# DESIGNING AND CREATING CONTEMPORARY HANDICRAFTS DEPENDING ON THE LOGICAL NUMBERS PUZZLE 

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#### Abstract

This research is an Applied one through the exhibition "Plastic views of the puzzle in the handicraft" Which was held at "Prince Taz Palace" - Egypt, in January 2017, it included contemporary handicraft pieces based on the researcher personal experiment that depended on the logical numbers puzzle through Sudoku game philosophy . although the design is considered one of the handicrafts essentials ,it isn't only about distributing the decorative units in successful configurations, but it also depends on distributing the technical methods, so through my work in the field of teaching art education, I noticed that making a handicraft design takes a lot of time and effort especially when there is a need to use several technical methods in one handicraft , it takes a lot of time and thinking to get the perfect technique in its perfect place, to reach the best results , all this because of the verity of materials and the technical methods which can be applied on each material to enrich it , so the researcher tried to find new methods which can be used in producing balanced handicrafts without the need to waste time in modifying designs, and to give more attention in using the material and knowing its plastic and technical potentials through the applying of Sudoku game philosophy, which depends on logicality in distributing numbers and figures, so balance, variety, unity ,harmony and integration can be achieved without the need to think over and over again in the way of placing the material or the technical methods in the handicraft .


So that the research problem is summarized in the following questions:

- Is it possible to reduce the required time for the use of the technical methods and materials combination by relying on the logical numbers puzzle through the Sudoku philosophy?
- Is it possible to get a professionally balanced design by relying on the logical numbers puzzle?
- Can the logical numbers puzzle through the Sudoku game philosophy be used to create contemporary handicrafts in an interesting way?

The research aim is about having benefit from the Sudoku game philosophy as a design source to create contemporary handicrafts, the research importance appears in being one of the researches that contributes to the design development in handicrafts field, and it includes a lot of special technical methods in using the materials of handicrafts, this research also cares about inspiring some of contemporary handicrafts through the Sudoku game philosophy, and deals with the word Sudoku which comes from Japan, it means (digitsingle) ,originally called (Number Place), it is a logic-based, combinatorial number-placement puzzle, The objective is to fill a $9 \times 9$ grid with digits so that each column, each row, and each of the nine $3 \times 3$ sub grids that compose the grid (also called "boxes", "blocks", or "regions") contains all of the digits from 1 to 9 . The puzzle setter provides a partially completed grid, which for a well-posed puzzle has a single solution ,there are many types of Sudoku grids, so this philosophy can be used in designing handicrafts by putting materials and technical methods instead of each number from one to nine if the sub grid is $3 \times 3$, and from one to four if the sub grid is $2 \times 2$,so in this cease four technical methods can be applied on the used material, to put each one instead of the numbers from one to four to make it more interesting and easier in

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designing the handicraft, so that can save time and effort, and make the creating proses of the handicraft more fun ,so this study includes five main themes:

1. The Sudoku game history and its philosophy.,2. The design and its basics,3. The environmental handicraft materials which had been used in this research, 4. The technical methods of the environmental handicraft materials which had been used in the research., 5. the personal experiment which had been applied by researcher , and was presented through the exhibition "Plastic views of the puzzle in the handicraft " ,Which was held at "Prince Taz Palace" - Egypt, in January 2017, it included contemporary handicraft pieces based on the researcher personal experiment that depended on the Sudoku game philosophy, in three deferent sizes $(20 \times 20 \mathrm{~cm}, 50 \times 50 \mathrm{~cm}$, and $70 \times 50 \mathrm{~cm})$, They had a variety of techniques, materials, colors, decorative units, and three deferent sizes of the handicrafts, all this gave each handicraft variety, unity ,harmony and integration ,then the results and recommendations are presented followed by references.

Keywords: Sudoku game - design - handicrafts - environmental materials - personal experiment- logical numbers puzzle.

