in which this building is built, and this meaning is confirmed by Zakaria Ibrahim, since the structure of the thing is its composition or the manner in which it was built (Zakaria Ibrahim, 1976, p. 32. The researcher agrees with Zakaria Ibrahim that the system can be considered the means through which the structure of the artwork is realized.

As for the concept of structuralism, it is stated in the Larousse Encyclopedia that "it is a general trend of research in many human sciences aimed at explaining the human phenomenon by returning it to every organizer." (Voir-Structuralism, 1968, p. 73)

Building in the philosophy of contemporary thought has many definitions about the roots of the concept of construction, as mentioned in the Arabic Encyclopedia is "the synthesis of simple molecules" (Muhammad Shafiq Gabriel et al., 1965, p. 406.), in another definition by Nabila Ibrahim, in which she explained that construction is the way in which materials and parts come together in order to create a specific thing that has a specific function (Nabila Ibrahim, 1981, p. 118), and Magdi Wahba defines it as "the general system of one or several ideas related to each other (Magdi Wahba Kamel, 1972, p.92).

Second: Applied Framework:

Introduction

The aesthetic value of space in the stereoscopic sculptural work is represented in the aesthetic relationship between the internal and external space with the structure of the shape and this superiority increases when there is a reciprocity of aesthetic relations and coexistence and interdependence between the body of the form, and the surrounding place, and the determination of the shape and the general body of any two-dimensional or three-dimensional work of art is in fact an attempt by the researcher to carve and form the space surrounding the boundaries of the sculptural form, and sculptor Robert Morris comments by saying, "We cannot do a work The best works of art must be very relevant to what is outside the work itself, that is, it must be in contact with space, light, and nature, and it must be identical to the meanings in our hands.

"In structural sculpture, space is not just a part of the cosmic space surrounding the shape only, but it is a material in itself, which is a compositional part of the form and has the ability to connect volumes to each other as if it were a bond force or a link or even like any other solid material that has its properties and effectiveness, it is an effective and positive element in this regard" (Elsen, Albert E. , 1979, p. 82.)

Objectives of the experiment:

The applied side of the research aims to achieve the following:

1. The student explores the components of crystals, physical properties, and the stages that a crystal goes through during the formation process.

Print ISSN
2735-5357
VOLUME 5, ISSUE 1, 2022, 133 –160.
Online ISSN
2735-5365

2. Introduce the student to the types of space resulting from the crystalline morphology process.
3. The student discusses the malleability of the materials that suit the nature of the formation inspired by the crystalline formation process.
4. Take advantage of the movement resulting from crystal morphology and embody it as a plastic value in stereoscopic sculptures.
5. Finding new sources of artistic vision among students of the Faculty of Art Education based on scientific concepts of microscopic vision.
6. Emphasizing the concept of the relationship of the phenomorphology of crystals to their structural system and seeing the fourth dimension by tracing the interfaces.
7. Simplifying and clarifying each system so that it becomes usable to make various plastic solutions to build the sculptural shape.

Experiment tools: - Designing an evaluation form for the results of the application of the experiment by the arbitrators and verifying the logical validity of the content of the card.

Sample experiment: - A sample by a group of (60 students) from the Fourth year students at the Faculty of Specific Education - Alexandria University for the academic year 2020 /2021

Trial time: - The experiment includes six interviews, four hours per interview per week.

Materials & Tools:

- The researcher used raw materials (plastics, metals, and wood) that have been studied to determine their plastic potential to know the extent of their malleability in the stereoscopic sculptural formation as he made experimental practices to identify this potential directly and know the advantages and disadvantages of each raw material and the tools required in the use of those raw materials.

Entrance to the experience:

1. Sculptural works in which movement and space are achieved using tape, links, and both together with a material (plastics - metals - wood).

Method of application of the experiment:

The presentation is carried out during the appetizers through discussion and dialogue based on questions and the presentation of images showing the components of crystals and the processes of their formation, as well as the researcher displays pictures of international artistic creations in the field of sculpture in which movement and space are achieved in accordance with the nature of the content of the lesson through practical statement and work in small groups.

Educational Activities:

Learner: Listening, paying attention and practicing the required actions during the lesson of application skills.

Teacher: The use of balance, classroom, follow-up and accompanying activities in interviews The researcher relied on choosing the appropriate activities for the general objectives of the experiment and its content, with an emphasis on diversity and accompanying activities.

Teaching aids:

Hosted by Prof. Dr. Sherif Kandil, Professor of Materials Science at the Institute of Graduate Studies and Research, Alexandria University, to clarify the nature of crystals and their types, in cooperation

Print ISSN
2735-5357
VOLUME 5, ISSUE 1, 2022, 133 –160.
Online ISSN
2735-5365

between the Faculty of Specific Education and the Institute of Graduate Studies at Alexandria University as a nucleus in contributing to the simplification of science through students of art education and students of studies and research at the institute so that art students embody crystals to simplify science in the field of research at the university.

