УДК 744

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Specifics of teaching technical drawing to toy designers

Abstract. The article examines the specifics of teaching technical drawing to future toy designers. The importance of mastering techniques that allow for the correct representation of toy shapes and textures is emphasized, and the role of the "Technical drawing" discipline in developing the professional competencies of future toy designers is revealed. The author focuses on the need to integrate knowledge and skills acquired through the study of academic drawing, technical drawing, and drafting into the toy design curriculum. A curriculum adjustment is proposed, according to which the study of technical drawing should begin after mastering the basic principles of academic drawing and precede the start of project activities. This will ensure a closer connection between key professional disciplines and enhance the effectiveness of the toy design learning process.

Keywords: technical drawing, academic drawing, toy design, learning content, design graphics, visual representation, toy designer.

Academic drawing as an educational discipline serves as the foundation for developing skills in analyzing form, understanding construction and conveying volume and spatial positioning of objects graphically among students, including future toy designers. However, certain challenges arise when interpreting the image of a toy, preventing the execution of the graphic part of the project at a high professional level. Here are some examples:

- lack of thorough rendering of internal object structure;
- insufficient shaping of the toy's form using light and shadow;
- unconvincing interpretation of patterns;
- monotonous, uniform line in depicting the toy's image;
- inaccurate representation of surface texture through shading techniques (washing, hatching);
- uncertainty in handling graphic media: coloured and watercolour pencils, liners, markers, etc.

The term “technical drawing” is ambiguous. In many instances, technical drawing is perceived as part of drafting, engineering graphics, or descriptive geometry. Indeed, the scope of application for technical drawings is quite diverse. For example, design engineers frequently employ this type of drawing. Furthermore, it is also utilized in textbooks, scientific literature, historical texts as illustrative material during architectural planning, interior design, clothing patternmaking, household item design, cartography, etc. Technical drawing in drafting manuals (technical and engineering graphics) is described as “...a method of drawing

according to axonometric rules – a special kind of axonometric drawing that most quickly and conveniently creates 'visual' representations of objects supplementing and complementing projections in the 'projection system'" [4, p. 6].

In the textbook "Technical drawing" authored by Yu.E. Lapina and V.F. Maksimovich, the specifics of teaching technical drawing to students studying under the program "Decorative applied arts and folk crafts", specialization: artistic lacemaking, are reflected [6]. The authors note: "The creative and stylistic range of technical drawing is very broad and its importance so great that each variety of technical drawing deserves separate description. The task of technical drawing is objective representation of objects. <...> The specificity of technical drawing, necessarily correlated with a specific type of traditional applied art, requires depiction of every element included in the composition using appropriate artistic means" [6, p. 4]. Yu.E. Lapina provides a concise and clear definition of technical drawing: "Technical drawing is a graphic representation of an object made manually or by other means, in approximate scale, sufficiently clear to accurately reveal the technical concept and structure of the object" [5, p. 10].

Worthy of attention is the tutorial by A.V. Konstantinov, where he presents an algorithm for working with students majoring in "Design" while mastering the course "Technical drawing" [4]. Teaching methodology for technical drawing was developed by specialists such as A.D. Botvinnikov, S.V. Rozov, N.N. Rostovtsev, S.A. Solovyev, and others.

N.P. Burdin and E.V. Shapin justified the need to expand the existing widespread conception of the subject "Technical drawing": "it logically follows to interpret technical drawing as an effective visual representation of an object respecting proportions, aimed at demonstrating its technical idea or intention..." [1, p. 167].

Unlike academic drawing, technical drawing adheres to the rules of executing axonometry. An idea conceived by a designer necessitates fixation in the form of a simple and comprehensible image that reveals the essence of the concept. Simplicity and conciseness are characteristic traits of project graphic style, which will later be implemented in art-graphical projects of semester, coursework and graduation qualification papers. Let us outline conventions typical for technical drawing:

- it is recommended to execute technical drawing according to the rules of axonometric projections. Isometry is preferable as the most suitable way to convey maximally clear imaging;
- lighting depicted in the drawing has a symbolic nature – the imaginary rays of light are conventionally considered parallel and directed diagonally downward from above left (like sunlight);
- background and cast shadows are typically not represented.