## 1 INTRODUCTION

The design is the base of successful handicraft, yet it is a stumbling block for beginners in this field, where design process is difficult, incomprehensible and need a lot of time, sometimes it doesn't lead to reach satisfactory results in the end, so the researcher tried through this research to use ready template designs that could give successful handicraft through the logical numbers puzzle such as the Sudoku game, which is based on the distribution of a set of numbers within a grid, so that the number isn't repeated more than once in any row or column of the game net columns, that each row contains a set of numbers which is not repeated, The numbers are changed in the next row so that no number falls in line with the same row or column, thus achieving a set of design values such as harmony, balance, unity Proportionality, In addition the square grids, which are geometric shapes representing the "unity of shape, also the equality of the sides and its parallelism allows to divide the total surface in a regular unit, and it has the characteristics of stability and integrity because the sides are equal and angles are right angles, And the most common quadratic forms are square and rectangle." (Afifi, 1997, p. 32) ,so the researcher tried to find one of the grids that can make the design process of handicrafts more easier through the philosophy of the Sudoku game, which confirms the repetition and possible alternatives for the redistribution of raw materials or technical methods in the handicraft, through grids of different types starting from $4 \times 4$ matrices to $16 \times 16$, and there are " countless evolving modes of this game, some of them have multiple overlapping grids, others replace partial grids, which are square, others have different forms, and some impose additional restrictions, that's Forcing you to explore new logical strategies." (http://www.oloommagazine.com, 2017), so the researcher selected simplest types of Sudoku grids for the research application, by using grids of matrices $4 \times 4$, matrices $9 \times 9$, also in some of the handicraft parts of the Sudoku grids had been used, and did not commit in some works to divide the handicraft into square areas, where rectangular spaces were used in Some of the handicraft, so that the process of developing modern balanced handicraft designs became more easier and fun.

## 2 RESEARCH PROBLEM

The design is considered one of the essentials of handicrafts, it isn't only about distributing the decorative units in successful configurations, but it also depends on distributing the technical methods, so through my work in the field of art education teaching, I noticed that making a handicraft design takes a lot of time and effort especially when there is a need to use several technical methods in one handicraft, it also takes a lot of time and thinking to get the perfect technique in its perfect place, to reach the best results , all this because of the verity of materials and the technical methods which can be applied on each material to enrich it, so the researcher tried to find new methods which can be used in producing balanced handicrafts without the need of wasting time in modifying designs, and to give more attention to use the material and knowing its plastic and technical potentials through the Sudoku game philosophy, which depends on logicality in distributing numbers and figures, so balance, variety, unity, harmony and integration can be achieved without the need to think over and over again in the way of placing the material or the technical methods in the handicraft .

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So that the research problem is summarized in the following questions:

- Is it possible to reduce the required time for the use of the technical methods and materials combination by relying on the logical numbers puzzle through the Sudoku philosophy?
- Is it possible to get a professionally balanced design by relying on the logical numbers puzzle?
- Can the logical numbers puzzle through the Sudoku game philosophy be used to create contemporary handicrafts in an interesting way?


## 3 RESEARCH HYPOTHESES

So the researcher assumed that:

- It is possible to reduce the required time for the materials combination and the technical methods by relying on the logical numbers puzzle through the Sudoku philosophy.
- It is possible to get a professionally balanced design by relying on Sudoku's philosophy.
- There could be a benefit of the logical numbers puzzle through the Sudoku game philosophy in creating contemporary handicrafts.


## 4 RESEARCH AIM

It is about having benefit from the Sudoku game philosophy as a design source to create contemporary handicrafts, and developing handicrafts balanced in design and rich in technical methods, without wasting time in thinking of alternatives and without losing balance while using technical methods, through the philosophy of the Sudoku game, which bases on distributing numbers in a square grid, which is Leveling in difficult and complexity from $4 \times 4$ squares to $16 \times 16$ squares .

## 5. RESEARCH IMPORTANCE

The research importance appears in being one of the researches that contributes to the design development in handicrafts field, and it includes a lot of special technical methods in using the materials of handicrafts, this research also cares about inspiring some of contemporary handicrafts through the Sudoku game philosophy.

