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WORKING ON THE SUBJECT OF FUNDAMENTALS OF GRAPHIC ILLUSTRATION

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Annotation: This article presents the development of assignments in the subject of Fundamentals of Graphical Representation. It highlights the importance of structured tasks aimed at improving students' understanding of basic concepts in technical drawing, including orthographic projection, axonometry, and section views. The study focuses on task-based learning as a method to enhance visualization, precision, and independent problem-solving skills. Special attention is given to the integration of didactic principles and modern teaching technologies to make the learning process more effective and engaging.

Keywords: graphical representation, technical drawing, task development, orthographic projection, engineering graphics, visualization, didactic principles, axonometric drawing

In ancient Egypt, geometry was used mainly for practical purposes, in land surveying and architectural construction. They were based on simple but accurate measurement methods and used laws similar to the Pythagorean theorem. In the art of depiction, a method known as the "Egyptian rule" was formed, in which people and objects were depicted in frontal and side views.

Ancient Greek scientists, including Thales, Pythagoras, Euclid, and Archimedes, developed geometry on a theoretical basis and formulated its rules. Euclid developed an axiomatic system of geometry in his work "Elements". The Greeks introduced realism into art by focusing on relative size, proportion, and perspective in their methods of depiction.

In general, while the Egyptians used geometry for practical purposes, the Greeks studied it in depth theoretically and created its scientific foundations. In terms of depiction methods, while Egypt relied on a frontal and schematic approach, Greek art was based more on naturalism and proportion. These studies also had a great influence on the development of science and art in the later period.

Geometry and depiction methods in ancient Egypt

In ancient Egypt, geometry was associated with vital needs and played an important role mainly in land surveying, the construction of pyramids and temples, and in the agricultural system. Since the boundaries of land areas disappeared as a result of the floods of the Nile River, the Egyptians developed special measurement systems. They used simple arithmetic and geometric formulas to determine the surface of the earth, correctly place buildings, and perform engineering calculations.

In ancient Egyptian art, depiction methods had a unique schematic approach, in which the human body was depicted according to certain rules. For example, a person's head and legs are depicted

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from the side, while the chest and eyes are depicted directly. This "Egyptian rule" has long dominated art, used to express holiness and order.

Research by ancient Greek scientists in geometric and representational methods

In ancient Greece, geometry was not only a practical field, but also the focus of philosophical and scientific research. Thales was the first to explain geometry on a theoretical basis, while Pythagoras studied the relationship between numbers and shapes. Euclid's "Elements" set out the basic rules of geometry and had a great influence on subsequent centuries. Archimedes, on the other hand, discovered new principles for calculating the area of a circle, measurements, and volume.

In the field of fine arts, the Greeks tried to depict the human body in a way that was proportional and natural. They understood perspective and tried to reflect depth in landscape paintings. Through this, ancient Greek art had a realistic and dynamic appearance, unlike the traditional frontal images in Egypt.

Comparison of geometry and methods of depiction in ancient Egypt and Greece

There are a number of differences between the geometry and methods of depiction of ancient Egyptian and Greek scientists:

• While the Egyptians used geometry for practical purposes (land surveying, construction and engineering), the Greeks developed it theoretically and used it to create mathematical foundations. Figure 1

• Egyptian fine art was schematic and formalized, while Greek art was based on naturalness and proportion.

• The Egyptians used measurements and shapes in practice, while Greek scientists studied the general laws of geometry and developed it with abstract concepts.

These scientific and artistic researches later developed further in the Roman, European and Islamic worlds, laying the foundation for the formation of modern geometry and fine arts.

Some of the methods of representation described in the works of "Geometry" and "Astronomy" by the great Central Asian scholars and encyclopedists Muhammad al-Khwarizmi, Abu Nasr al-Farabi, Ahmad Farghani, Abu Rayhan al-Biruni, Abu Ali ibn Sina, Omar Khayyam and others, who lived in the 9th-11th centuries and mastered one or more fields of science and conducted major research in various areas, are presented. We present some information about the lives and research of these scholars.

Muhammad al-Khwarizmi (783-850). Al-Khwarizmi's full name is Muhammad ibn Musa al-Khwarizmi. He is a famous mathematician and astronomer from Central Asia. Al-Khwarizmi was born in 783 in Khorezm (Khiva) and died in 850 in Baghdad (Iraq). Al-Khwarizmi arrived in Baghdad at the end of the 8th century. Scholars and people of various professions began to

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settle in Baghdad. The development of science dates back to the period of the caliphate of Harun al-Rashid (786-809) and his son al-Ma'mun (813-833).

Al-Ma'mun built the "Bayt al-Hikmat" ("House of Wisdom") in Baghdad. The "House of Wisdom" had a well-equipped observatory and a rich library. It could be called the Academy of Sciences of its time.