1. Providing projectors to display works of art by Egyptian and foreign artists.
2. The researcher makes a practical statement in front of the students.

Design and application of the proposed educational unit:

The researcher used the matrix "Laura Chapman to present the vital steps of the artwork, which the matrix crystallized in six steps:

1. Ability to form ideas.
2. The ability to adapt and crystallize ideas.
3. Ability to use raw materials.
4. Responsiveness to visual elements.
5. Analysis and interpretation.
6. Judging the artwork.

The matrix focused on visual culture, linking the student and the artist, the role of art in society, the sources from which the student draws his ideas and the sources he resorts to in his artistic expressions, and Chapman relied on recognizing and tasting aesthetic and innovative values in art and nature.

Since this matrix serves the current research, the researcher has relied on it, and in the light of which the basic structure of the proposed educational unit was built in accordance with the topic presented to students in this research.

- **Experience interviews: Consists** of six interviews**:**

First interview: (crystal systems).

The researcher presents the crystal formation processes as stages and its components (faces, strips,links and interspaces between them) and the extent to which they can be used in creating stereoscopic sculptures with moldable materials characterized by voluntariness to achieve the concept of movement and space.

- **Interview Objectives:**

1. Students learn about the shape of the faces and connections that make up the crystals and the intervals (space) between them.
2. The student learns about the formal assumptions of the crystal structure assumed by scientists as well as the movement in the gene, as crystals are vocabulary capable of formulating shapes suitable for the processes of building and forming the shape to obtain innovative stereoscopic sculptures.
3. The student learns about the extent to which crystallization processes are used to reach sculptures in which plastic values represented in movement and space are achieved through plastic vocabulary originating from the faces and tape, the links that make up the crystal.
4. Students are introduced to the types and potential of non-traditional sculptural materials such as plastics, metals, wood and other consumed and ready-made materials that suit the concept of morphology on which the current research is based.

- **Conduct of the interview:**

Print ISSN
2735-5357
VOLUME 5, ISSUE 1, 2022, 133 –160.
Online ISSN
2735-5365

1. The researcher presents pictures of the components of the crystal structure (faces,tape and links) and the space they confine, and the resulting aesthetics.
2. The researcher explains how the faces and links can be used to create stereoscopic sculptures in which the concept of movement and space is realized.
3. Hosted by Prof. Dr. Sherif Kandil, Professor of Materials Science at the Institute of Graduate Studies and Research, Alexandria University, to clarify the nature of crystals in terms of their types - factions - their structural system - their presence in nature in their various forms.
4. The researcher displays pictures of some crystals and their composition, in which the use of the two bonds forming the crystal is shown and the movement and vacuum are achieved.

5- The researcher presents some practices for various materials that illustrate the potential of each material and how to benefit from it in making voluntary bonds that can be formed to create stereoscopic sculptures.

Second interview: (Starting to design and implement a sculptural model of natural crystal systems).

- **Interview Objectives:**

1. The student learns how to build and use compound links (a building link from vocabulary of one or various shapes).
2. The student is fluent in implementing a stereoscopic sculptural structure through the multiple forms of the link in which the concept of movement and space is realized**.**
3. Introducing students to the importance of the overall external form of the shape, and the distinct and specific manifestations of the edges, angles, shape of surfaces and the balance of design on the shape.

- **Conduct of the interview**:

1- The researcher discusses students about the aesthetics of sculptural work using links from plastic, metal or wood.

2- The researcher presents artworks related to movement and space using links. The researcher presents the skills and techniques associated with the material and the tool to implement stereoscopic sculptures using links, emphasizing movement and space.

3- The student implements a sculptural model commensurate with his own thought using the material he has chosen.

Third interview: (movement and space usinglinks).

- **Interview Objectives:**

1. Providing students with performance skills in using the tools for each material in forming with links
2. Emphasis on the techniques of metal and plastics such as connection, welding and gluing.
3. Emphasizing the techniques of wood material to obtain links from wooden slats and wooden slats to achieve movement and space.
4. The student is fluent in the skill of finishing the stereoscopic sculptural work through finishing operations (polishing, polishing, roughing paint).

Print ISSN
2735-5357
VOLUME 5, ISSUE 1, 2022, 133 –160.
Online ISSN
2735-5365

1. Emphasizing the good finding of the relationship between the sculptural sculpture built with links and the base.

- **Conduct of the interview:**

1. Presenting the researcher's practices in which the forming techniques for each of the materials used are clarified.
2. The researcher emphasizes the techniques (bending, bending, folding, fitting, assembling, gluing and welding) of the ties through individual guidance.
3. The researcher makes a practical statement explaining the finishing processes (smoothing, polishing, polishing and coating emphasizing the tools used. and oxidation) of the materials used with each technique.
4. Display of artworks by Egyptian and foreign artists that emphasize the relationship of the sculpture with the base in relation to size and material.