## 6 METHODOLOGY

This study includes theoretical framework which deals with four main themes, and experimental framework, as the following:

Theoretical framework includes 1. the Sudoku game history and its philosophy.,2. The design and its basics,3. The environmental handicraft materials which had been used in this research, 4. The technical methods of the environmental handicraft materials which had been used in the research ,then the experimental framework was dealing with the personal experiment which had been applied by researcher ,and was presented through the exhibition "Plastic views of the puzzle in the handicraft " ,Which was held at "Prince Taz Palace" - Egypt, in January 2017, it included Twelve contemporary handicraft pieces based on the Sudoku game philosophy, in three deferent sizes one of them was $50 \times 50 \mathrm{~cm}$, the other was $70 \times 50 \mathrm{~cm}$, and the last one was $20 \times 20 \mathrm{~cm}$, They had a variety of techniques, materials, colors, decorative units, and two deferent sizes of the handicrafts, all this gave each handicraft variety, unity.

## 7 THEORETICAL FRAMEWORK

### 7.1 Sudoku Game Philosophy

Sudoku means (digit-single, originally called Number Place) is a logic-based, combinatorial numberplacement puzzle, The objective is to fill a $9 \times 9$ grid with digits so that each column, each row, and each of the nine $3 \times 3$ sub grids that compose the grid (also called "boxes", "blocks", or "regions") contains all of the digits from 1 to 9 . The puzzle setter provides a partially completed grid, which for a well-posed puzzle has a single solution. (https://en.wikipedia.org/wiki/Sudoku, 2017),"It is a very entertaining and useful game to the mind, the development of thought and focus practicing, has passed of different development stages, with the keeping the game rules stability and fundamentals, it is known that the Sudoku game is the game of everyone, as it does not need a certain level of intelligence or culture And all the users of this game will feel the improvement level of concentration, activity of thought and developing intelligence after continuing to practice Sudoku" (https://www.almrsal.com/post/308657, 2017) ,"It is surprising that no one needs to try to solve it with any amount of math, although it is a game of numbers, where none of the calculations, including

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the addition or multiplication of a grid, help any network. Fill the grid with any set of nine different characters(letters, colors, icons, etc.)" (http://www.oloommagazine.com, 2017) ,So the researcher tried to benefit from the philosophy of this game to develop contemporary handicrafts, in which the numbers are replaced by a set of technical methods according to the used material in the handicraft, " Sudoku is also defined as a puzzle ,It is a matter of complexity that follows a series of logical calculations to be answered. The simplest riddles require the logical assembly of several pieces to form a particular shape or image. Riddles are usually used as a kind of entertainment, mathematical calculations and logical questions. Therefore, solutions to these puzzles are often found in mathematical form of the most successful mathematical research" (https://en.wikipedia.org/wiki/Sudoku, 2017)

### 7.1.1 Sudoku Game History

It is known as a Japanese game although it was not invented in Japan, it is originated in Switzerland and then traveled to Japan by way of America, Sudoku has its deep roots in ancient number puzzles. For many centuries people have been interested in creating and solving them. (http://www.sudokudragon.com/sudokuhistory.htm, 2017) ,"It is said that the first Sudoku game was invented by American architect Howard Garenz in 1979 and published by Dell magazine under the name Number Place. "Then Sudoku started to evolve" through a major company in Japan, where the company's president, Mr. Mackie Kage ), The publication of a puzzle called "Nicole" puzzle, and this was the beginning of success and spread, the puzzle is a patch divided into squares of their 30 numbers appear to the user in an analogous, the game began to spread and became a popular Japanese games, The Japanese daily newspapers and several other magazines published it, then after two decades it expanded to spread to other countries outside Japan, the Great Times newspaper in London began to publish it as a hard puzzle." (https://www.almrsal.com/post/308657, 2017)

### 7.2 The Design:

"Design in the plastic arts means the creation of beautiful things that are enjoyable and beneficial to man. It is the whole process of planning something and creating it in a way that is not only functional satisfactory but also brings pleasure and joy to the soul." (Zaki, 1996, p. 36) ,in the field of handicrafts, the design needs to be reflected on the appropriate technical methods and aesthetic aspects of the handicrafts in terms of appropriate composition which included balance, unity and harmony .

