The Teaching Method Combining Art Design and CAD Design

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Abstract. The implementation of art education in the teaching of engineering graphics is helpful to cultivate engineering interdisciplinary talents. At the same time, many teaching links of engineering graphics are permeated with the content of art education. Therefore, the content of art design can be integrated in the teaching practice of engineering graphics. Use abundant materials at any time to carry out art education for engineering students. Cultivate everyone's artistic literacy. At the same time, to promote students' learning of projection theory and mapping knowledge. This paper focuses on research from the aspects of graphics and aesthetics, graphics and sketches, and graphics. It constitutes a systematic integration method of graphic thinking and artistic thinking. This paper discusses how to integrate art education in engineering graphics teaching. Then it provides a beneficial exploration for the innovative education of engineering graphics.

Keywords: Engineering Graphics; Art Education; Convergence; Innovation Education
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1 INTRODUCTION

Most engineering students have a realistic and pragmatic attitude to study, scientific and rigorous thinking ability and strong scientific research practice ability. However, it is this rigorous, pragmatic and truth-seeking atmosphere that enables engineering students to absorb a large amount of natural science knowledge. However, these college students tend to neglect the cultivation and improvement of their humanistic qualities. The State Council of China has issued a related document titled "Decision on Deepening Educational Reform and Promoting Quality Education in an All-round Way". The document pointed out that art education can not only cultivate sentiment and improve literacy, but also help develop intelligence [1]. Art education plays an irreplaceable role in promoting the all-round development of students. Art education is an important part of quality education and a catalyst for innovation and practice. Art education is an

important means of cultivating well-rounded talents. Education without aesthetic education is imperfect education. Therefore, engineering students need to implement art education. Art education is the key to cultivating engineering compound talents. However, engineering schools

Art education is different from pure technical teaching in general art schools. These engineering theoretical education models are new forms of art education that comprehensively consider diverse factors. This format aims to integrate arts education into the engineering curriculum [2]. This article focuses on how to integrate art education into the teaching process of engineering graphics.

2 RELATED STUDIES

The aesthetic theorist Aristotle once said that beauty lies in order, symmetry and clarity [3]. Engineering graphics is a subject with graphics as the research object, and it also pays attention to reasonable, simple and clear expression. The course of engineering graphics contains rich aesthetic factors. This kind of course teaching provides a wide range of ways for students' aesthetic education. The teaching of engineering graphics should be through artistic teaching activities. It integrates science, engineering and artistry, and constantly reveals the beauty of engineering graphics. Students get aesthetic education in the study of graphic knowledge, and get the edification of beauty. In teaching practice, materials can be drawn on the spot at any time. This method can guide and stimulate students' aesthetic taste and deepen the content of engineering graphics. Classroom teaching introduces students to various line types such as thick solid lines, thin solid lines, and dashed lines in drawing. Classroom teaching can make students feel the different expressions of various lines. Classroom teaching can express various linear emotions through body odor. Develop students' perception of linearity. For example, a thick solid line has the characteristics of being rough, bold, masculine, strong, and heavy. This solid line segment expresses the outline of the part. Thin solid lines reflect the characteristics of refinement, straightness and sharpness. Comprehensively show the dimension line and section line of the tire. Dashed lines have a fuzzy and unreal feel and are used to represent invisible but existing contour lines.

When teaching the content of "Physical Analysis of Combinations", if the classroom teaching simply talks about the content of the body [4]. It is a bit difficult for students to grasp. But current research combines teaching with aesthetic observation of objects. Teachers can guide students to study while observing the aesthetic laws in graphics. For example, the beauty of order in the arrangement of point-to-line and dimension lines. Symmetrical aesthetics in section views of parts of revolution. Harmonious beauty in the layout of the drawing. The contrasting beauty that exists in the cutaway view. Burkett and Dwyer [5] mentioned through multi-angle and multi-method aesthetic observation, students can more easily imagine the graphic features of objects in their brains. Students can grasp the characteristics of the body. This lays a good foundation for learning the three views of the composite. Intelligent visual art is characterized by multidisciplinary intersectionality, involving technology, art, and philosophy, which have been developing through interweaving, mutual inspiration, and influence. The scope of this paper is to analyze and interpret the creation of intelligent visual art based on deep learning in the context of the era of artificial intelligence, to find the core theoretical support around the background of art, design, philosophy, and other related disciplines, to determine the scope of this paper and thus to elaborate it, and the author will do his best to sort out these contents so that this paper has a rigorous academic foothold. For example, Silverman and Hudson [6] explores the relationship between visitors and spatial animation in the form of immersive exhibitions, and so on, in different forms of interactive animation creation attempts. Khan and Gunpinar [7] said no matter how the forms change, the goal of using these design methods is to better communicate the message. When the user has a good experience in the work, it will be easier to accept the information conveyed in the work, so that the work can achieve the purpose of efficient information output.