There are various methods for producing technical drawings: linear drawing; hatching; cross-hatching (Schraffierung, from German "schraffieren" meaning "to hatch"); wash technique; dotting (Pointillism, from French "point" meaning "dot");

pen-and-ink work; watercolor wash. In some cases, appliqué and airbrush techniques may also be applicable (Fig. 1[79]).

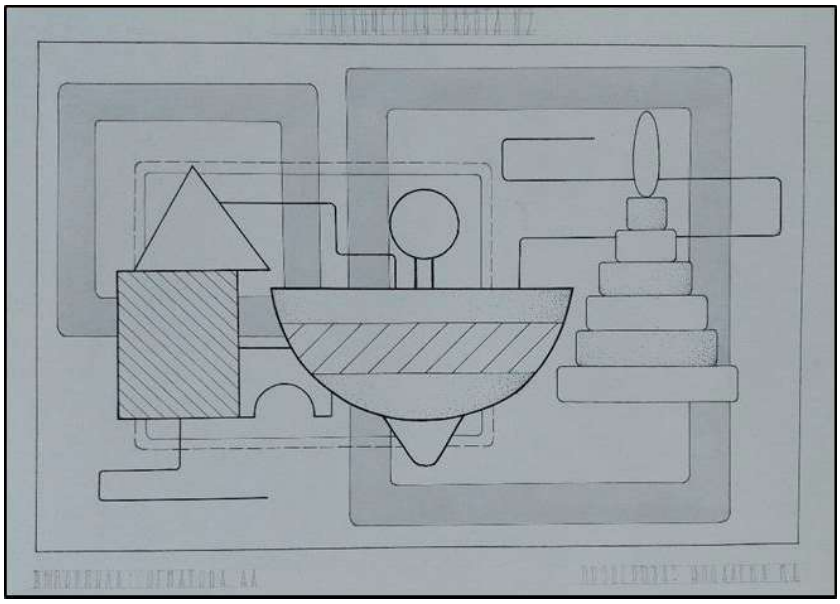

Fig. 1. Ignatova N. Graphic work “Types of lines”. First year student. Sergiev Posad institute of toys

The most suitable materials for implementing the graphic component of semester and graduate qualification works by toy designers are: watercolors, tempera paints, gouache, colored and watercolor pencils. This dictates the selection of analogous materials when performing technical drawing within the corresponding course. Measurable and competent use of colored pencils, complementing watercolor, makes the image of the toy more expressive. Insufficient command of this medium could spoil the general impression, turning the project drawing into an illustration.

Teaching technical drawing to future toy designers has several distinctive features determined by the specifics of this profession. Before starting practical exercises, students receive an overview of the methods used for creating illustrative images in technical drawing. Technical drawing is done manually [3]. In initial exercises, students learn how to divide segments into equal parts visually, draw lines of varying directions, curved lines, arcs and trace projections of toys by hand.

The assignments aim to develop technical drawing skills relevant to creating prototypes and working drawings of toys. The goal of the discipline is to acquire theoretical knowledge, abilities and skills in technical drawing of products aligned with the training profile “Artistic toy design”.

The object of study, analysis and representation is a toy. Academic drawing ensures comprehension of the rules for depicting three-dimensional objects on a two-dimensional plane, helps master the basics of artistic literacy, including construction, composition, proportionality, transmission of form and volume of objects, exploration of chiaroscuro and perspective.

[79] Figs. 1-7. Photo by the author of the article.

Technical drawing provides skills for depicting objects considering their technical characteristics, enabling a clear understanding of precise dimensions and structure of the object.

The graphic expression means of technical drawing are more restrained than in academic drawing due to the necessity of transmitting accurate and unambiguous information about the object or construction. Limitation of graphic resources stems from the requirement to avoid inaccuracies and errors in interpretation, whereas academic drawing focuses on conveying an artistic image.

Creating technical drawings gives students insight into the inner structure of toys, fosters a constructive approach in depicting complex objects, develops rapid drawing skills and cultivates the ability to swiftly produce clear and understandable drawings. The primary purpose of creating a technical drawing of a toy is to correctly convey proportions, relative placement of elements and detailed rendering of structural details.