### 7.2.1 The Aesthetic Basis Of Design

"Formal elements or vocabulary, beside their function in plastic construction playing an aesthetic role, which is related to the placing of these elements on the design plane, and their interrelationship with the adjacent elements to achieve different artistic values" (Shawky, 1999, p. 224)

## a. HARMONY:

The term harmony comes from music and refers to the relationship between musical tones that are heard simultaneously (Hornung, 2012, p. 95), but in handicrafts field it's about the area for movement. It is a term that refers to the regular repetition of the movement that combines unity and the changing, it includes the repetition of blocks, spaces or shapes made up of units that may be identical or different, close or spaced. (Zaki, 1996, p. 66)

## b. Balance

It is one of the design basics" it is the balance between the different elements of the design such as (color line - space - shape) that design does not focus on the part without the other, and depends on the order of elements arrangement and its coordination within the design" (Zaki, 1996, pp. p. 68, 70.) ,"It is the state in which the opposing force is equal, also the instinctive feeling that arises in the soul about the nature of gravity, the equal sensation of the head line on a horizontal line, and the sense of human existence in a moderate position, vertical and balanced on a horizontal floor, Which plays an important role in the aesthetics of composition or design, where it achieves a sense of psychological comfort when looking at it" (Shawky, 1999, p. 230)

## c. Unity

"Achieving unity is one of the main requirements of any artistic work, it is also one of the most important principles for its aesthetic success, it means that its parts are connected to each other to be one, no matter how accurate the parts are in themselves, the artwork does not acquire its aesthetic value without the unity that connects the parts to each other organically and makes it coherent, " (Shawky, 1999, p. 232) The

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technical unity of the design is achieved through the creation of a relationship between the parts of the design, through the relationship of the part to the whole, it is the relationship between the elements and their control systems overlap, the intersection, similarity and contiguity, all relationships working on the interdependence between forms and unity" (Zaki, 1996, p. 67)

## d. Proportionality

Proportion is the relationship of two or more elements in a design and how they compare with one another, it is said to be harmonious when a correct or desirable relationship exists between the elements with respect to size, color, quantity, degree, or setting, that good proportion adds harmony, symmetry, or balance among the parts of a design. (http://605.wikispaces.com, 2017)

### 7.3 DESIGNE AND GEOMETRIC NETS

"The concept of measurement and its uses in the field of design for art works has resulted in a close relationship between design and geometric system, that the design is the balance of structure, where geometric nets are one of the measurement tools, therefore it is possible to rely on them to achieve many design formulas which have their unity and their balance from the aesthetic geometrical proportionality, There are many areas of benefiting from the Geometric systems in the construction of designs, especially in the arts of Islamic civilization " (Shawky, 1999, p. 212), so the researcher tried to benefit from the geometric net system in Sudoku game, which relies on the simple square grid, and the philosophy of the game through the distribution of numbers in this grid with a logical system, to develop contemporary handicrafts characterized by unity and balance.

## 8 THE ENVIRONMENTAL HANDICRAFT MATERIALS WHICH HAD BEEN USED IN THIS RESEARCH:

The environment has a lot of materials which could be used in handicrafts, it can be divided as diagram(1) shows to natural materials, industrial materials, and consumed ones.
8.1 Natural Materials In this research they are meant to be, all the available raw materials in the environment, which can be obtained from natural origin whither it was from animal or inanimate or vegetarian sours in their natural state before the human hand reaches them, such as (shells, snails, wood, gems, bone , leather, fur, plant seeds ....ext.)
8.2 Industrial Materials they are divided between synthetic and industrial materials made of natural materials as diagram (1) shown, In this research they are meant to be (Copper in all its types such as foil and wire, aluminum foil, plastic of all kinds such as strips and cylinders, paper, yarns of all kinds such as cotton or wool, textile ribbons, plastic and wooden beads)
8.3 Wasted or Consumed Materials In this research, all the raw materials which are used in various functional purposes and became useless for its purpose which they were designed to be used in ,so they are reused and in a new form and function such as ( plastic residues from bottles, strips, covers and tubes, , The remains of brochures and magazines, the remnants of water purifiers, cans, remnant of plastic, fabrics , paper, wood)


### 8.4 The Environmental Handicraft Materials Technical Methods Which Had Been Used in The Research

The researcher used a lot of technical methods according to each material that had been used, such as (rolling, quilling, crimping ,pasting, embroidery, hollowing ,thermoforming, weaving, coloring, and adding).

