The Application of Fractal Art in the Teaching of Fine and Applied Arts in Higher Education

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Abstract: This article provides information on the role of fractal compositions in fine and applied arts, their rhythmic repetition in natural products and appearances. Fine arts classes cover the students’ teaching methods to use them in their independent work. It also reveals the student’s individual perception characteristics and ways to activate students' creative activity in the teaching of fractals in the teaching of fine and applied arts on the basis of experimental work with students.

Keywords: fractal composition, rhythm, symmetry, asymmetry, principle, method, galaxy, crystal.

Introduction

Research relevance. The role of highly qualified specialists in the ongoing reforms in the country is enormous. As the President said: “Tomorrow will require highly qualified specialists with innovative thinking and modern knowledge”. Therefore, a mature specialists training system based on the rich intellectual heritage and universal values of our people, modern culture, economy, science and technology has been developed and is being implemented at a rapid pace. The content and timing of deep and comprehensive reforms in the education system are reflected in the Law of the Republic of Uzbekistan "On Education".

The provision of all higher and secondary special educational institutions of the republic with modern computers and direct connection to the Internet has laid the foundation for the intellectual and creative knowledge expansion of youth. Each student had the opportunity to search and process materials on the Internet in their field and specialty. The wide network of information systems allows the population to be aware of the Presidential and the Cabinet of Ministers decisions and orders on the development of socio-economic spheres, to understand their essence and implement them in practice. In particular, the President of the Republic of Uzbekistan Resolution of the Republic of Uzbekistan on March 21, 2012 "On measures for further introduction and development of modern information and communication technologies" and the implementation of this resolution for 2012-2014 ensuring the quality of the program is a modern requirement. Indeed, there is no doubt that the importance of information technology in the steady development and rapid development of society. At the same time, the introduction of information technology in various spheres of society, the specialists training with practical skills and theoretical knowledge is also a topical issue.

It is known that fractals are now widely used in computer graphics, physics and various other natural sciences, as well as in radio engineering, telecommunications, cinema, television as special effects and visualization elements. Depending on the study level, the study of methods for constructing geometric fractals, the development of geometric models, the development of efficient computational algorithms and software are among the most important issues.

Consequently, the application of fractal art in the teaching of fine and applied arts in higher education has identified the problem of our research and demonstrates the relevance of the topic. Therefore, in higher education, the need for textbooks to teach the creation of fractal compositions in the study of fine and applied arts remains growing.
Taking into account the problems that need to be addressed, as well as the current development of science and art, the modern production level, the shortcomings in the teaching of fine and applied arts in higher education based on the application of fractal art. It is necessary to improve the training of teachers of fine and applied arts.

In order to develop students' creative abilities, it is recommended to practice fine arts and teaching in the classroom, taking into account the specifics of teaching fine and applied arts.

The use of facts in applied art compositions, color palettes, and graphics teaches students to observe, to enrich their imaginations, and to see the fractality of the structure of objects.

It is well known that many sets of phenomena in nature have two characteristics: first, they are very large, multifaceted and complex, and second, they are formed under the influence of a very small number of simple laws and develop according to these simple laws.

These range from crystals and simple clusters (clouds, rivers, mountains, continents, stars, etc.) to ecosystems and biological objects (from crustaceans to the human brain). Fractals are just such objects: on the one hand, they are complex (consisting of an infinite number of elements), and on the other hand, they are based on very simple laws. Because of this feature, fractals have much in common with many natural objects and phenomena. But the fractal is distinguished by a certain ease with respect to the object of nature, i.e. it has a strict mathematical precision and is subject to a strict description, definition and analysis.

Therefore, fractal theory allows us to predict the growth rate of the root system of plants, the amount of labor required to dry the swamp, the dependence of the straw mass on the length of the branches, and many other factors.

This new trend revolutionized twentieth-century science on a par with probability theory and quantum mechanics. Objects of fractal geometry, in their appearance, are very different from the geometric "straight" shapes that are common to us. In fact, it was a major breakthrough in the mathematical description of systems that have long been beyond description. Fractal kits have a number of unusual features. Their length in "macroscopic" dimensions depends on the length of the part being measured. Often, in the case of books, for example, the length is infinite and the area is zero. This means that such objects cannot be considered one-dimensional or two-dimensional.

Fractal is not a “pure” geometric theory. It is a concept that encourages the researcher to look at the world from a new perspective, a new perspective on what is already well known, a change in perception of being.

Modern models are so beautiful, charming and mysterious that they can drive influential student and research scientists crazy. Images of fractals in different colors amaze with their unprecedented harmony.

