

## AI'S ROLE IN TECHNICAL DRAWING EDUCATION

Tamar Pataraiia, Ph.D., Associated Professor,  
*The University of Georgia, (Tbilisi, Georgia)*

Oksana Budnyk, Ph.D., Junior Researcher of the International SES laboratory,  
*Institute of Physics of the National Academy of Sciences of Ukraine*  
*(Kyiv, Ukraine)*

Hanna Shepel, Senior Lecturer,  
*National Technical University of Ukraine «Igor Sikorsky Kyiv Polytechnic*  
*Institute» (Kyiv, Ukraine)*

**Abstract** – *The integration of artificial intelligence (AI) in educational domains has paved the way for transformative advancements in various academic fields. One such area where AI demonstrates its potential is in technical drawing education. This article explores the possible role of AI in learning technical drawing.*

**Key words** – *Technical drawing, artificial intelligence, ChatGPT, self-study.*

**Problem statement.** Despite the transformative advancements brought about by the integration of artificial intelligence in educational domains, the specific role of AI in learning technical drawing remains to be fully explored. Though AI has demonstrated its potential in various fields, its potential contributions to technical drawing education are not yet clearly defined.

**The state of theme research.** The current state of research regarding AI's role in technical drawing education is still evolving, with significant strides being made in recent years. Studies have begun to explore the effectiveness of AI-powered tools and platforms providing real-time feedback and facilitating collaborative learning experiences in the context of learning technical drawing.

**Task statement.** This article aims to address this gap by investigating the possible role of AI in enhancing the learning experience and outcomes in technical drawing education for students. The assumptions presented in this article are based on the opinions and perspectives gathered from students and teachers who have recently interacted with AI technologies, specifically ChatGPT.

The focus was on understanding their perspectives on how to utilize AI tools responsibly and ensure ethical practices. The inclusion of students' opinions is particularly significant as they represent the end-users and beneficiaries of AI technologies. By incorporating teacher's perspectives, the authors aimed to ensure that the assumptions and conclusions drawn in the article reflect the experiences and concerns of those directly impacted by AI in the learning process.

**The main material.** Technical drawing, as a discipline, encompasses the principles, techniques, and standards used to create accurate and detailed drawings that communicate design and technical information effectively. It is a specialized field that focuses on the graphical representation of objects, structures, and systems using precise measurements, symbols, and conventions. Drawings created by technical professionals must possess clarity and precision, leaving no room for ambiguity or multiple interpretations. Drawings serve as official documents, and the success or failure of a structure relies heavily on the clarity of the depicted details. Therefore, it is crucial that the drawings are free from any potential misinterpretation, even unintentional one [1].

As a discipline, technical drawing involves the following key aspects:

- **Drawing techniques.** Technical drawing involves learning and applying specific drawing techniques to represent objects and their features accurately. This includes skills such as freehand sketching, perspective drawing, and various projection methods like orthographic projection, isometric projection, and oblique projection.

- **Standards and conventions.** Technical drawing adheres to specific standards and conventions to ensure consistency and clarity in communication. These standards govern various aspects, such as line types, line weights, dimensioning practices, symbols, and abbreviations. International standards, such as ISO (International Organization for Standardization) [2] or ANSI (American National Standards Institute) [3], provide guidelines for technical drawing practices.

- **Geometric construction.** Technical drawing involves the use of geometric construction techniques to create accurate and precise shapes, angles, curves, and intersections. This includes methods like compass and straightedge constructions, tangents, bisectors, and intersections of lines and planes.

- **Dimensioning and Tolerancing.** Accurate dimensioning is a critical aspect of technical drawing. It involves specifying the measurements, tolerances, and allowances necessary for the manufacturing or construction of objects. Dimensioning conventions, such as indicating dimensions, tolerances, and geometric tolerancing symbols, are essential components of technical drawings.

- **Computer-Aided Design (CAD).** With the advent of computer technology, technical drawing has evolved to incorporate computer-aided design (CAD) software. CAD enables engineers and designers to create and modify digital drawings, perform precise measurements, simulate real-world conditions, and generate 3D models. Being able to work with CAD software is essential now due to the fact that it has become an integral part of technical drawing.

Such complex concepts are pivotal to a successful career in the sphere; therefore, they have to be dealt with at university but they can be initially challenging for students to grasp. Technical drawing necessitates the capacity to mentally envision three-dimensional objects and correctly depict them on a two-dimensional medium. The development of spatial visualization skills can pose challenges for certain students, as it involves mentally rotating and manipulating

objects within the imagination. As it has already been mentioned, technical drawing involves using specific standards, conventions, and symbols to communicate information effectively. Learning these conventions and symbols can be overwhelming for students, especially when faced with a large number of rules and symbols to remember.

Ongoing discussions often arise regarding the merits of manual drawing versus using digital tools. In both approaches, achieving accuracy is paramount, requiring a profound comprehension of the subject matter and the application of standards and conventions, alongside the development of visualization skills. Technical drawing skills develop through practice and patience. Students may become frustrated if their initial drawings do not meet their expectations. Encouraging perseverance and providing opportunities for ample practice can help them overcome these challenges.

This leads us to a situation when acquiring a precise discipline can be challenging in the learning process. Using ChatGPT [4] for teaching technical drawing offers numerous benefits in the learning process. Incorporating AI into education enhances student engagement, provides personalized feedback, and offers interactive learning experiences. The number of studies and courses focused on exploring the integration of AI into the educational process is continually increasing [5, 6].

AI-powered platforms like ChatGPT can captivate students' attention and foster engagement. The interactive nature of AI chatbots makes learning technical drawing more dynamic and interesting. Students can have real-time conversations with ChatGPT, ask questions, and receive immediate responses, creating an interactive learning environment that promotes active participation. ChatGPT can provide personalized feedback tailored to individual students' needs. This personalized feedback helps students understand their strengths and weaknesses, allowing them to focus on specific areas for growth and development.

As a text-based AI model, ChatGPT cannot directly generate visual content like technical drawings. Still it can assist with providing descriptions, explanations, and guidance related to technical drawing concepts, principles, and techniques. However, for actual visual examples of technical drawings, it would be best to refer to textbooks, online resources, or specialized software designed for creating technical drawings.

In this study, we will not focus on AI products such as Midjourney [7] or DALL·E2 [8], as they typically involve costs and are not freely available. Instead, we will concentrate on discussing other relevant aspects related to the topic at hand.

Firstly, AI-powered platforms have the advantage of scalability and accessibility. ChatGPT can accommodate a large number of students simultaneously, providing individualized attention and support to each learner. It eliminates the constraints of time and location, allowing students to access the learning platform at their convenience, promoting flexibility in their learning journey.