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KEMENTERIAN PENDIDIKAN TINGGI



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Rotation Kit Model

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ABSTRACT

Rotation Kit Model is an innovative teaching aid developed to enhance students' understanding of rotational transformation in Mathematics, particularly among Form 2 learners. Many students, especially those with moderate to low achievement, face difficulties in visualising image formation and determining coordinates based on given angles and directions of rotation using conventional methods that are often complex and less engaging. This innovation aims to improve students' conceptual understanding, increase learning engagement, and assist teachers in delivering more effective instruction. The Rotation Kit Model was developed using a structured design approach based on the ADDIE framework, involving analysis, design, development, implementation, and evaluation phases. The kit consists of simple, low-cost materials such as transparent plastic and a fixed pivot point that enables accurate rotation without shifting the centre. Users can draw objects on the transparent surface and rotate them according to specified angles and directions, allowing abstract concepts to be visualised more clearly through hands-on interaction. The application of this innovation shows improved student engagement, better understanding of rotational concepts, and increased accuracy in determining image coordinates, while also reducing the time needed to solve problems. It further supports teachers by simplifying explanations and enhancing teaching efficiency. In conclusion, the Rotation Kit Model provides an effective, practical, and user-friendly solution for learning rotational concepts, with strong commercial potential due to its affordability, durability, and suitability for widespread use in educational settings.

Keywords: rotational transformation, hands-on learning, teaching aid, mathematics education, visualisation

1. INTRODUCTION

Understanding geometric transformations, especially rotation, is important for developing students' mathematical thinking and problem-solving skills. In Form 2 Mathematics, students must interpret how shapes change position around a fixed point, which can be difficult to grasp through explanation alone. The Rotation Kit Model was developed as a hands-on teaching aid that allows students to manipulate shapes and observe rotational movement directly. This approach makes learning more accessible and engaging, using simple materials to help students explore rotational movement through direct interaction.

1.1 Problem Statement

Many students find it hard to visualize how shapes change after rotation. Traditional teaching methods are often too abstract, making it difficult for them to follow the steps and remember how to solve rotation problems, which lowers their interest in learning the topic.

1.2 Objectives

This project aims to develop a Rotation Kit Model as a hands-on teaching aid to make rotation easier to understand. It helps students visualize concepts clearly, simplifies problem-solving steps, and increases their interest and engagement in Mathematics.

2. METHODOLOGY

This product employs the ADDIE Model as the foundation for crafting the Rotation Kit Model. This instructional design model comprises the phases of Analysis, Design, Development, Implementation and Evaluation, serving as a cornerstone for effective teaching and learning.



Figure 1. ADDIE Model Diagram

2.1.1 Analysis, Design and Development

In the *Analysis* phase, the need for the product is identified by looking at students' difficulties in understanding rotation, especially when they try to visualize image formation and determine coordinates accurately. This leads to the main question of how a hands-on tool can help students understand these abstract concepts more easily. This issue is important in both theory and practice, as learning theories like cognitive and constructivist approaches highlight the value of active involvement. In the *Design* phase, the structure, materials, and functions of the Rotation Kit are planned to support interactive learning. The materials used in producing this model are transparent plastic, pins, ruler, marker pen and a softboard. The *Development* phase then involves building the kit, turning abstract ideas into a simple and practical teaching tool.