This paper focuses on the drawing layout on the drawing. Lawless et al. [8] mentioned that it strives for a well-proportioned layout and takes full account of the location of dimension lines. This process is actually composition in art design. Our teachers can compare through different layouts. Teachers can experience the ideal composition scene, and the composition results should make people feel comfortable and pleasing to the eye. When making a partial enlarged view or a section view, you can work with students to explore the rules of formal beauty used in composition. Such as: balance and symmetry, contrast and harmony, proportion and scale, rhythm and rhythm. As well as individual and subject, difference and harmony, Billault et al. [9] said that singularity and order. Students' drawing assignments can also demonstrate an aesthetic of vividness and order. The last part of the mechanical drawing class is for students to draw the assembly drawing of the reducer. In this process, teachers can guide students to appreciate the beauty of principle, beauty of organization, beauty of appearance, beauty of packaging and other contents of the component. Thereby improving the aesthetic ability of students [10]. So as to inspire students to create beauty. Lay the foundation of "creativity" for subsequent professional course design.

3 RESEARCH ON THE TECHNOLOGY OF ART DESIGN AND CAD ENGINEERING DRAWING

3.1 Computer-Aided Design on Freehand Drawing and Sketching

The course system of engineering graphics includes the link of "Surveying and Mapping of Mechanical Components". At this time, it is necessary to draw freehand sketches, discuss design plans and technical exchanges. Sketches are also often drawn during site visits. The process of creating a sketch is not simple. Manual drawing without drawing instruments. Through a figurative thinking process, an image is generated through the brain's thinking. Sketched by freehand. However, sketching is an important foundation course for art and design majors. Through various drawing techniques, the body observed by his eyes is presented concretely.

Emphasis is placed on expressing the structure of geometry, assemblies and parts. Transition from ruler and ruler drawing to freehand three-dimensional drawing. Introduce the common sense and essentials of sketching, and train the perception ability of observation and visual observation. It helps us to understand the contents of "near big and far small", "near real and far virtual", "one-point perspective", "two-point perspective", "three-point perspective", "curve perspective" and so on. In line with the "three sides and five tones" rule of light and dark transition. Combine the projection analysis of graphics with the visual experience of sketching. Practice skills that can not only describe accurately, but also sketch quickly. While doing the exercises, students can also be encouraged to sketch the parts using a combination of known projections and spatial imagination. This method converts three-sided projections into three-dimensional figures on paper, helping students solve problems and understand projection theory. Engineering students are able to overcome these problems by introducing the concepts and knowledge of sketching. Due to the psychological burden caused by the difficulty of developing imagination, it can also allow students to diverge their thoughts, as shown in Figure 1.

The computer-aided design approach focuses on the use of graphic design software to create a graphic plan. When sketching, pay attention to figure scale and layout. This is consistent with the requirements of design sketches. Freehand drawing of parts is actually a sketching process. In the teaching of engineering graphics, descriptive geometry, mechanical drawing and perspective can be combined. Design sketching is trained by strengthening the freehand sketching of parts. This is beneficial to develop students' sketching ability. For example, the construction of axonometric and perspective projections in engineering graphics is similar to structural sketching. Teachers can give theoretical guidance to the course through axonometric projection and perspective projection of graphics. Use basic drawing as a drawing technique.