Fourth interview: (completion of movement and space using links).

- **Interview Objectives:**

1. Providing students with performance skills in using the tools of each material in forminglinks.
2. Emphasis on the techniques of metal and plastics such as bending, folding, cutting, welding, and gluing.
3. Emphasis on the techniques of wood material to obtain wooden bonds to achieve movement and vacuum.
4. The student is fluent in the skill of finishing the anthropomorphic sculptural work through finishing operations (polishing, polishing, roughing, painting).
5. Emphasizing the good finding of the relationship between the sculptural sculpture built from links.

- **Conduct of the interview:**

1. Presenting the researcher's practices in which the forming techniques for each of the materials used are clarified.
2. The researcher emphasizes the techniques (bending, bending, folding, fitting, assembling, gluing and welding) of the tape through individual guidance.
3. The researcher makes a practical statement explaining the finishing processes (smoothing, polishing and polishing) of the materials used, with an emphasis on the tools used with each technique.
4. Display of artworks by Egyptian and foreign artists that emphasize the relationship of the sculpture with the base in terms of size and material.

Fifth interview: (movement and space using strips and links).

- **Interview Objectives:**

1.The student learns how to build and use links with tapes in one work.

2. The student is fluent in implementing a stereoscopic sculptural structure through multiple forms of strips and links in which the concept of movement and space is realized.

- **Conduct of the interview:**

Print ISSN
2735-5357
VOLUME 5, ISSUE 1, 2022, 133 –160.
Online ISSN
2735-5365

1.The researcher discusses the students about the aesthetics of sculptural work using strips and links from plastic, metal or wood.

2.The researcher displays artworks related to movement and space using strips and links.

3.The researcher presents the skills and techniques associated with the material and the tool to implement stereoscopic sculptures using link strips, emphasizing movement and space.

1.The student implements a sculptural model commensurate with his own thought using the material he has chosen.

Interview Session: (Conference on Materials Science at the Institute of Graduate Studies andResearch)

- **Interview Objectives:**

1. Providing students with performance skills in using the tools for each material in forming with strips and links together.
2. Emphasis on the techniques of metal and plastics such as bending, bending, folding, cutting, welding, and gluing.
3. Emphasis on the techniques of wood material to obtain wooden strips and links to achieve movement and space.
4. The student is fluent in the skill of finishing the stereoscopic sculptural work through finishing operations (polishing, polishing, roughing paint).
5. Emphasizing the good finding of the relationship between the sculptural sculpture built with strips, links and base.

- **Conduct of the interview: -**

1. Presentation of the researcher's practices in which the formation techniques for each of the materials used are clarified.
2. The researcher emphasizes the techniques (bending, bending, folding, fitting, assembling, gluing and welding) of strips and links through individual guidance.
3. The researcher presents the results of the application through a scientific conference entitled: Materials Science at the Institute of Graduate Studies and Research at Alexandria University in the presence of the deans of the Faculty of Specific Education - and the Dean of the Institute of Graduate Studies and in the presence of a group of scientists from the Department of Materials Science
4. The researcher makes a practical statement explaining the finishing processes (smoothing, polishing, polishing, painting and oxidation) of the materials used, emphasizing the tools used with each technique.
5. With the display of artworks by Egyptian and foreign artists, it emphasizes the relationship of the sculpture with the base in terms of size and material.

- **Evaluation methods:**

Evaluation methods are carried out through the activities of students inside the classroom of the sculpture atelier, and the discussion, dialogue and creation of stereoscopic sculptures, as well as their applications during the lesson using methods and techniques derived from the philosophical thought of the research subject.

Analysis and discussion of the statistical results of the research experiment sample:

Print ISSN
2735-5357
VOLUME 5, ISSUE 1, 2022, 133 –160.
Online ISSN
2735-5365

The researcher conducted the applied side of the research on the experiment sample, then prepared a survey form consisting of a set of items, and then presented it to the arbitrators and experts in art education to verify the sincerity of the items, then the researcher presented the results of the sample experiment in the form of axes for arbitration with the arbitration form of the sample works through a committee of arbitrators and experts in art education, and then the researcher analyzed and discussed the statistical results of the opinions of the arbitrators, which will be presented in the results And its interpretation: -

- Statistical interpretation of the three axes separately.

- Interpretation and statistical analysis of each item of the questionnaire in the three axes to see the extent to which it has been achieved at a higher rate in the three axes.