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## 9 THE EXPERIMENTAL APPLICATION

The researcher had benefit from Sudoku philosophy as a logical numbers puzzle in making contemporary handicrafts by using the solved Sudoku games to be the design basis, for a group of handicrafts, that had different areas $(20 \times 20 \mathrm{~cm})(50 \times 50 \mathrm{~cm})$, $(50 \times 70 \mathrm{~cm})$, through using the game grids after solving it, to be a guide in distributing the materials and the used technical methods in each handicraft, to get a professional balanced design, that also shows the diversity, unity, frequency, uniqueness, novelty and originality, variety, there were a group of an environmental materials, such as shells and snails, magazine sheets ,disposable pamphlets, plastic pipettes, ceramic dough, canvas, jeans, industrial fabrics, satin ribbons, crochet pieces, cotton, yarn, consumed plastic strips, wire of red copper, and wooden chopsticks, there were two types of handicrafts one of them was limited to use one type of raw materials with a variety of colors or techniques, the other was characterized by the process of combining between the different materials, so that each handicraft is different from the other ones, the researcher tried to develop a set of suitable techniques for each used material, also the transparent varnish was used in the handicrafts that needed to be protected from damage and dust, such as the ones that are made of paper or fabrics, all this appeared through the experimental application that were represented at the following handicrafts:

### 9.1 Handicraft No.(1) Texture

The researcher used deferent types of fabrics, shells, cotton and wool threads, there were also deferent Technical Methods, such as, pasting, embroidery, hollowing and adding The grid of the four-squares Sudoku game was used in the handicraft fig.no.(2), which depended on using a Piece of fabric that was divided to small squares $10 \times 10 \mathrm{~cm}$, so it was easy to apply the Sudoku game philosophy on it , where a set of technical methods were applied to each square and then repeated according to the Sudoku philosophy, the variety appeared In the handicraft through using deferent technical methods, and color groups, which varied between orange, turquoise and violet, the Sudoku philosophy had played an important role in emphasizing the repetition, harmony and integration of the handicraft parts by repeating technical methods and color combinations fig.no.(1) .

fig (1) handicraft no.(1) Texture

fig (2) the solved Sudoku game

### 9.2 Handicraft No. (2) Plastic Texture

The materials which were used in the handicraft are Disposable plastic bottles, covers and pipettes, the researcher used many technique methods such as adding, cutting, pasting, thermoforming, a grid of four squares of Sudoku were used fig.no.(4), each square of them were repeated for four times, the aesthetic values of the handicraft appeared in using a set of consumed plastics, such as plastic bottles, covers and pipettes, The researcher chose a bright color range such as orange, and violet in addition to the green color, which showed the color contrast between the hot and cold grades and had a great impact in highlighting the color in the handicraft, the used techniques also varied between Thermoforming, cutting and pasting in addition to studding with plastic mats that were flattened and pasted by using heat, The researcher used the addition method by adding layers of flat pipettes to create geometric formations that serve the design of the handicraft, and contribute to emphasis on diversity and getting away from monotony by Showing diversity through combining between flatness and shaping, The Sudoku philosophy had played an important role in emphasizing the repetition, harmony and integration of the handicraft parts by repeating technical methods and color combinations in the game squares fig.no.(3).