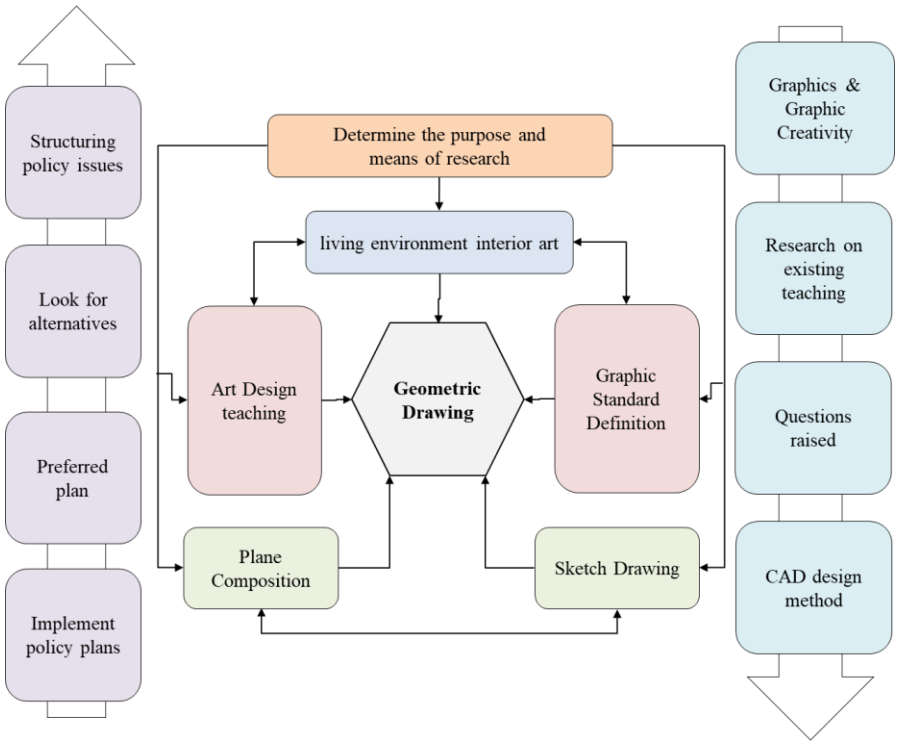

Figure 1: Computer-aided design on freehand drawing and sketching.

3.2 Analysis of Engineering Graphics and the three Components

Drawing on paper can help students develop free associations. Students find high interest in learning. At the same time, students recognize the importance of freehand drawing. Students develop good design habits while being exposed to design. Art design pays attention to three major components, namely plane, three-dimensional and color. There are also three important links in engineering graphics, namely geometric drawing, composite configuration and three-dimensional modeling. These links are permeated with three components. Teachers can edify students with art in these links, as shown in Figure 2.

Plane composition is to study two-dimensional space and sort out the interior according to the rules of formal beauty. Focus on the decomposition of modeling elements such as points, lines, and surfaces. By combining, deforming, reconstructing, etc., the ideal form is formed. The engineering drawings are also in compliance with certain national standards. Under the premise of industry sector standards, it consists of some basic geometric elements such as points, lines, and surfaces. Finally, relevant engineering and technical information can be transmitted. Therefore, through mathematical description of geometric figures, connection drawing, configuration work, etc. It can enable students to initially grasp some basic laws about plane composition. Let students feel the art of organically displaying geometric shapes. For example, a butterfly drawing exercise can inspire students' creativity. Give new forms and new content to point, line, and surface expressions. In the process of drawing, it can be represented by some basic elements in points, lines and surfaces. It is also possible to express all three elements at the same time. However, the visual effect conveyed is different. Different expression techniques such as the size, square and circle, virtual and real of the basic elements will also bring different intuitive feelings to the picture. This makes the engineering drawing a rich and powerful picture. The composition of the screen includes various elements such as points, lines, and planes. The content of the drawing is rich in

connotation, thus exercising the students' creative thinking. Adds artistry, liveliness and fun to engineering graphics courses.

