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APPLYING MATHEMATICAL MODELING IN TEACHING DESCRIPTIVE GEOMETRY AND TECHNICAL DRAWING

Abstract

This paper discusses the application of mathematical modeling in teaching descriptive geometry and technical drawing in technical schools. By utilizing the mathematical modeling process, the paper aims to develop students' thinking skills and meet the practical demands of their future careers in the era of Industry 4.0.

Keywords:

model, mathematical modeling, thinking

1. Introduction

The current trend shows that mathematics increasingly penetrates other sciences, reflecting the general state of modern scientific research. Alongside specialization, there is a necessary trend towards the unification and synthesis of various sciences, including social sciences. Applications through mechanics and physics, and increasingly through cybernetics, are becoming more important. Any advancement in automation is inseparable from mathematical achievements, such as the design and use of automated machines, control systems, and communication systems, which rely on logical, informational, algebraic, and reliability theory advances.

Mathematical models, in particular, are widely and effectively used in control processes. Models allow us to study processes that unfold over years in just a few hours, investigate processes that cannot be physically experimented on, and predict and control them.

2. Theoretical Basis and Some Illustrative Teaching Activities

A model serves as a substitute that retains all properties of a real object. By studying the model, we can understand the essential attributes of the target object without direct interaction. According to Kai Velten (2009), the best model is the simplest one that still meets the research objectives, being complex enough to understand the system's operation and resolve the posed problems. Lê Thị Hoài Châu (2014) notes that solving real-world problems using mathematical knowledge and skills requires following the steps of the mathematical modeling process. Nowadays, mathematical models have many applications in physics and other natural sciences, as well as in economics and social sciences. Kai Velten (2009) describes a mathematical model as a triad (S, Q, M) — System, Questions, and Mathematical Statements — used to solve the posed questions.

2.1 Steps in the Modeling Method

Step 1: Construct a practical model of the problem. Identify the input data and the required outcomes or output data.

Step 2: Develop a mathematical model for the problem, noting that a single problem can have multiple mathematical models.

Step 3: Use mathematical tools to solve the problem formed in Step 2.

Step 4: Analyze and validate the results from Step 3. If the results are unsatisfactory, repeat the process.

2.2 Proposed Modeling Process in Teaching Descriptive Geometry and Technical Drawing

To flexibly apply the above process in teaching descriptive geometry and technical drawing, instructors can design and organize modeling activities as follows:

- **Step 1 (Mathematization):** Analyze the practical problem, simplify it by removing non-essential elements, and describe it using mathematical tools and language.
- **Step 2 (Solving the Problem):** Use appropriate mathematical tools and methods to solve the problem.
- **Step 3 (Understanding and Interpreting):** Understand and present the solution's significance concerning the initial practical problem.
- **Step 4 (Reality Check):** Reevaluate the problem or the initial problem statement, review the mathematical tools and methods used, and refine the model based on practical considerations.

By adhering to this process, starting from real-life situations, expressing the problem verbally, and using mathematical tools to solve it, students can understand the practical significance of the solution, evaluate, and refine the model.

The following example illustrates mathematical modeling through the content of descriptive geometry and technical drawing:

Example: Steps to Create an Object as Shown in Figure 01, establishing the technical drawing

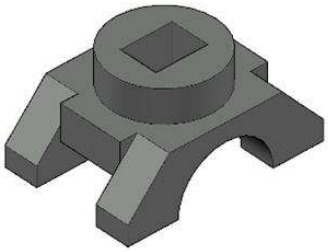
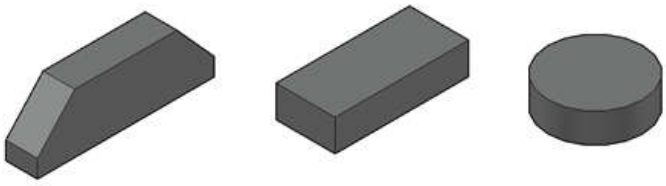


Figure 01

Step 1: Analyze the object into basic components.

We can consider the object as composed of 3 simpler parts as shown in Figure 02:

- A vertical rectangular block *A* with two side triangular prisms removed.
- A horizontal rectangular block B.
- A vertical cylinder *C*.



A B C

Figure 02

Step 2:

- Stage 1: The basic objects A, B, and C are unified through the union operation to form object D as shown in Figure 03.

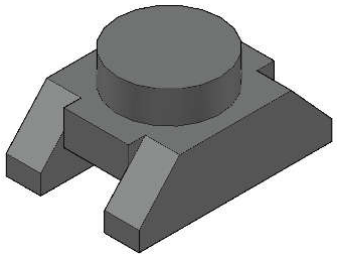


Figure 03

• Stage 2: Object D is considered as the basic object in this step, combined with object E using the difference operation to obtain object F as shown in Figure 04.

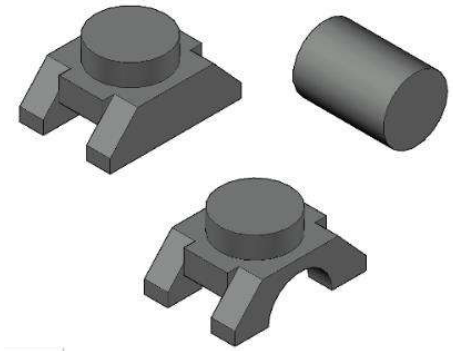


Figure 04

• Stage 3: Subtract object G from object F using the difference operation to obtain the desired object as shown in Figure 05.