- Evaluation of sculptural spatial works Outcome of the experiment:

The work carried out is evaluated according to the following steps:

- Preparing the evaluation card of the spatial sculptural works The product of the experiment, the researcher took into account that the card measures the basic research objective, which is to benefit from the structural systems of natural crystals in the development of artistic expression and aesthetic taste on the sculptural form, and the card also measures the technical aspects and plastic in sculptural form.
- The opinion of specialists in the field of sculpture was used to amend the terms of the card (according to the opinions of seven arbitrators) until the evaluation card reached its final form.
- The sculptural spatial works of the students were evaluated by the arbitrators, and the researcher used the five-grade scale (achieved very large = 5 degrees, achieved in a large way = 4 degrees, achieved in an average = 3 degrees, achieved twice = 2 degrees, achieved very weak = 1 degree) and the arbitrator put A sign (√) in front of the box of his choice and achieved at work.
- The scores of the seven arbitrators for each sculptural form were collected and the average scores were calculated to perform statistical operations to reach the results, which will be presented in the results and interpreted.
- The researcher has codified the questionnaire to know its truthfulness and stability.

- **The sincerity of the questionnaire evaluates the applied experiment.**

- To find out the authenticity of this questionnaire, the researcher used the sincerity of the content by presenting it to (7) arbitrators and the agreement rate was 87.6%.

- **The stability of the questionnaire evaluates the applied experience.**

- To know the stability of the resolution, the researcher used the Cronbach alpha coefficient, and its value was 0.862, which is a high value that confirms the stability of the resolution.

Thus, the questionnaire is characterized by honesty and stability, which enables it to evaluate the applied experiment and it is clear that the percentage obtained in the answers to the phrases that have been tested (achieved very significantly) 65 by 7.5% and the percentage obtained by the answers to the statements (achieved in a large way) 24 by a percentage of 3.43% and the percentage of scores obtained by the phrase (achieved in an average way) 7 by a percentage of 0.6% and the percentage obtained by the answers to the statements (achieved poorly) 4 by a percentage of 1.62% and the percentage Percentage obtained by answer statements (achieved very poorly) -- .

The total degree of the resolution is 100 and the percentage is 13.15%, and this indicates that the objectives of the experiment have been achieved through the mentioned items and their association with a high significance as factors affecting the tasting process of sculptural works.

Research Experience:

INTERNATIONAL JOURNAL OF
DESIGN AND FASHION STUDIES

Print ISSN
2735-5357

VOLUME 5, ISSUE 1, 2022, 133 –160.

Online ISSN
2735-5365

For students of the second year, Department of Art Education, Faculty of Specific Education - Alexandria University The following will be presented and analyzed some of the students' work, the product of the research experience to find out some of the plastic and aesthetic artistic values achieved by the proposed educational unit for research through the embodiment of some forms of natural crystals illustrated through a microscope and converting them into three-dimensional shapes with sculptural space bodies as a contribution to simplifying science and explaining the crystal form of materials to graduate students at the Institute of Studies Supreme and Research.

Figure (11)

Figure (12)

Figure (13)

Figure (14)

Figure (15)

Figure (16)

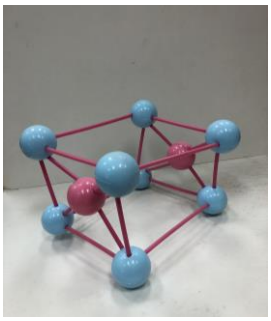


Figure (17)

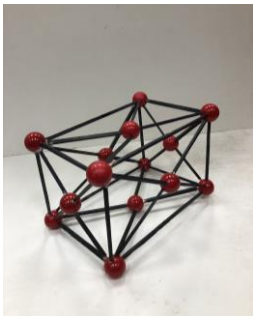


Figure (18)

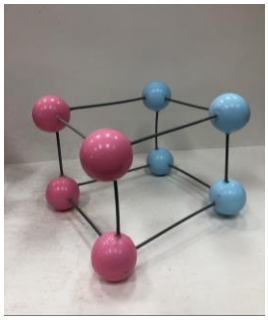


Figure (19)

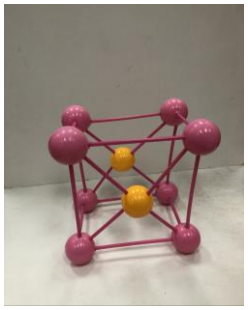


Figure (20)

INTERNATIONAL JOURNAL OF
DESIGN AND FASHION STUDIES

Print ISSN
2735-5357

VOLUME 5, ISSUE 1, 2022, 133 –160.