Proceedings of SOCIOINT 2018-5th International Conference on Education, Social Sciences and Humanities, 2-4 July 2018- Dubai, U.A.E.

fig ( 3 ) handicraft no.(2) Plastic texture

fig (4) the solved Sudoku game

### 9.3 Handicraft No.(3) Color Relationships (Forming By Quilling)

It was made by cutting the fabrics for ribbons which are varying in their length and width, then rolling each one of them to form circles or shapes look like beads, fig. (5) each one has deferent shape according to the cutting way, the aesthetic values of the handicrafts appeared in using a net of Sudoku fig.no.(6) that consists of four squares, each of one of them is repeated for four times, then the researcher used the technique of quilling the fabric Strips, it was the only technique that had been used with the change in the fabrics color combination for each one of the four squares, The researcher also tried to combine the groups of hot colors and cold colors in each square by using different proportions, so that the color balance is achieved in the handicraft fig.(5), The transparent varnish was also used as an insulation to achieve sustainability in the handicraft, The diversity appeared through color combinations, and the use of Sudoku's philosophy in the design units distribution emphasized the movement, unity, balance and integration of the handicraft .


### 9.4 Handicraft No. (4) Color and Texture Relationships

the researcher used shells, snails, transparent white glue, the technical methods appeared in using inlaying technique, varnish paint as insulation, where four squares of Sudoku net were used fig.no.(8), that each square was repeated for four times, The aesthetic values of the handicraft were shown by using the technique of Inlaying the handicraft with shells and snails, The researcher provided two different types of snails and two different types of shells, that each square of the four squares consisted a different type of shells or snails that gave four color groups that differ according to the colors of the used shells and snails, and vary in texture ,color intensity and severity, then the varnish was used as an insulation to achieve sustainability in the handicraft, the diversity was reflected in the color groups, which varied between the brown, black, purple and light orange, the use of the Sudoku philosophy in the handicraft design confirmed balance, unity, movement, and integration in the handicraft, fig.(7) .

fig(7)handicraft no.(4) snails and shells

| 1 | 2 | 3 | 4 |
| :--- | :--- | :--- | :--- |
| 3 | 4 | 1 | 2 |
| 2 | 1 | 4 | 3 |
| 4 | 3 | 2 | 1 |

fig(8) the solved Sudoku game

### 9.5 Handicraft No.(5) Texture Relationships

the materials which were used in the handicraft were ceramic dough which was prepared by the researcher, consumed materials, plant seeds, transparent white glue, Varnish, so that many technical methods had been used, like inlaying technique, rolling, forming, drilling, pasting, varnish paint as an insulating material, a four squares of Sudoku net were used fig.no.(10), that each square was repeated for four times, The aesthetic values of the handicraft were shown by using a variety of materials suitable for ceramic dough, such as plant seeds, and transparent varnish, the diversity of the handicraft appeared through the color combinations and the technical methods which were used in the four squares, so the use of the Sudoku philosophy in the design confirmed unity, movement, integration in handicraft. fig. (9).

fig (9) handicraft no.(5)ceramic dough

fig 10 the solved Sudoku game

### 9.6 Handicraft No.(6) Plastic Formations

The researcher used plastic pipettes, glue, a four squares of Sudoku net were used fig.no.(12), that each square was repeated four times, The aesthetic values of the handicraft are shown by the use of various technical methods such as cutting and studding, rolling the pipettes in large and small sizes, and shaping, each of the four squares of the Sudoku net contains a particular technical method, variety of colors were used, it varied between cold colors such as dark green and hot colors such as dark red, yellow, orange and purple, the researcher tried to take advantage of this color group to form four color groups that each one of them were repeated for four times according to the philosophy of the Sudoku game, the technical diversity were characterized by four different technical methods and color combinations, the diversity of the handicraft has been shown through bright color combinations and the used technical methods, the use of the Sudoku philosophy in the handicraft design confirmed movement, unity and integration. fig.(11).


### 9.7 Handicraft No. (7) Rolling and Quilling Formation

The researcher used pamphlets and magazines Papers ,water Colors, transparent white glue, varnish., also there were deferent technical methods, such as twisting, quilling, rolling, weaving, coloring, pasting, varnish paint as an insulating material, through using the four squares of Sudoku net fig.no.(14) that each square was repeated for four times, so the aesthetic values of the handicraft were shown by the use of various technical methods such as quilling,rolling, crimbing, and using the bright colored magazine papers, which showed the color contrast between the handicraft parts, and that was used with the rolling technique, while crimbing was used with the paper of newspapers, where the researcher used four technical methods so that each one of them was concentrated in a square, and was repeated for four times, through using a variety of technical methods that led to the appearance of four technical methods with different values and color combinations, which were differ in intensity, color, and unity, the transparent varnish had also been used as an insulating material, the use of the Sudoku philosophy in the handicraft design confirmed movement, unity and integration in the handicraft fig (13).