The concept of fractal was invented by Benoit Mandelbrot himself (Latin for fractus, broken, divided). In 1975, he explained fractals in his book “Les Objets Fractals: Forme, Hasard et Dimension”. In this book, Mandelbrot first uses the term "fractal" to describe a rare event that exhibits unpredictable and surprising behavior. These emergencies occur when a recursive algorithm is used to obtain a curve or set. The Mandelbrot Collection is one such event named after its researcher.

The word fractal is derived from the Latin word ‘fractus’, which means ‘fragmented’, ‘composed of parts’, and it is derived from the terms ‘fraction, fractional’ (unit, division). Till today, the concept of fractal has no clear definition, but from a mathematical point of view, fractal is a set of fractional dimensions.1

1 Mandelbrot B. Fractal geometry of nature / B. Mandelbrot. - M .: Institute for Computer Research, 2002.—p. 656
The concept of fractal and fractal geometry became firmly entrenched in the scientific research of mathematicians and programmers in the mid-1970s and 1980s.

The term fractal was coined by the American scientist Benoit Mandelbrot in 1975 to describe uneven but self-similar structures.

The origins of fractal geometry can be traced back to the 1977 book The Fractal Geometry of Nature by Benoit Mandelbrot. In this book, Mandelbrot made extensive use of the results of scientific research of several scientists (Poincaré, Fatu, Julia, Cantor, Hausdorff, etc.) who worked in this field from 1875 to 1925.

**What is fractal?** Fractal is a term that has a self-similarity, that is, a geometric shape, each consisting of several parts that repeat the whole shape. Broadly speaking, a fractal is a set of fixed topological points with a fractional metric size or metric size. It should be noted that the word "fractal" is not a mathematical term and does not have a strict mathematical definition. It can be used when studying a form that has any of the following properties:

1. To the order structure at all levels. They are also different from regular shapes (circle, ellipse, function graph): if we look at a small part of a regular shape on a very large scale, it looks like a straight line.

The growth of the scale for fractals does not lead to the simplification of the structure, we see the same complex picture at all levels.

1. Self-similarity or has a close resemblance to itself.

2. From the topological dimension to the fractional metric dimension or chemometric dimension.

3. Can be constructed using recursive mode.

The following are definitions of fractals.

As mentioned above, fractals do not have a clear definition, but we do find different definitions in the literature. A fractal is a geometric fractal that is made up of parts, each of which represents a reduced copy of the whole fractal. A fractal is a geometric shape that repeats itself over and over again, changing the size of a particular part. A fractal is a structure that is, in a sense, completely identical.

A fractal is a broken spatial shape, flat or uneven, chaotic or concave, and a complex structure that repeats itself on different scales. These are self-contained structures of images that do not depend on the fractal scale. A set whose fractal Hausdorff size is strictly larger than its topological size.

Fractals are self-similar collections of dimensional size, infinitely self-similar forms, and fractional collections. Here are a few more.

Based on the above definitions, they can be divided into two groups:

**Mathematical definition of fractals.** Fractals are functional or generative sets expressed as a result of infinite recursive processes and have the following properties:

- self-similarity or scale invariance (infinite scaling), that is, on a small scale and on a medium scale, it looks like a large scale;

- the fractional dimension (called the Hausdorff dimension) is strictly larger than the topological dimension;

- non-differentiable and fractional products are also defined in integrals.

**Physical description of fractals.** Fractals are geometric objects (lines, surfaces, objects) that represent a strongly shear structure and have a similar character on a limited scale.
Fractals are primarily the result of abstraction, a theoretical model, a boundary transition that does not exist in reality. However, there is no definitive definition of fractals. But fractal geometry is the geometry of nature.

Self-similarity – one of the main properties of fractals. In the simplest case, a small part of the fractals contains all the information about them.

Fractional – another feature of fractals. The fractals fractionality is called the mathematical expression for the fractal error degree.

In fractals, size is also a key concept. There is a size concept in Euclidean geometry. That is, the cross-section is one, the circumference is two, and the sphere is three. For example, if we divide the section length into pieces, then the section size is N, if the section is two, then 2N, and if the section is ten, then 10N. In this case, the correct proportionality is observed. When we measure the area, we get the following values: 4N, 100N, where the relationship is quadratic. The size of a three-dimensional shape is proportional to the linear dimensions of the cube. If we apply this rule to fractal objects, we get a paradoxical case of fractions.

References
1. Shavkat Mirziyoyev "We will resolutely continue our path of national development and raise it to a new level" - T., "Uzbekistan", 2017.
5. Law of the Republic of Uzbekistan "On the National Training Program". // Harmoniously
developed generation is the basis of development of Uzbekistan. –Tashkent; "Sharq", 1997, p. 31-61.