Upon arriving in Baghdad, Al-Khwarizmi engaged in scientific research. He diligently studied the works of the ancient Greek mathematicians Euclid, Archimedes, and Apollonius, as well as the works of ancient Indian astronomers and mathematicians. His first research work in Baghdad was editing an Arabic translation of the Indian astronomical work "Sindhanta".

Al-Khwarizmi soon gained fame throughout the Middle East in mathematics, astronomy, geography, history, and medicine. He supervised the library, observatory, and all scientific research work in the "Bayt al-Hikmat." If we call the "House of Wisdom" the Academy of Sciences, then Al-Khwarizmi was the president of that Academy.

Khwarizmi's contribution to the development of mathematics is incomparable. His treatise "Indian Calculus" is devoted to the decimal system of numbers (0, 1, 2, 3, 4, 5, 6, 7, 8, 9), which he supplemented by introducing the number "zero". Khwarizmi simplified these numbers, discovered in India, and for the first time described them in Arabic. These numbers passed from the Indians to the Arabs, and then to Europe, thanks to Khwarizmi's treatise in the 11th century.

Khwarizmi is considered the founder of the science of algebra. The term "algebra" comes from the Latin spelling of the word "Al jabr" in his work "Al jabr wal muqabala".

Abul Abbas ibn Muhammad ibn Kathir Farghani (797-865). He is a great astronomer, mathematician and geographer. In European scientific literature, he was called Alfraganus.

Ahmad Farghani worked in Baghdad during the reign of al-Ma'mun, son of Harun al-Rashid (813-833), together with Central Asian scholars Muhammad ibn Musa al-Khwarizmi, Abbas ibn Sa'id al-Jawhari, and others. They initially translated the works of Greek scholars into Arabic, and then created independent works in Arabic themselves. Caliph al-Ma'mun built an observatory in 829 under the "Bayt al-Hikmat" (House of Wisdom) in Baghdad, and in 832 in Damascus.

Farghani's first work was called "Introduction to Astronomy." With this work, Farghani showed that he was an accomplished astronomer. Farghani had previously demonstrated his deep knowledge of astronomy by predicting a solar eclipse in 812.

Interest in Ferghani's works continued in Europe after the 13th century. His Elements of Astronomy was translated into Latin by Jacob Gallius in 1969 and published in Amsterdam with an Arabic text.

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Ferghani wrote a work entitled "Thirty Chapters on the Introduction to the Almagest" dedicated to the commentary on Ptolemy's "Almagest". He continued to write books on astronomical instruments and also created a complete book on the "Asturlobe" and works such as "On the Making of the Asturlobe".

In his work "On the Making of the Asturlobe", Ferghani gave the following concepts about stereographic projection. He described the method of projecting a sphere from a point S onto a plane drawn from a point S1 diametrically opposite to this point and its properties:

1. Circles lying on the sphere are projected onto the plane through the center S as circles. If the circles pass through the center of the sphere, they are projected as straight lines.

2. In stereographic projection, the angles between the curves lying on the sphere when projected onto the plane are equal to the angles between the curves that are their projections.

3. When the sphere rotates around the diameters S and S1, the tangent plane also rotates around that point by the same angle.

These properties are also found in the works of some scientists who lived before Ferghani (for example, Ptolemy). However, they did not prove these properties. Ferghani gives a complete proof of the first property in the above-mentioned work. In this, he bases his proof on the following lemma: suppose that when a circle is projected onto a straight line, the points M and N of the circle pass through the points M′ and N′ of the straight line. Then SMN = SN′M′, SNM = SM′N′ (Fig. 1.2.1, Appendix 2).

Abu Nasr al-Farabi (873-950). Al-Farabi is a great Central Asian encyclopedist. His full name is Abu Nasr Muhammad ibn Muhammad ibn Uzlug Tarkhan Al-Farabi. He was born near the city of Aris, Shymkent region, present-day Kazakhstan. His father was from the Turkic tribes and was a military officer. He received his initial education in his native land, in the cities of Tashkent (Shosh), Bukhara and Samarkand. Later, his passion for science led him to Baghdad, the scientific center of that time. In Baghdad, Al-Farabi, like other scientists, first studied medieval science and various languages, and then began to write independent works.

Al-Farabi defines mathematics as a science that studies the quantitative and spatial relationships of objects and divides it into seven parts.

The first part is arithmetic - the science of numbers, which consists of theoretical and practical parts.

The second part - geometry - arose from the fact that different parts of existing things have different shapes and the need for a science that studies their measurement. "Thus, geometry is a measuring science, through which we know the measurement, compare lines, surfaces and volumes with each other," writes Farabi.

The third part - optics - the science of observation - also belongs to geometry, it studies the shapes of figures, distances between objects using light and light.