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fig (13) handicraft no.(7)paper

fig (14) the solved Sudoku game

### 9.8 Handicraft No. (8) Combination

The researcher used shells, satin ribbons, consumed crochet pieces, wood sticks, red copper wire, burlap, there were also deferent technical methods, such as crochet, pasting, hollowing, coloring with marbling , sewing, The researcher also used the four-squares grid of Sudoku game fig.no.(16), that each one of them was repeated for three times, a column of the grid was removed to obtain the handicraft rectangle shape, where the aesthetic aspects of the handicraft were shown by using a variety of materials and technical methods, so each one of the three rectangles contained a set of materials and technical methods that were combined together, also the use of different materials types led to have deferent color groups, and emphasized the diversity in the handicraft, while Sudoku philosophy had a great role in the distribution of the design units and technical methods, that emphasized the movement, frequency, unity and integration in the handicraft fig.no.(15).

fig (15) handicraft no.(8)combination

fig (16) the solved Sudoku game

### 9.9 Handicraft No. (9) Textures

the researcher used burlap, wool thread, plastic strips, consumed plastic, nail polish, beads and stones, there were also deferent technical methods such as marbling, hollowing, waving and rolling, the researcher also used the grid of Sudoku that contained four squares fig.no.(18), and repeated every one of them for three times, where the aesthetic aspects of the handicraft appeared through using a variety of materials and their technical methods, that the researcher used a set of plastic parts which were treated in two different ways, one of them was colored by marbling it using nail polish, while the other one was treated by hollowing and using the wool thread through the holes, then the complementary materials such as colored strips, beads were used, therefor applying the Sudoku game philosophy had an important role in emphasizing the movement, frequency, unity and integration in the handicraft fig.no.(17).

fig (17)handicraft no.(9)

| 1 | 2 |
| :--- | :---: |
| 3 | 4 |
| 2 | 1 |
| 3 | 4 |

fig (18) the solved Sudoku game

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### 9.10 Handicraft No.(10) Jeans

This handicraft depended on using deferent technical methods such as embroidery, hollowing, Additing , coloring, rolling, quiling, that the researcher used the four-square sudoku grid fig.no.(20), where three squares of it were repeated for two times, while one square was repeated for three times, the aesthetic aspects were shown by using the jeans fabric as a basic raw material, by applying its own techniques to each square, with a variety of technical methods, and several complementary materials, such as burlap, natural leather, colored ribbons, cloth buttons, crochet pieces, beads, cotton thread, also the used color group played an important role in emphasizing the color values and the contrast between the handicraft parts, through using the blue jeans fabric, pieces of orange dyed cloth, and colored crochet pieces which were treated with white glue and colored by marbling it using nail polish ,then a group of colored strips in violet tones were added to emphasize the color of the used natural leather in the handicraft, and also to emphasize the repetition, movement and diversity of the materials, where the application of the Sudoku game philosophy helped to achieve the design values in the handicraft fig.no.(19).

fig (19)handicraft no.(10) jeans

| 1 | 3 | 4 |
| :--- | :--- | :--- |
| 3 | 1 | 2 |
| 2 | 4 | 3 |

fig (20 )the solved Sudoku game

### 9.11 Handicraft No.(11) Combination

The researcher used many materials in this handicraft such as Fabrics, Colored Beads in various shapes and sizes, copper wire, canvas, consumed Plastic, jeans Cloth, cotton thread, and due to the diversity of the materials technical methods which were used according to the nature of the material ,there were a lot of applied technical methods such as hollowing, adding, twisting, weaving, stripping, folding, crimping, forming beads with copper wire, all that led to had many aesthetic values which appeared in using rich color groups that varied between the degrees of blue, brown and purple, also the use of the Sudoku philosophy through using the Sudoku game grid of six squares fig. (22), that each one of them was repeated for four times, had an important role in emphasizing Design values which wererepresented in diversity, unity, integration, and harmony as well as the repetition through repeating the technical methods and color combinations in the handicraft. fig. (21).

