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ORTHOGONAL PROJECTOR KIT (OPK) AS A NEW TEACHING AIDS WITH INNOVATION ICT IN TEACHING AND LEARNING 21ST CENTURY

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ABSTRACT

Mathematics education filled with abstract concepts, the use of teaching aids is important to increase students' understanding by giving the concrete experience of those concepts. This article aims to introduce and express the importance of Orthogonal Projector Kit (OPK) to the parties that involved in the education system. Many teaching aids have been studied and developed to help students' understanding the topic Plan and Elevation, but most of them are software for computers that cannot be touched by students. Therefore, OPK was created to enable students to touch and feel the objects that they need to draw and also give them a concrete experience through this concept.OPK consists of an orthogonal projector (OP), colored skeleton blocks (CSB) and a module for teaching and learning by using it.

Keywords: Orthogonal Projector Kit (OPK); teaching aids; teaching and learning 21st century; plan and elevation

1. INTRODUCTION

In these pages of science and technology, the teaching and learning in classrooms are affected by it. Studies in the fields of education find that the learning process will be more effective if students' mathematical knowledge is built by teaching and learning process that involves the use of teaching aids.

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Consist of tangible objects, teaching aids are useful for students to learn abstract concepts in mathematics because enable the students to visualize the concepts[2]. There are many teaching aids available these days which have been categorized into three types, which are visual aids, audio aids and audio-visual aids.

The tremendous evolution of technology in the world brings enormous challenge in the education system in Malaysia. The government has taken various steps to implement the use of information and communication technology (ICT) that includes aspects of infrastructure, charging and training for educators. In the Malaysia Education Blueprint (MEB) 2013-2025 there are 11 shifts proposed by Ministry of Education (MOE) to produce positive change in the education system. Each shift was made to make an impact at least on one of the five outcomes of the education system which are accessible, quality, equity, unity and efficiency[3]. However, quality is the main focus of concern for each shift.

ICT should be used as a tool to help teachers meet the educational needs of the students. Teachers play an important role to face significant challenges in mathematics education, particularly for integrating the dynamic and effective use of ICT in classroom[4].Many education experts agree that teaching and learning methods should be changed in accordance with the increasingly advanced in the development of ICT and internet access. Recognizing the importance of teachers understand and are willing to make changes in teaching and learning according to the learning of 21st century, MOE has launched a pilot initiative for the learning of 21st century in 2014 and expand the implementation throughout the country since 2015[5]. There are three skills that should be dominated in the process of teaching and learning of 21st century, which are learning and innovation skills, the information, media and technology skills, and life and career skills. The learning of 21st also emphasis four elements that must be included in the learning process for students, which are communication, critical thinking, collaboration and creativity.

2. PROBLEM STATEMENT

Topic Plan and Elevation become students' favorite in Mathematics paper 2 in SPM because they do not rely on the use of mathematical formulas, but it depends on their visualization skill to answer the question[6]. The previous studies found that the visualization skill among students were at a low level. As the result, there are a lot of students do not perform well for this question. The lack of understanding in learning topic Plan and Elevation often causes discouragement among the

students, which invariably will lead to poor performance. Furthermore the traditional teaching and learning method conducted in class prevents students' visualization skill. Now, educators desperately have to change their teaching method to be in line with today's modern world. Reliance on textbooks alone and lack of attractive teaching aids such as graphic approaches or use of technology can make it harder for students to have a better understanding of the subjects[7].

There are few teaching aids have been developed and studied to assist and facilitate students' understanding of the topic Plan and Elevation. But most of them are software that installed in the computer which it cannot give students concrete experience about the concept[7,8]. So, OPK as teaching aids with innovating ICT has been designed in this study that can be touched and used by students either individually or by group. The use of conventional methods in teaching will cause students to become passive in the classroom. When students do not have a concrete experience of exploration about the topics, so they cannot visualize and interpret the object in their drawing

3. ORTHOGONAL PROJECTOR KIT (OPK)

OPK consists of an orthogonal projector (OP), colored skeleton blocks (CSB) and a module for teaching and learning by using it. As a new teaching aid with innovative ICT, the main purpose ofusing OPK is to assist teachers and students in the process of teaching and learning in topic Plan and Elevation, Engineering Drawing and Orthographic Projection. This OPK has been tested in schools and it can improve student's achievement in the subject that being taught.