Instruction begins with familiarization with types of lines. Students practice drawing lines of varied orientation and types (horizontal, vertical, diagonal straight lines, arcs, circular sections, spirals) without using drafting instruments. The goal of the practical assignment is to complete a drawing of arbitrary composition utilizing straight, curved and broken lines of different orientations and thicknesses.

Students are asked to create a composition linked to the theme of folk crafts and toys. The composition should be balanced, all elements harmonized with each other. Completing the task integrates acquired knowledge in technical drawing, design and composition, reinforcing and advancing practical skills tailored to the specifics of the profession. Students have the opportunity to demonstrate creativity, explore technical data exemplified by depictions of toys and artifacts of traditional applied art, experiment with line and form, resulting in unique creations (Fig. 2).

The next stage of instruction focuses on studying demonstrative images of elementary volumes – geometric solids (cube, sphere, cylinder). As reference objects, children's building set elements are used, whose basic components resemble simple geometric bodies (cubes, cones, hexagons). While drawing these building set details, students acquire foundational technical drawing skills. Spatial thinking is enhanced: learning to perceive and reproduce proportions, depth and dimensional relationships between objects.

During the drawing process, students learn constructive analysis of simple forms via cross-sectional drawing, volumetric modeling using light and shade and wood texture rendition (Fig. 3).

The topic “Shading techniques in technical drawing” implies applying various shading methods in independently composed compositions (wash technique, hatching, rastr (pointillism), cross-hatching).

Next comes the task of drawing a mechanical toy (car, train) according to the rules of depicting solid bodies in isometric or dimetric projection. The drawing is completed from real-life observation. The type of axonometry is chosen by the student individually, taking into account the clarity of the image. Construction lines remain preserved (Fig. 4). To simplify constructions in the preliminary version of the drawing, millimeter paper is used. From the general form, smaller details are

gradually extracted and the drawing becomes increasingly specific, revealing structural elements. These tasks help develop the ability to identify simple geometric shapes in complex volumes and combine them when designing original products. They enhance spatial reasoning and provide insight into the object's structure.

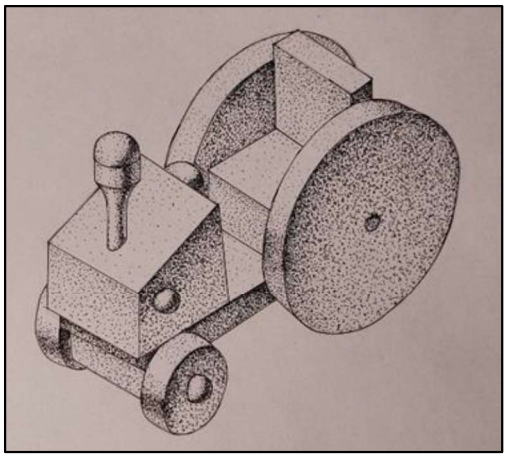

Fig. 2. E. Sukhova. Technical drawing of a transport toy (pointillism technique) completed by a first-year student of Sergiev Posad institute of toys

Fig. 3. N. Ignatova. Technical drawing of children's construction set components completed by a first-year student of Sergiev Posad institute of toys

A designer must be able to faithfully convey the characteristics of toy materials (wood, plastic, fabric, papier-mâché) in a project. Therefore, the technical drawing curriculum includes practical assignments focused on depicting toys made from different materials. Through completing these assignments, students refine their skills in reproducing texture features. Work on interpreting the texture of an object is carried out through several tasks (Figs. 4, 5).

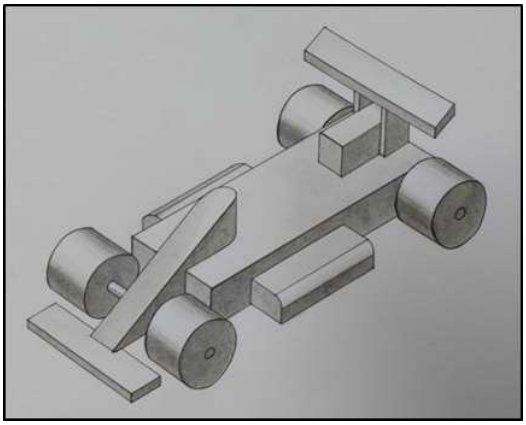

Fig. 4. N. Martynenko. Technical drawing of a transportation toy (wash technique) completed by a first-year student of Sergiev Posad institute of toys