fig (21) handicraft no.(11)combination

| 3 | 4 | 1 | 6 | 2 | 5 |
| :--- | :--- | :--- | :--- | :--- | :--- |
| 2 | 6 | 5 | 3 | 1 | 4 |
| 4 | 3 | 2 | 5 | 6 | 1 |
| 1 | 5 | 6 | 4 | 3 | 2 |

fig (22) the solved Sudoku game

### 9.12 Handicraft No.(12) Forming By Using Crochet

The researcher used Colored fabrics, satin ribbons, there were a group of technical methods such as using dyeing, crochet, and sewing, the aesthetics of the handicraft appeared through the division of the squares, where the researcher did not use a unified size of the Sudoku game grid, which consists of six squares fig.(25), so that each one of them was repeated for four times, through using crochet technique by using ribbons which were made of fabrics instead of threads, fig.(24) that had different colors such as dark red, turquoise and violet, there was also a collection of bright colors such as red, all this played an important role

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in emphasizing the aesthetic values of the handicraft, the researcher used the standardization of the used technical methods, and using a variety of color groups, which were distributed in the handicraft according to the philosophy of the Sudoku game, that had a great role in emphasizing the, diversity , movement , integration, harmony between the handicraft parts fig. no(23).

fig (23)handicraft no.(12) fabrics

| 3 | 1 | 4 | 6 | 2 | 5 |
| :--- | :--- | :--- | :--- | :--- | :--- |
| 6 | 5 | 2 | 1 | 3 | 4 |
| 1 | 4 | 5 | 3 | 6 | 2 |
| 2 | 3 | 6 | 5 | 4 | 1 |

fig (24) the solved Sudoku game

Through analyzing the handicrafts that were the results of the researcher practical experiment in the previous presentation, it appears that the results of the research is satisfactory to a large extent, where it was possible to benefit from the application of the Sudoku game philosophy as a logical numbers puzzle, in the process of designing the handicraft, and the achievement of design values, through the color distribution and combination process between various materials, So that the process of design and implementation became more easier, enjoyable, and consuming less time, where a number of plastic and technical treatments had been applied to the used materials according to the nature of each one , The materials that were used in the handicrafts varied, that each one was distinguished by different materials from the rest of the others, there were also variety of areas, in addition to the richness of colors, all that will be helpful to the students of the first grads, and to the beginners in the handicrafts field, who have difficulty in the designing process and the imagination of materials and their combinations, as it summarized in the following results:

## 10 RESULTS

- It was possible to reduce the required time for designing the handicrafts and applying the materials and technical methods through the use of the Sudoku game philosophy.
- Appling the Sudoku game philosophy helped to achieve a balanced design.
- The ressearch showed many materials that can be used in the field of handicrafts, and the technical methods that can be used for each on of them.
- using the Sudoku game philosophy was varied in the handicrafts by changing the sizes of the handicrafts and the distribution of the materials and there technical methods which had varied too.
- creating handicrafts became more enjoyable and interesting through the use of the logical numbers puzzle through Sudoku game philosophy.


## 11 RECOMMENDATIONS

- Experimenting in various invironmtal materials and applying technical methods to suit the nature of each one of them .
- Innovating new technical treatments which are suitable to the material nature, to achieve sustainability in the handicraft.
- Attempting to access the design methods and make the implementation of the material technical methods more interesting and enjoyable, in addition to have the design principles of diversity, unity and proportion between units.
- Designing the handicrafts and its material technical methods in short time.
- Taking advantage of the available environmental materials (natural, industrial and consumer).
- Trying to find design and configuration solutions to help the beginners in the field of handicrafts, and make the implementation process mor easier and enjoyable

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