Online ISSN
2735-5365

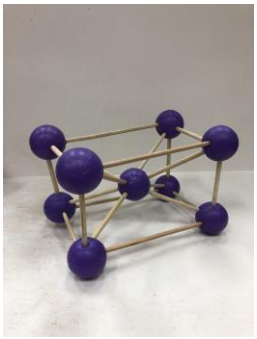


Figure (21)

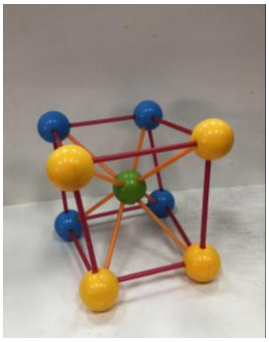


Figure (22)

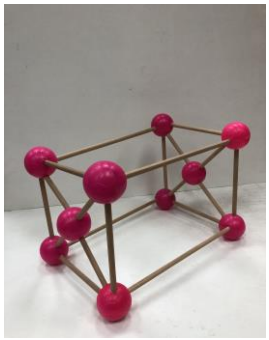


Figure (23)

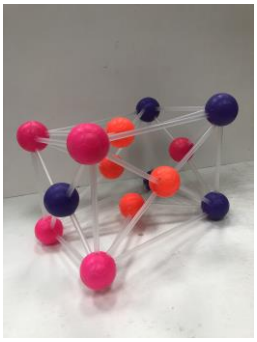


Figure (24)

Figure (25)

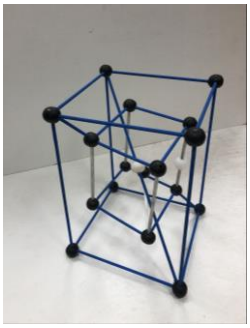


Figure (26)

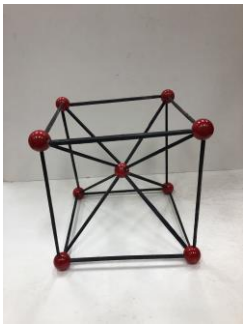


Figure (27)

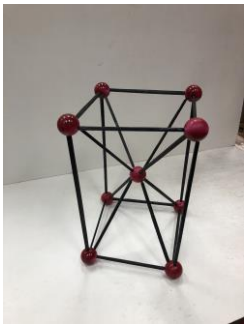


Figure (28)

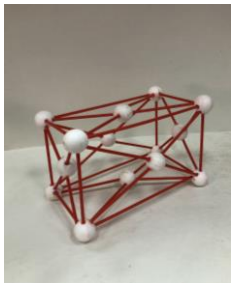


Figure (29)

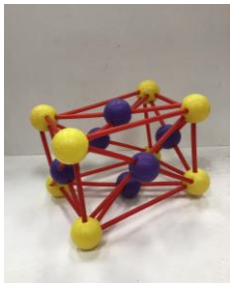


Figure (30)

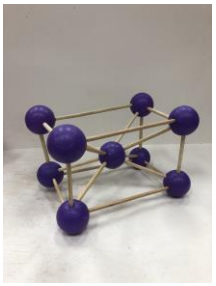


Figure (31)

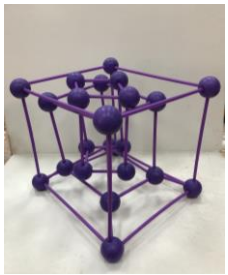


Figure (32)

INTERNATIONAL JOURNAL OF
DESIGN AND FASHION STUDIES

Print ISSN
2735-5357

VOLUME 5, ISSUE 1, 2022, 133 –160.

Online ISSN
2735-5365

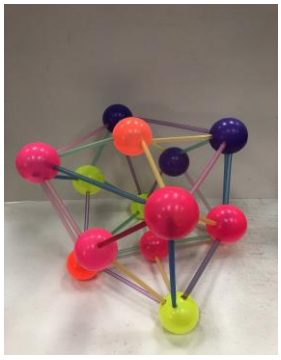


Figure (33)

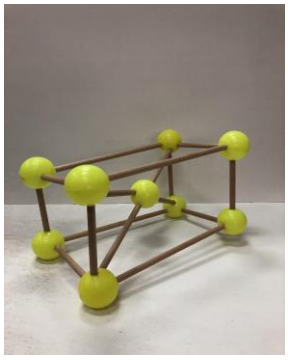


Figure (34)

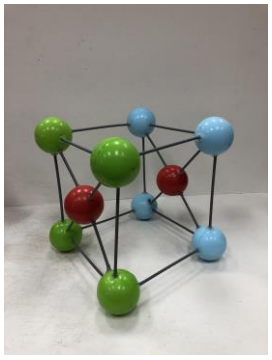


Figure (35)