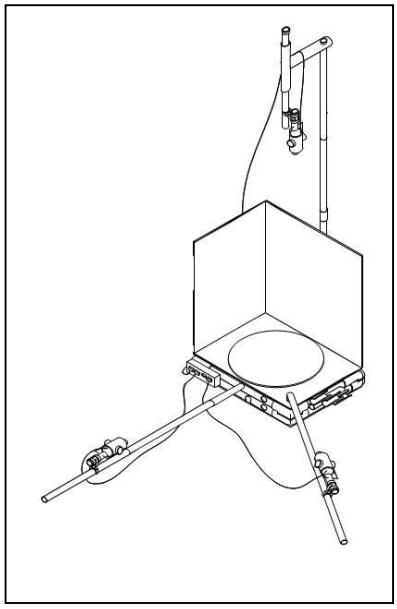

Fig.1. Orthogonal Projector (OP)

i. Orthogonal Projector

The OP's site and barricades are constructed using modeling board. The structure of the OP is made of PVC pipes. OP is equipped with three webcams which placed in different positions to see from above, front and side of the CSB that's been placed on the OP's site. The position of these three cameras can be adjusted to get the best view of CSB which the PVC pipe that holds the front camera can be lengthened or shortened, and the PVC pipe that holds the side camera can be moved to the left or to the right. Not only the PVC pipes that can be adjusted, but the angle of the three webcam also can be adjusted. Besides that, the use of those webcam is selected because it is capable to capture pictures and also for saving the cost of developing the OP. All three webcams connect to the laptop to see the view from top, front and side. Students and teachers can see the view of the CSB through webcam which, being displayed on laptop screen. In addition, teachers also can connect the LCD projector to the laptop and then show the display on the LCD screen in front of the class. OP has been tested in schools and increase student achievement in the subject that have been taught.

ii. Colored Skeleton Blocks (CSB)

Apart from OP, CSB is also provided in this OPK. For this kit, the researcher recommends the use of CSB against a solid block because if the students use that block, they cannot clearly see the back side of that block from the point of view of the webcam. But if they use CSB, they can see all sides of the CSBclearly which is colored with three different colors, which are yellow, red and blue. These colors are used to facilitate the students to identify which side of the CSB that is in front and behind for the angle of webcam that they want.When students have mastered how to draw a plan and elevation by using CSB, so they can put other objects on the OP's site and then they draw a plan and elevation for that object. Through this, it can encourage students to explore the knowledge that they have learned and apply it in their environment.

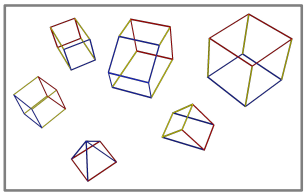

Fig.2. Colored Skeleton Blocks (CSB)

iii. Module

This module consists of two parts which are, a module on how to use the OP, and a teaching module by using OP for topic Plan and Elevation. Based on the module on how to use OP, users

will able to learn step by step of installing the OP from beginning on how to connect OP with a laptop, to see and change the webcam's view until the way to fold and store it.Teaching module was built according to the specifications of the mathematics curriculum for form 5, which comprises three main objectives; to understand the characteristics of geometric cube, cuboid, prism, cylinder, cone and sphere; understandand use the concept of orthogonal projection; understand and use the concept plan and elevation.

4. ACTIVITIES OF TEACHING AND LEARNING USING OPK

The module needs to be used in the process of teaching and learning by using OP in the classroom. Firstly, teachers should explain how to use the OP for the students based on the module. Teachers should not re-read the instructions contained in the module, but they must be wise to use simple sentences to understand and show some examples of usage OPK so that students do not feel confused while using it.

For example, one of the objectives in OPK's learning module is to understand and use the concept of plan and elevation. The learning outcomes for this objective are students able to draw a plan, front elevation, and side elevation of a block. A triangular prism is shown in the question and students are asked to draw it from the requested point of view. First of all, students and teacher need to install OP and connect it with a laptop or computer according to the usage module of OPK. After that, for this question, teachers need to ask students to use triangular prism of CSB and put it on the OP's site exactly figure that being shown in the question. Students should aware of what color of CSB on the top, side and back. Then, students will choose the point of view of the webcam based on what's being asked in the question, for example, students have to choose the front view of the triangular prism. Based on the image on the laptop screen, students will draw a front elevation of the object.

5. CONCLUSION

The use of OPK as innovative ICT is to ensure the success of the process of teaching and learning in the classroom. The importance of this study is to help the various parties involved in the education system. This OPK has been developed in order to help student to improve their visualization skill that need to be used in the topic Plan and Elevation, Engineering Drawing and Orthographic Projection. In addition, the findings of this study are also aiming to help educators in

solving the problems faced by students especially those have low visualization skill. This method is another way to diversify the use of teaching aids in teaching and learning process related to the topic Plan and Elevation, Engineering Drawing and Orthographic Projection. Through the development of OPK, the Ministry of Education (MOE) can make it as one of the teaching aid that can be recommended by the school to assist the process of teaching and learning.

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