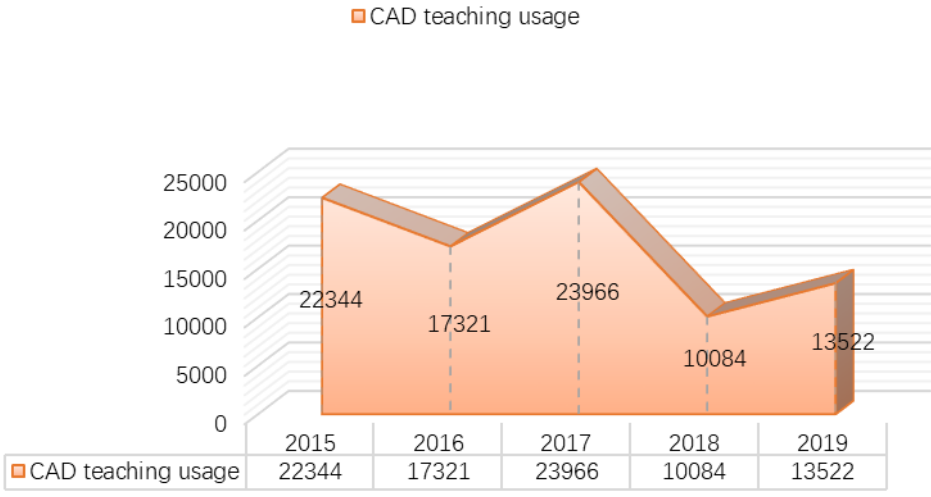

Figure 2: CAD Design and Graphic Creativity.

In the teaching of geometric drawing, the configuration design training of plane graphics can be added. Use common shapes such as lines, hexagons, circles, and arrows as basic shapes. According to the requirements of plane composition, the requirements of emission, gradient, and specificity are carried out. And then design different shapes and meaningful patterns. Such as allowing students to imagine configuring these basic shapes according to the emission laws. Further, guide the students and put all the emission graphics together. Build a strong visual effect with visual focus, dazzling look and dynamic perception. Make students feel the speed and other aspects from it, and enhance the visual impact. Through the training of geometric configuration, students' physical imagination and spatial thinking can be cultivated. Especially the ability to think creatively.

The specific loss of the two network models, U-net and SGRU, as shown in Figure 3. As the data in the figure shows, the training loss of the two network models is relatively similar at the first training round, but when the number of training rounds reaches 50, the loss difference between the SGRU network model and the former reaches 3134.683. Thus, as the number of training rounds increases, SGRU can achieve lower image loss than U-net, and the network performance of SGRU is significantly better than U-net. The network performance of SGRU is significantly better than that of U-net.

In order to verify the visual effect of the proposed coloring method, the author discussed with the team and proposed to conduct another. The same character illustration sketch is input into the SGRU network model and the same type of sketch coloring programs Paints chinar and Style2paints, and the images of coloring effects of the sketch and several different programs including the SGRU network model are compared, as shown in Figure 3. It is hoped that through compiling, comparing, and analyzing the coloring images outputted by different programs, the author can focus more on the degree of realism, image quality, and visual effect of the automatic coloring effect of different programs, and promote the results of the deep learning algorithm-based coloring method for illustration. At the same time, we hope that the process and the results of this experiment can be used as a reference for more active cooperation between art and computer disciplines in the future.