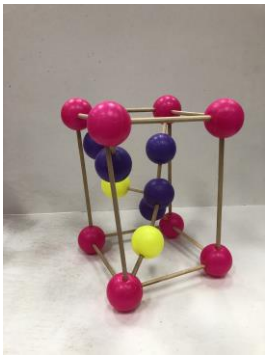


Figure (36)

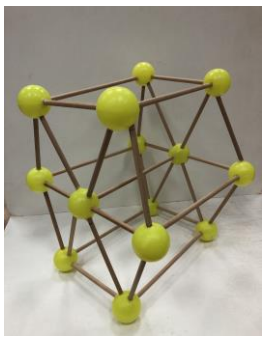


Figure (37)

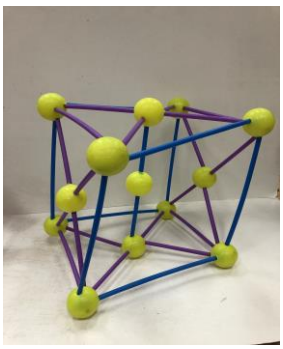


Figure (38)

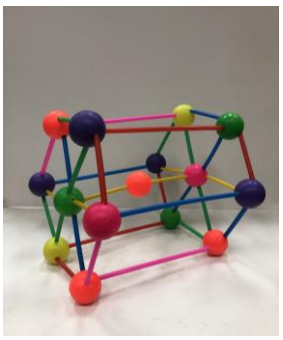


Figure (39)

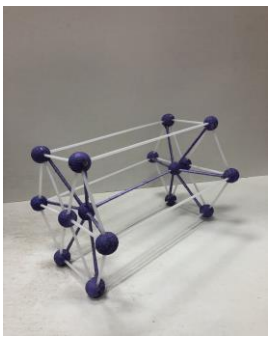


Figure (40)

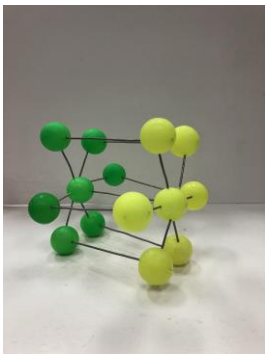


Figure (41)

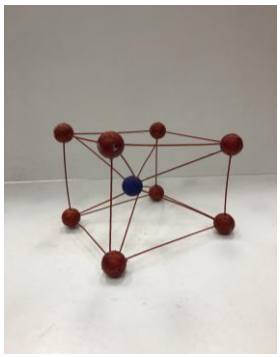


Figure (42)

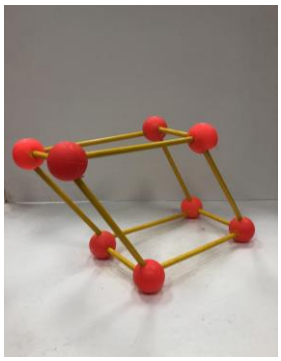


Figure (43)

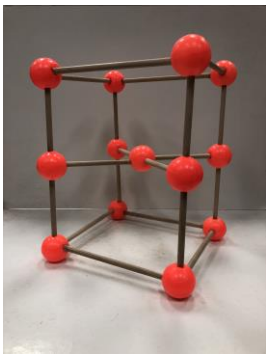


Figure (44)

INTERNATIONAL JOURNAL OF
DESIGN AND FASHION STUDIES

Print ISSN
2735-5357

VOLUME 5, ISSUE 1, 2022, 133 –160.

Online ISSN
2735-5365

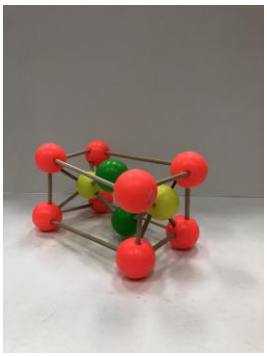


Figure (29)

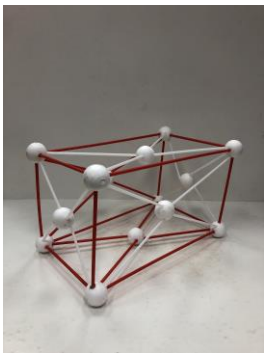


Figure (30)

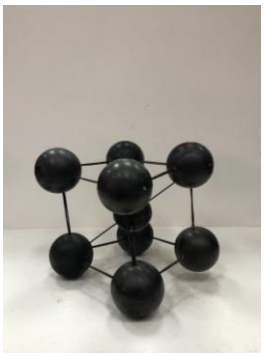


Figure (31)

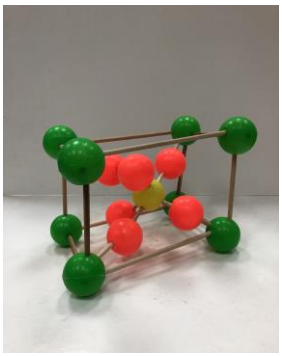


Figure (32)