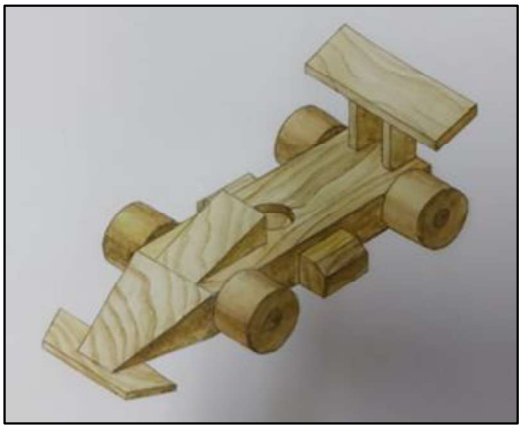

Fig. 5. N. Ignatova. Technical drawing of a transportation toy depicting wooden texture completed by a first-year student of Sergiev Posad institute of toys

The ability to render toy details and ornamentation is an essential skill for future toy designers. Detailed rendering of ornaments is realized in the task of

drawing a wooden pull-toy (Figs. 6, 7). The challenge here is to apply the ornament (painting) appropriately onto the three-dimensional form of the toy. Mastering this skill aids in grasping the mechanism and technique of portraying artistic painting on the surface of an object situated in space.

Fig. 6. N. Ignatova. Technical drawing of a pull-along toy with painted decoration completed by a first-year student of Sergiev Posad institute of toys

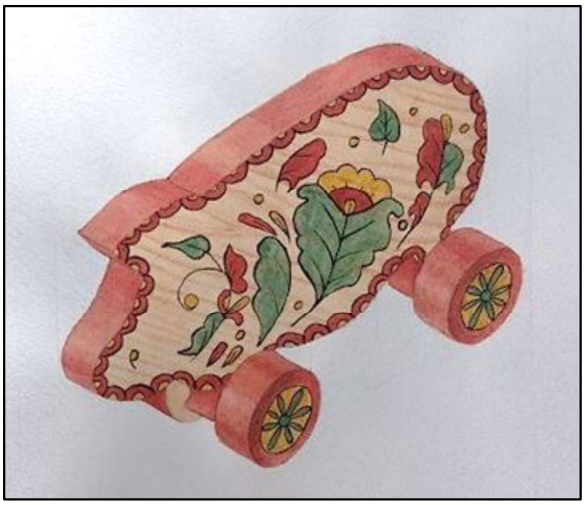

Fig. 7. I. Kostyakova. Technical drawing of a pull-along toy with painted decoration completed by a first-year student of Sergiev Posad institute of toys

When creating technical drawings of toys using pencil and liners, students develop the skill of producing lines of varying thickness and intensity, as well as smooth transitions in line width. The main objective in such assignments is to achieve volume and depth in the image using minimal graphic means by altering the intensity and thickness of the line.

Knowledge, skills and competencies gained in courses on academic drawing, academic painting, technical drawing and drafting integrate into the design course. Project graphics act as a universal language for designers, through which they communicate ideas, illustrate construction, color and other significant attributes of the object being created. It operates based on principles of projective drafting combined with laws of linear and atmospheric perspective. Technical drawing, academic drawing and project graphics are complementary elements in the professional training of a specialist in toy design [2].

Mastering the fundamentals of academic drawing should always precede technical drawing education. Acquiring technical drawing skills, which foster spatial thinking and introduce students to theoretical foundations and practical methods of depicting three-dimensional forms with certain constraints, establishes a basis for transitioning to project-related activities.

Without mastering the basic principles of academic drawing, it is impossible to fully grasp technical graphics, which, in turn, guarantees high-quality performance of design projects. The course “Technical drawing” assists in developing spatial thinking among students, refining their skills in graphical

representation of toys of various shapes, thereby complementing the professional training of a designer.

Summarizing the aforementioned points, we conclude that there exists a substantiated need for adjustments to the curriculum, implying that the course “Technical drawing” should only be undertaken after acquiring initial foundations in academic drawing but before commencing project activity. Such modifications would facilitate achieving robust and stable interconnections between core professional disciplines of graduating departments and open new opportunities for achieving superior outcomes in toy design.

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