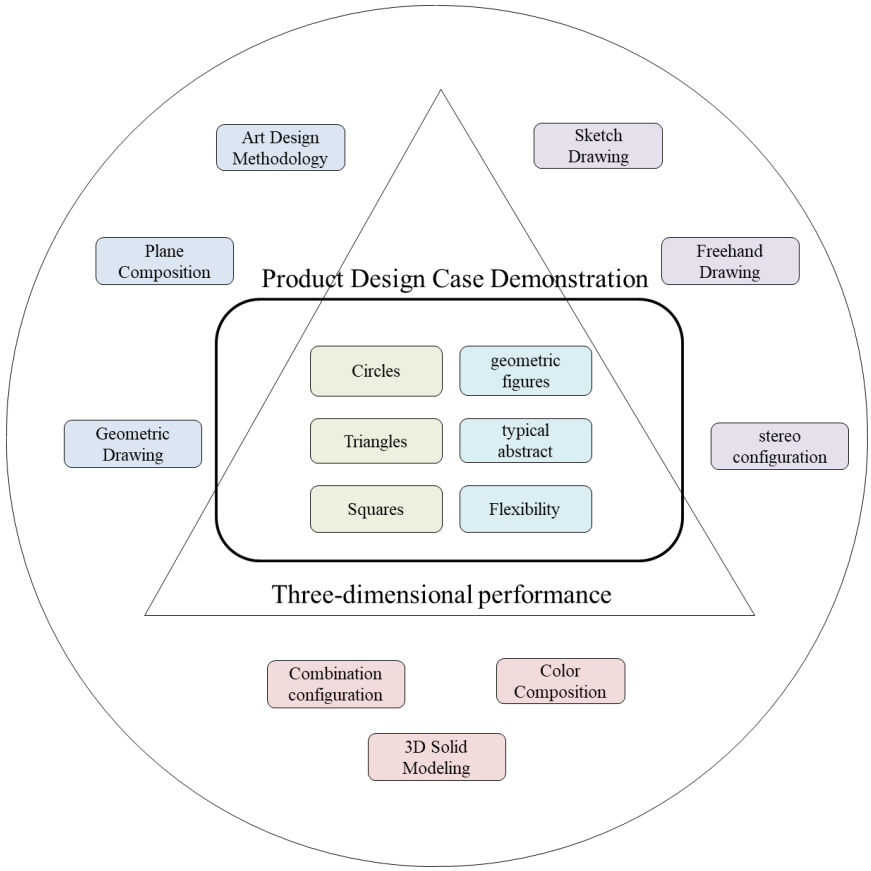

Figure 3: Engineering graphics and the three components.

Three-dimensional composition is the combination of artistic elements such as points, lines, surfaces, and bodies. The cycle proceeds from splitting to combining or combining to splitting. Finally, it realizes the mutual restoration of any form and point, line, surface, etc. Only the three-sided projection of the composite can uniquely determine the shape size. The configuration principle of the composite body is to conceive the shape and size of the composite body according to the projection of one or two sides. Further, express the shape of the idea. This process requires spatial imagination and creativity. For the combination configuration or three-dimensional composition. The same floor plan can generate an infinite number of different three-dimensional shapes. For this part of the content, teachers should be good at classifying the projection characteristics of basic geometric elements (points, lines, planes and basic solids). By choosing typical examples that draw inferences from others. Take advantage of the cumulative nature of its projections. Derived from known conditions to imagine a variety of stereo possibilities. To improve students' divergent thinking ability. For example, a line on a plane might correspond to a curve passing through that line. Include any straight line or curve in a vertical plane. A rectangle on the plane may correspond to a cuboid or a cylinder. There are also three-dimensional forms such as prisms and various irregular cylinders. A circle may correspond to three-dimensional shapes such as cylinders, cones, spheres, etc. A composite is formed by cutting, combining and accumulating basic three-dimensional elements. These exercises enable students to learn the principles of three-dimensional composition of basic shapes. Help them come up with newer, unique combinations.

4 ANALYSIS OF RESULTS

4.1 Combination Configuration and Three-dimensional Composition

Color composition is the spatial combination of two or more colors. Through the relationship of mutual comparison, the focus is on the contrast of the three elements of color, the contrast of cold and warm, and the contrast of area. In the theory of engineering graphics, the application of three-dimensional solid modeling is very extensive. In order to correctly reflect the physical effect of the product, a highly artistic real rendering effect is produced. Thereby helping users better understand and accept the product. Render retouching is required for the product. Rendering of 3D solids is based on color composition. Mastering the mixing method of colors is beneficial to the display of 3D solid modeling drawings. Through the picture brightness gradient, purity gradient and hue gradient and so on. It further expresses the spatial coordination of 3D solid modeling. These methods help to grasp the components of color. It is beneficial to reconcile the color and make the 3D solid modeling drawing look more comfortable, as shown in Figure 4.