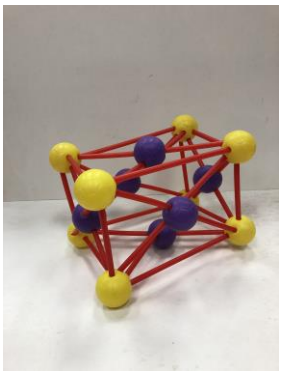


Figure (33)

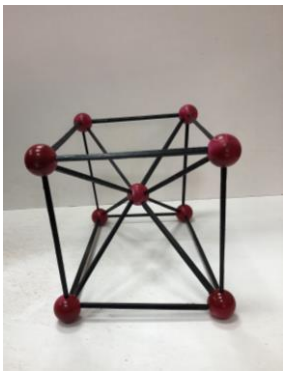


Figure (34)

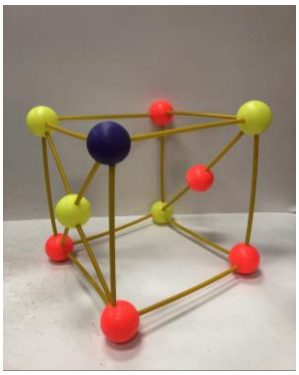


Figure (35)

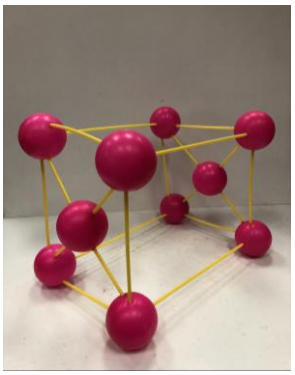


Figure (36)

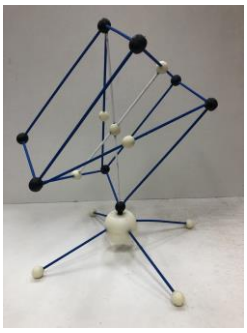


Figure (37)

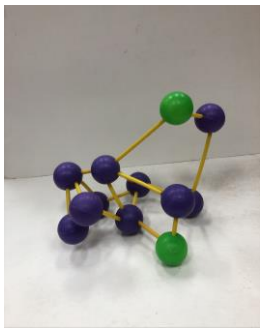


Figure (38)

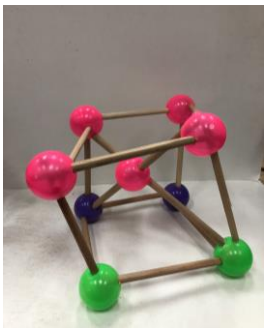


Figure (39)

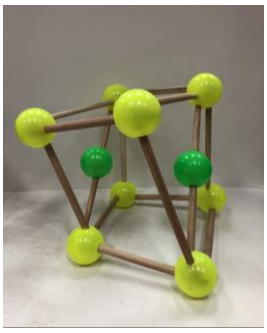


Figure (40)

Findings and recommendations

First: Results

1. There is a very interrelated relationship between science, its laws and possibilities, and sculptural works, that is, there can be a sculptural form built through the microscope's vision of natural forms, as technology has facilitated the detection of the mysteries of nature and its depiction in the form of visual perceptions.
2. Microscopic vision enabled artists to recognize beyond the phenotypic form of crystalline forms and elements of nature.

Print ISSN
2735-5357
VOLUME 5, ISSUE 1, 2022, 133 –160.
Online ISSN
2735-5365

3. The microscopic vision of the natural elements gives a diversity in the formulations, and this helped the artist to diversify in choosing the appropriate materials to emphasize their properties, capabilities and methods of use.
4. The research reached through the study and analysis of vocabulary, formula and formulation) of the fourth dimension in the crystals of various structural formulations.
5. Systems of morphological relations of the products of refraction of light through crystals have aesthetic values.
6. The researcher reached new experimental approaches in employing the structural systems of natural crystals in the light of constructivist philosophical thought that suits different levels of education as an input to simplify science.

Second: Recommendations

1. The researcher is recommended to pay attention to the study of nature and beyond in a way that includes abstract visual vision and microscopic vision to take advantage of the different approaches in the field of sculpture.
2. The researcher recommends the need to link the curricula of teaching sculpture at the Faculty of Art Education with other scientific studies.
3. The need to introduce students to how to obtain different structural formulations to produce various sculptural forms.
4. The sculpture curriculum in the faculties of arts contains information linking the fields of science with art, to train in scientific thinking and the use of scientific theories and natural phenomena as real material for artistic creativity.
5. Allocating part of the course at the Faculty of Specific Education, Department of Art Education, to study, introduce and draw inspiration from the structural systems of natural crystals as a contribution to the field of simplifying science.