The fourth part is devoted to the science of stars and is the science of astronomy.

The fifth part is the science of music. The reason for the inclusion of the science of music in mathematics is that Al-Farabi studied the mathematical principles of the harmony of melodies. In his work "The Great Book of Music", he also presents various tables and geometric drawings of the harmony of melodies. This work does not only consist of music theory, but also gives musical instruments known in the East such as the rubab, tanbur, drum, flute, and the rules for playing melodies on them.

Al-Farabi also wrote many works on mathematics. These include "A Word on Volume and Quantity", "A Short Book on Introduction to the Geometry of Space", "The Book of Applications" and "The Book of Subtle Secrets of Geometric Figures and the Book of Intelligent Methods of Thinking".

Abu Rayhan Al-Biruni (973-1048). Beruni's full name is Abu Rayhan Beruni Muhammad ibn Ahmad) - a great medieval encyclopedist. He was born in the city of Qiyat in Khorezm. Qiyat was located on the site of the present-day city of Beruni.

Beruni was interested in science and knowledge from a very young age. His favorite subjects were astronomy, mathematics, geodesy, geography and mineralogy. He writes in his work "Geodesy" that he determined the geographical latitude of the city of Qiyat.

In 1022-1024, Mahmud of Ghaznavi took Beruni with him on his campaign to India. During the trip, Beruni also studied science. He measured the length of one degree of the meridian of the globe near the Nandna fortress in Punjab and determined that it was 110,895 km. This information is compared with the result of modern measurements of 111.1 km, and the accuracy of Biruni's measurements is much closer. He collected material for his future work "History of India" in India and completed it in 1030. That year, Mahmud died and was succeeded by his son Mas'ud. Mas'ud showed many favors to Biruni. For this reason, Biruni dedicated his masterpiece to Mas'ud and called it "The Canon of Mas'udi".

Biruni's contribution to mathematics and other fields of science can also be seen in the more than 100 works he wrote down. The largest of them are "India", "Monuments", "The Canon of Mas'udi", "Geodesy", "Minerology" and "Astronomy".

Abu Ali ibn Sino (980-1037). Abu Ali Al Hasayin ibn 'Abdullah Ibn Ali (980.8, Hussein). When Hussein, Ibn Sino joined the capital-Bukhara and to study it They will give them the age of 10 years old. He also reads the fields of Ibn Sina, who reads the Arabic language and literature. He reads the Arabic language and literature perfectly. Ibn Sina was known as a skillful physician of the Greek Authors as well as Ibn Sina, in this book, and in this book. Ibn 'Mamun (997-1009) and Mamun ibn' Mamun (1009-1017) were very interestive in science and created a comfortable environment for scientists for scientific creatures. These include large mathematical and astronomy Abu Sahl Christmi. , honor, "Hujat Al Khaqq" (Evidence "(" Indeed, "Ibn Sina in the history of the world. The various sources have written more than 450 works, but it is the name of its medical legacy, especially in the West. at -category: Interpretation - Interpretation: Al Burhan -

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Proof; al-Signica - Rialectics; Al Knismica - Regretic; Ash-poem-poetry -Poetics (the art of poem); 2) Nature (here minerals, plants, animals and humans are discussed in separate sections;

3) Mathematics - divided into 4 disciplines: arithmetic, geometry, astronomy and music;

4) Metaphysics or theology. Parts of this work have been published in Latin, Syriac, Hebrew, German, English, French, Russian, Persian and Uzbek.

Ibn Sina's worldview is shaped by the teachings of Aristotle and the works of Al-Farabi. The simplest indivisible form of matter consists of 4 elements: air, fire, water, and earth. As a result of their various combinations, complex material objects are formed. Complex objects can change in form, but the 4 elements that are their material basis do not disappear, they are preserved forever. According to Ibn Sina, first mountains and rocks appeared, then plants, animals, and as a result of development, man appeared, who differs from other creatures in his mind, ability to think, and language.

“Logic,” writes Ibn Sina, “gives man such a rule that, with the help of this rule, a person is protected from errors in drawing conclusions.” He deeply studied logical methods, the issues of description, judgment, conclusion, and proof, and developed the science of logic after Al-Farabi as the correct method of knowledge.

In his opinion, volcanoes are actually associated with mountain formation and earthquakes. Mountain formation itself occurs in 2 ways:

1) the uplift of the earth's crust during strong earthquakes;

2) the gradual action of water and air, which causes deep ravines to form, and as a result, a height is formed near them. There are also several reasons for the occurrence of earthquakes.

Ibn Sina was interested in astronomy from his youth and maintained this interest until the end of his life. He devoted separate chapters to astronomy in 8 independent treatises and in the mathematical parts of the "Book of Healing" and "Donnishnama". He revised Ptolemy's "Almagest" and created a manual on practical astronomy on its basis.

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