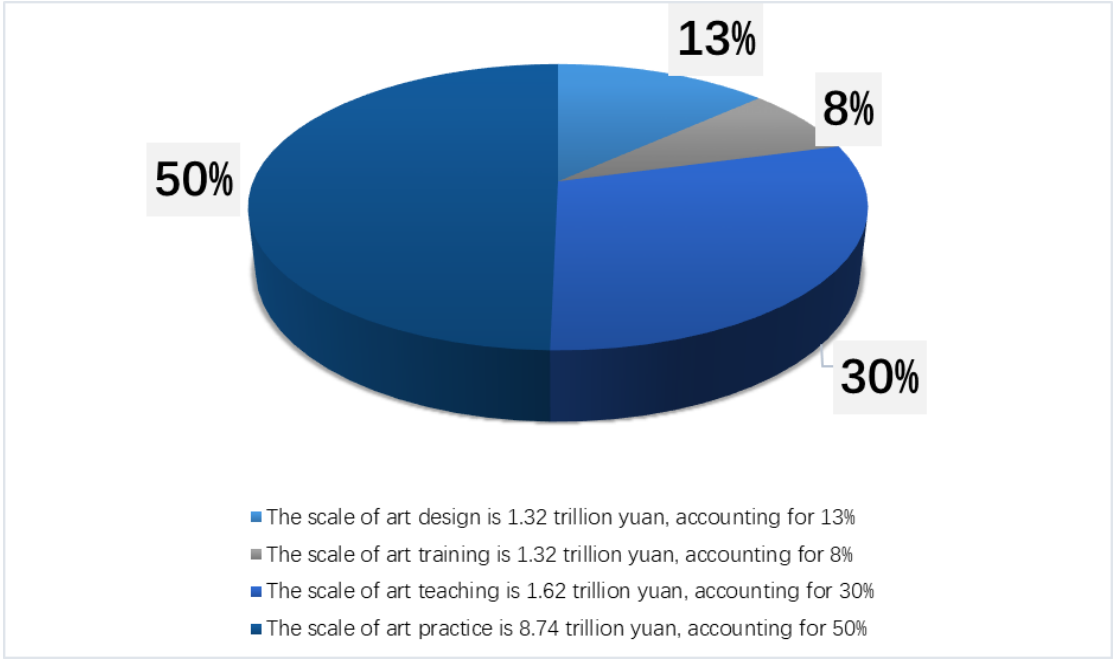

Figure 4: Market share of art and design activities.

Graphical thinking is a topic that many scholars have studied in recent years. The subject is based on a concrete image as a sensory basis. Finally, the common personality is reflected according to the specific connotation and internal connection. And then show the overall image. The process of expressing from image to image. Graphical thinking is the intersection of image thinking and logical thinking. In the process of graphical thinking, although some association activities are involved, it is relatively narrow and superficial. However, artistic thinking integrates image thinking, logical thinking and innovative thinking. At the same time, the method focuses on different approaches in graphical thinking. Through a wide range of psychological activities such as association and imagination, it can promote the cultivation of students' spatial imagination ability. Graphical thinking can better reflect image and creativity only when combined with artistic thinking. Image thinking is the foundation, logical thinking is the main line, inspirational thinking is the key,

and the three kinds of thinking interact. Complement each other and depend on each other, as shown in Figure 5.

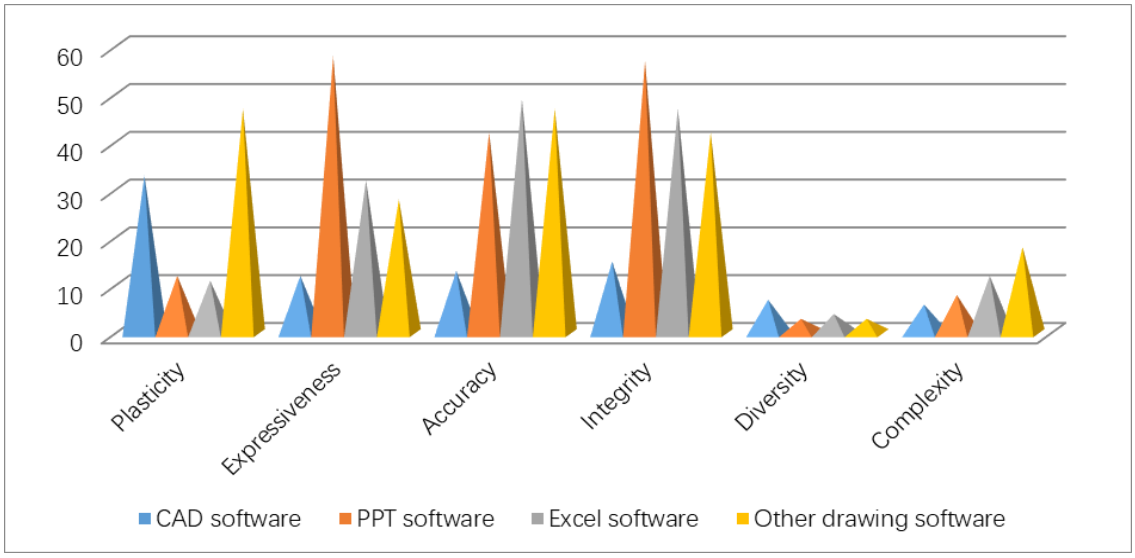

Figure 5: Application Characteristics of Engineering Drawing Products in Art Design.