References

First: - Reference books and Arabic

1. Robin George Collingwood: "Principles of Art", translated by Ahmed Hamdi Mahmoud, Egyptian House for Authorship and Translation, April, Cairo, 1966.
2. Zakaria Ibrahim: "Philosophical Problems of Structure", Misr Printing, Cairo, 1976.
3. Zaki Mohamed Zaghloul, Amina Mohamed Abdel Rahim: "The Science of Crystals", Anglo-Egyptian Library, Cairo, 1965.
4. Foucault Michel: "Structuralism between Science and Philosophy according to Michel Foucault", translated by Dr. Abdul Wahab Jaafar, Dar Al-Maaref 1989.
5. Abdel Aal Abdel Karim: "The World of Crystals ", Zagazig University Press, 2003.
6. Nabila Ibrahim: "Structuralism from where and to where?" General Book Authority, Cairo, 1981.
7. Majdi Wahba Kamel: "Dictionary of Arabic Terms in Language and Literature", Librairie du Liban, 1972
8. Mohamed El-Desouky: "Nature Dialogue in Fine Art ", Nasr Al-Islam Press, Cairo, 1990.
9. Muhammad Shafiq Ghobrial and others: "The Facilitated Arabic Encyclopedia", National House for Printing and Publishing, Cairo, 1965.

Print ISSN
2735-5357
VOLUME 5, ISSUE 1, 2022, 133 –160.
Online ISSN
2735-5365

10. Muhammad Ghaleb Sayyid: "Crystallography", Periodical, Damascus University, 1983.
11. Mohamed Ezz El-Din Helmy - undated: "The World of "Metals" Anglo-Egyptian Library - Cairo.

Second: - Research and scientific theses

12. Iman Ahmed Mahmoud Abu Durra “Shapes and Microscopic Cells as a Source of Inspiration for Innovative Ceramic Forms", Unpublished master’s Thesis, Faculty of Art Education, 2002.
13. Abdel Wahab Abu Zeid: "The Effectiveness of Linear Structure as an Input to Capacity Development in the Formation of the Spatial Stereotype", Research Published in Journal of Educational Sciences, Institute of Educational Studies, Cairo University, 2001.
14. Abd al-Rahim Ibrahim - Mervat Sharbas: "Aspects of the contributions of the arts of movement and light to achieve the element of time in modern art", Journal of Science and Arts, Volume IV, Issue Three, July 1992.
15. Ali Al-Sulami: "New Trends in Organizational Thought", Alam Al-Fikr, Fourth Issue, Volume Eight, a periodical series issued by the Ministry of Information in Kuwait.
16. Mohamed Radwan Khalil: Constructivism and its Impact on Contemporary Sculpture "A Comparative Analytical Study", Unpublished PhD Thesis, Faculty of Fine Arts, Helwan University, 2006.
17. Mona Omar Mustafa Abdel Qader: "Microscopic Vision as an Introduction to the Development of Contemporary Sculptural Formulations among Students of the Faculty of Art Education", unpublished master's thesis, Faculty of Art Education, Helwan University, 2018.
18. Nagwa Mohamed Ahmed Al-Masri: "Enriching the Design of Decorative Paintings through Microscopic Analysis of Banana and Chromatic Systems in Mineral Crystals", Unpublished master’s Thesis, Faculty of Art Education, Helwan University, 1993.
19. Hoda Ibrahim Ali Al-Nadi: "Mathematical Systems in Contemporary Sculpture as an Introduction to Teaching Stereoscopic Formation", Master Thesis, Faculty of Art Education, Helwan University, 2015.

Third: Foreign References

20. Duane and Sarah Preble: Art Forms, Harper and Row Publishers Inc,New York, 1978.
21. Elsen, Albert E: Modern European Sculpture, 1979.
22. Jack Barnham: “Beyond Modern Sculpture, George”, Braziller, NEW York, 1968.
23. Lewis, R.: Design and Pattern from the microscopic world, Dover, New York, 1974.
24. Ocrirk, O.C. and Others: Art Fundamentals, filth Edition W. M.C Publishers, New York, 1963.
25. Perry, L.G. & Mason, B.: "Mineralogy" CBS Publishers and Diatrl Butors, Delhi, India, 1982 .
26. Tony Linden: "Frequently Asked Questions About Crystals for Students", http://www.chem.ncsu.edu 2001.
27. The New Encyclopedia Britannica, vol. 3, USA, 1985.
28. Voir-Structuralism-Ingrond Larouss encyclopedia- Supplement de- A.Z., 1968.

Fourth: Websites

29. https://www.marefa.org.
30. https://www.bing.com.
31. https://www.marefa.org.
32. https://ar.wikipedia.org.
https://minhaji.net/printlesson/16646