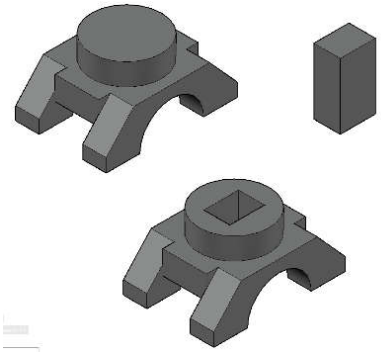


Figure 05

Step 3: The mathematical tools used are the union of blocks, intersection of two blocks (cylinder and block), intersection of a plane and cylinder giving an ellipse, circle, and generatrix. Figure 06.

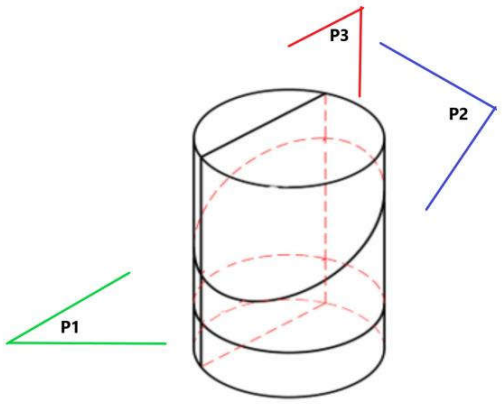


Figure 06

Step 4: Create the final drawing (Figure 07).

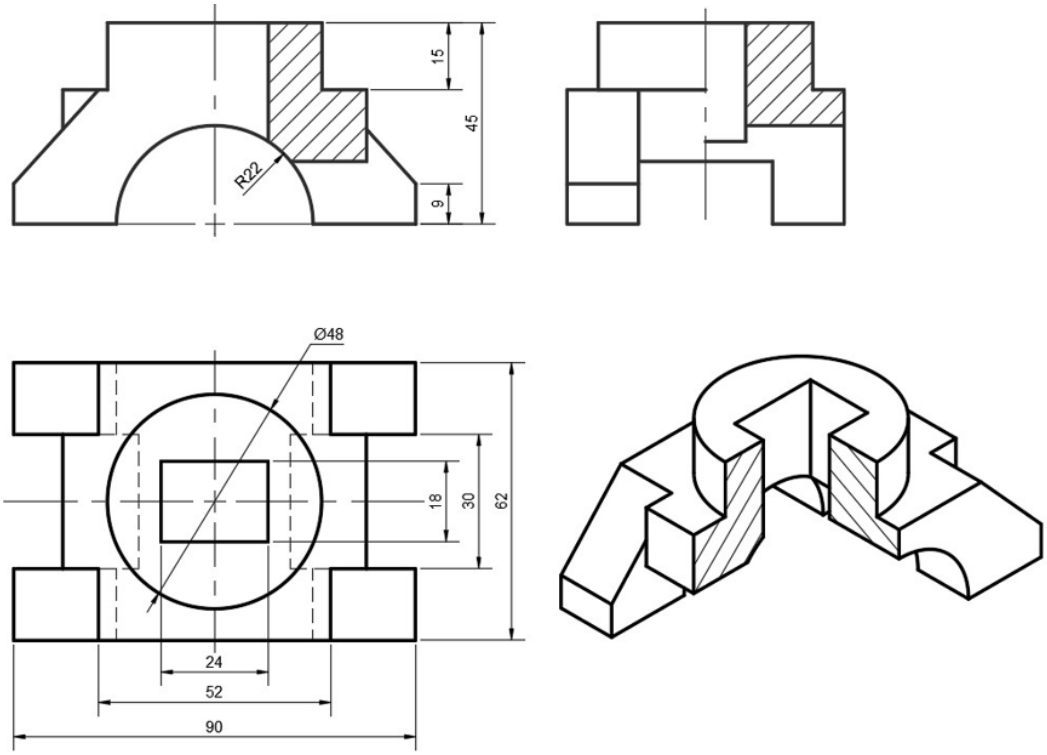


Figure 07

Conclusion

Developing the competence in mathematical modeling is essential across various subjects. In the context of descriptive geometry and technical drawing, applying mathematical modeling in teaching enhances students' ability to solve real-world problems and meet job requirements post-graduation. This paper proposes applying the mathematical modeling process in these subjects to develop students' modeling competence.

Acknowledgements

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ФОРМИРОВАНИЕ ЗНАНИЙ О ФИЗИЧЕСКОЙ КУЛЬТУРЕ В ПРОЦЕССЕ ПОДВИЖНОЙ ИГРЫ

Аннотация

В статье автор говорит о том, как подвижная игра на занятиях по физической культуре влияет на развитие ребёнка дошкольного возраста, чему учит, какие качества помогает приобрести, укрепить, сформировать и развить, на какие сферы оказывает наибольшее влияние

Ключевые слова:

подвижная игра, ребёнок дошкольного возраста, развитие ребёнка, физическое развитие, физическая культура.

Физическая культура для детей играет важную роль в развитии не только физических, но и психических качеств. Подвижные игры представляют собой один из наиболее эффективных инструментов формирования знаний и навыков в области физической культуры. Они способствуют активизации детской деятельности, развитию моторики, координации движений, выносливости и гибкости, а также укрепляют иммунитет и формируют здоровый образ жизни.

Подвижная игра – это увлекательный и интересный способ обучения детей основам физической культуры. В процессе игры дети учатся правильно выполнять различные физические упражнения, развивать свои двигательные навыки и координацию. Они не только делают физические усилия, но и