In addition, the teaching of engineering drawings must keep pace with the times and keep innovating. This method is of great significance for improving the comprehensive quality of modern engineering students. At the same time, it plays an important role in building an innovative country. Teachers should inspire and induce students' innovative potential by creating an innovative teaching atmosphere. Stimulate students' imaginations. In addition, the most important thing to cultivate innovative ability in engineering graphics is to cultivate innovative thinking. Innovative thinking is the source and core of artistic thinking. Therefore, graphic thinking must be integrated with artistic thinking, so that innovative thinking can run through the whole process of engineering graphics.

4.2 Analysis Results of Geometric Drawing and Plane Composition

Consciously set up questions that are conducive to the development and training of artistic thinking in course lectures, exercises and assignments. Set up more geometric exercises of one problem and multiple solutions. Encourage students to think of relatively simple or innovative answers. For example, in the design of plane graphics configuration, use straight lines and arcs to design a car graphics. In addition to simple profiling design, graphics can also be given the shape of birds through artistic thinking, as shown in Figure 6.

Specifically, it is envisaged to achieve aerial flight and other methods to construct flat graphics with rich associations and meanings. In the design of the assembly configuration, some exercises with clear objectives but insufficient conditions are set. If a rectangular projection view is given, it is required to give a variety of three-dimensional configurations. The concave-convex change, flat-curve change and positive-slope change of this configuration can be answered by a certain graphic thinking. In addition, coupled with artistic thinking, other alternative answers can be obtained. For example, one or even the entire surface of the profile is a beautiful profiled surface. This teaching process cultivates students' innovative thinking. At the same time, they have a deep

understanding of projection theory. It enhances students' confidence and interest in learning engineering graphics, as shown in Figure 7.

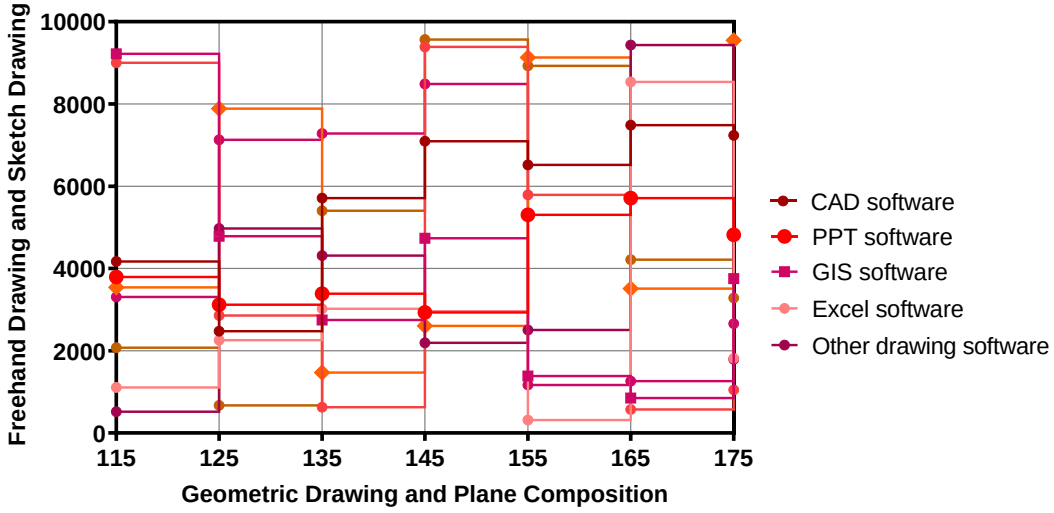

Figure 6: Combination configuration and stereo configuration.