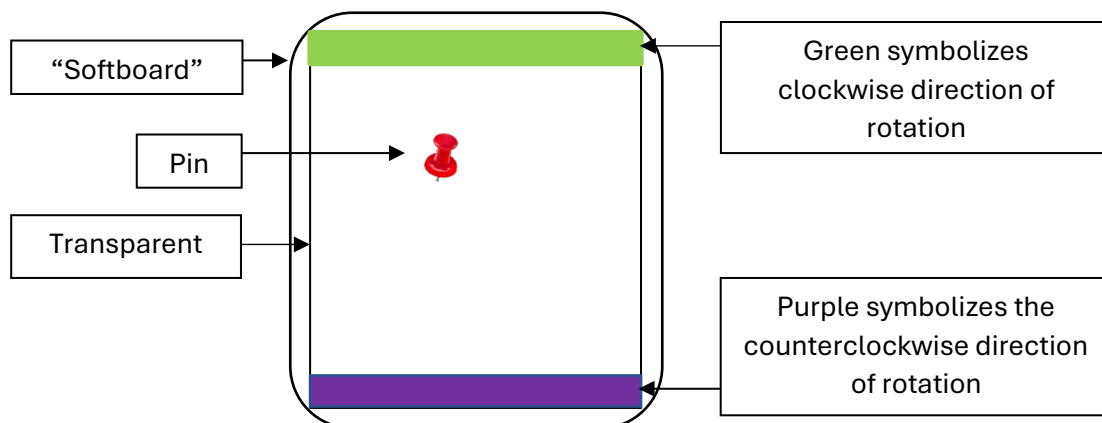


Figure 2. Rotation Kit Model

2.1.2 Implementation and Evaluation

In the *Implementation* phase, the Rotation Kit is used in the classroom to support hands-on and engaging learning, allowing students to explore rotation concepts more actively. This approach fits well with learning theories that emphasise learning through experience. The *Evaluation* phase focuses on gathering feedback and observing how useful and practical the kit is in real classroom situations. This helps ensure the product is relevant, effective, and able to support both teachers and students in the learning process.

2.2 Demonstration

Through this model, the Rotation Kit is placed on the position of the object on the question paper, then a sketch of the object is drawn on the transparent plastic. Next, the Rotation Kit is rotated at an angle of 90° at the centre point clockwise. The pin is placed at the centre point so that the centre position does not change. As a result, the new image position will be able to be produced based on the rotation on the Rotation Kit earlier.

3. RESULTS AND DISCUSSION

Testing involved two groups of Form 2 students, with a total of 10 respondents. They were given 5 rotation-related questions. Group 1 (Control Group) did not use the Rotation Kit Model, while Group 2 (Treatment Group) used it. Table 1 compares the pre-test scores of both groups before the model was introduced. Table 2 compares the post-test (written test) scores between the Control and Treatment groups after the Treatment Group used the Rotation Kit Model.

Table 1. Data collection during Pre-Test

Student	Control Group Score	Students	Treatment Group Score
A	1	K	1
B	0	L	1
C	2	M	0
D	2	N	0
E	1	O	2
F	0	P	0
G	0	Q	0
H	1	R	1
I	0	S	1
J	1	T	0

Table 2. Data collection during Post Test

Student	Control Group Score	Students	Treatment Group Score
A	1	K	4
B	1	L	3
C	2	M	5
D	1	N	5
E	1	O	4
F	0	P	4
G	1	Q	4
H	1	R	5
I	0	S	4
J	0	T	5

3.1 Usability Analysis

Based on the pre- and post-test results, both groups initially demonstrated similarly low levels of understanding in rotation concepts. However, after the intervention, the Treatment Group showed a significant improvement in scores compared to the Control Group, which recorded only slight progress. This suggests that the Rotation Kit Model effectively enhanced students' conceptual understanding and problem-solving abilities in rotation.

3.2 Effectiveness of the Developed Model

The Rotation Kit Model shown in Figure 2 proves effective as a teaching aid by transforming abstract rotation concepts into a hands-on learning experience. It enhances students' ability to visualise image formation, improves accuracy in determining coordinates, and reduces reliance on complex procedures, while increasing engagement and supporting teachers in delivering clearer and more efficient Mathematics instruction.

4. CONCLUSION

In conclusion, the Rotation Kit Model is a simple yet effective teaching aid that helps students understand rotation more clearly. By allowing students to physically move and rotate objects, it turns something abstract into something they can see and experience. This makes it easier to follow steps, build confidence, and improve performance in Mathematics. It also helps teachers explain the topic more smoothly and keep students engaged.

In terms of commercial potential, the Rotation Kit Model offers strong value, as it is made from low-cost, easily available materials, making it affordable and accessible for schools. It can be used as a classroom teaching tool or packaged as an educational kit. With its practical design and clear benefits, it has good potential as a marketable educational resource.

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