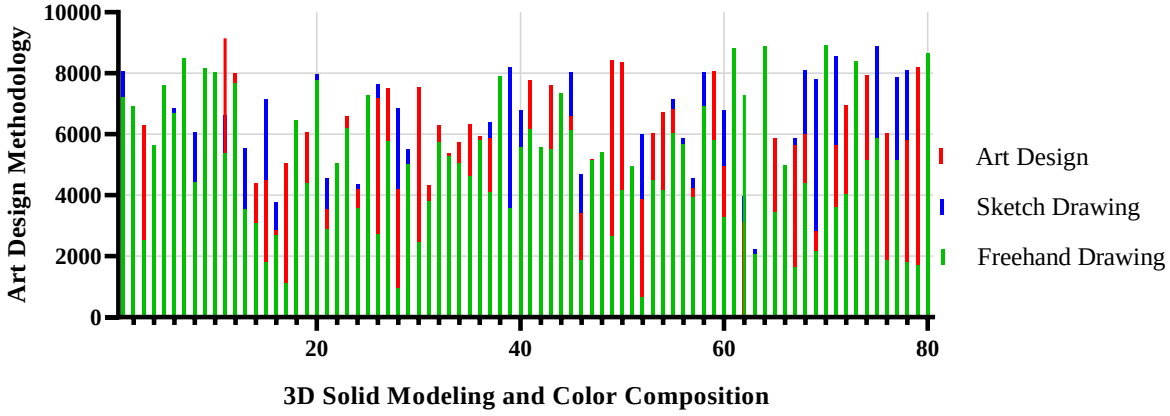

Figure 7: Combination configuration and stereo configuration.

The graphic is a unique texture structure formed by combining various shapes. It starts with a picture that people conceive and summarize in their minds. Expressed by means of drawings or other planes. Then, it is conveyed through people's vision. Graphics mean a lot to humans. It gives people the function of information communication. Drawings also reflect the characteristics of the things depicted. Drawing expressions also reflect people's real emotions. The reason why we can understand the meaning in the graphics is because it comes from nature. The content of the graphics is visualized by us, and it is the customary way of information exchange. Graphics are also a summary of visual experience, a figurative language. For example, the four ancient countries of ancient civilizations have had many figures that can reflect their national characteristics since ancient times. And research in various places pays attention to the graphics that have been left behind. These figures bear the characteristics of living environment and historical structure. The content of the graphics also carries their stories and emotions. In the

process of appreciating graphics, on the one hand, people can perceive the feeling of beauty in them. At the same time, it can also better understand the content and feelings that the designer wants to express to the audience. This is a manifestation of the process from extracting experience to cognition. Therefore, graphic design uses this graphic feature to abstract and extract concepts using graphic language. Then carry out related creative drawing. In this process, on the one hand, it is necessary for people to understand and feel the designer's emotion. In addition, the design also needs to have a sense of beauty and form. So, graphic design is also an art.

Graphics are symbols of human wisdom and progress, and are the deconstructed results of the fusion of natural things and reality. Graphics are the most important way of expressing visual information symbols. Graphics are the most important information carriers in visual communication design. It can be said that all objects with modeling images can be called graphics. Graphics are between works of art and text, and are a means of human information transmission and emotional communication. Humans endow graphics with profound meanings, which have a profound impact on vision, image thinking, and psychological communication through a variety of expression techniques. Graphic expression does not have the barriers of auditory, visual and comprehension of text and language recognition. Graphics are visual symbols that are not bound by any region, time, nation, or belief in an international context. The development and application of graphics are extremely extensive. Graphics show superiority in information communication. The important role it plays in various media. Graphics have become an artistic carrier that coexists with visual impact and formal beauty.

5 CONCLUSION

The science of engineering graphics is multidisciplinary and has a wide range of academic theories and practicalities. His content is relevant to numerous subject areas. Engineering cartography takes the concept of diagram as the core, goes deep into the field of art teaching, and provides rich content for the art education of engineering students. Cultivate artistic literacy in engineering graphics education, and accelerate the understanding of engineering graphics content in art education. Engineering graphics teaching and art education are complementary. Engineering cartography is a teaching mode integrated with art design, which can implement the scientific concept of development. This teaching method is of great significance for cultivating the comprehensive quality of engineering college students.

Graphic creativity occupies a very important position in advertising design works. Ads with great creativity are worth a thousand words. Recalling those unforgettable engineering drawing works, the classic cases are undoubtedly their good graphic ideas. Graphics leave a deep impression, not only for visual enjoyment, but also for spiritual communication. Graphics express the profound communication and transmission between the viewer and the designer. Designers have good ideas and thinking logic, and use ingenious expression methods to better display the creative content. Engineering graphic design has also become the key to success in the field of graphic design. Every link is essential and very important. The same goes for creative conception and design. Therefore, the generation of ideas is a training and a scientific method. Creative conception is a result of execution, and it is also a law that can be followed.

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