

E-Transform: Development of an Electronic Educational Quiz Board for Learning High-School's Mathematical Transformation

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Abstract — *Mathematical Transformation is a part of Mathematics Secondary grade syllabus in Malaysia where the students being exposed to three topics: translation, reflection and rotation. This paper is an extension of a published proceeding which proposed an educational kit that can be used to study the Topic of Transformation in Mathematics. The educational kit displays a question at an LCD screen in which student need to insert the correct shape at the appropriate slot at the given grid. Then, the educational kit gives feedback to the student. A survey is done to gauge the effectiveness of the educational kit. The result shows that the respondents agreed that the educational kit is suitable for the syllabus and catches the student's attention. From the same feedback, there is a need to improve the instructional of the educational kit as there are a few respondents among the students do not feel the educational quiz board can be handle without supervision.*

Keywords — *educational kit; mathematics; transformation; translation; reflection; rotation; shape; electronic quiz board.*

I. INTRODUCTION

'Transformation' is one of the main topics in the Mathematics subject. It consists of a few important sub-topics such as translation, reflection and rotation. Nowadays, most of the students in high school are unable to answer those questions which are related to this topic due to their weak imagination. For instance, to find out the image of a shape under rotation, students have to use the coordinates on the grid paper to perform their answers. Besides that, it is very difficult to check back and confirm their answers whether it is correct especially during dealing with rotation

as the questions can be the rotation in counter clockwise or clockwise in different angles.

There are increasing trend in academic publications related to unsupervised educational kit, [1] proposed an electronic board game of the famous Mastermind board game as the output of the Conceive-Design-Implement-Operate (CDIO) program implemented in Universiti Teknologi MARA Cawangan Johor Kampus Pasir Gudang. Faseh et al. [2] proposed a cheaper version of the electronic board kit which powered by Arduino that simulates Programmable Logic Controller's (PLC) Mneumonic Code which targeted to secondary school students.

Rifin et al. [3] proposed the development an Android-based app for examination purposed. Zakaria et al. [4] proposed the development of an electronic educational quiz board that test student knowledge on a topic of Control Principles. Yaacob et al. [5] proposed an educational kit that test student knowledge of C Programming by using Flowchart block. Kadiran et al. [6] has proposed an educational kit that use water level as application in order to test student knowledge in Control Principles subject. Meanwhile, Hafizan et al. [7] proposed the development an electronic-based of Congkak board game in order to encourage younger generation to play the traditional board game. Hairuddin et al. [8] on the other hand has proposed Computer Assisted E-Laboratory using LabView and Internet-of-Things Platform as Teaching Aids in the Industrial Instrumentation Course. Rozani et al. [9] proposed E-Othello: The Development of an Electronic-Hardware version of Traditional Othello Board Game.

Currently there are two educational tools that related to this project. Math Warehouse is a website that enables



students to learn transformation through animation [10]. It covered all the transformation part, such as reflections, rotations, translations and dilations. Math Interactive is a mathematics website that covered a number of topics such as Trigonometry, Graphs, Circles and more. Transformation is also one of the topics that covered in this website. IXL Learning is a website that allows high school students to learn transformation in different kind of levels via online [11]. It provides students a space to enter their answer based on the question given or by using cursor to drag the shape of the answer on the coordinate plane. A very detailed explanation will be given if the answer entered by the students were wrong. Dalila et. al [15] on the other hand has proposed teaching aids on IoT's subject using LabVIEW. Others teaching aids that use Arduino as a base hardware for the prototype includes in the papers [16 - 18]. Yusoff et al. proposed an interactive educational quiz board for testing student know in basic Control System [19]. Another work related to educational kit in Control System is done by Azahar et al. which focus on aiding student understanding on electrical mathematical modeling.

Noticing the problem mentioned earlier and the current solutions which all are website based, therefore this paper proposes a hardware electronic-powered educational kit that test student knowledge on 'Transformation' where the kit automates the process of providing questions, the student select relevant shape and insert the shape to a relevant coordinates of the grid, and the kit will give feedback to the students which reduce the dependency on the teacher. This educational kit provides an experiential learning to the student which is known to be beneficial as it accelerates learning, bridge the gap between theory and practice, and enable personalized learning.

II. METHODOLOGY

e-Transform is an electronic board that test high school student's knowledge in Mathematical Transformation. Students can easily insert the female pin header (Fig. 1(a)) that they want onto the long straight turn pin for the purpose of finding the image of an object according to the question given on the TFT LCD and check their answers by entering the instructed character on the 4x4 keypad. The melody "twinkle-twinkle little star" from the buzzer and green LED are used to indicate the correct answer, whereas the long "beep" sound and red LED are used to indicate the wrong answer. Fig. 1 shows the project prototype from the top-view of the educational kit while Fig. 2 shows the block diagram of the project prototype.

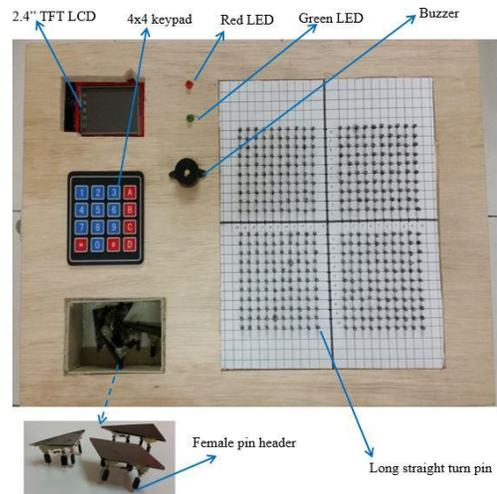


Fig. 1 Project Prototype

Fig. 3 shows the general flowchart of the educational kit. Firstly, students need to select the type of questions (reflection, translation or rotation) that they want and follow the instructions that displayed on the TFT LCD by entering the indicated value on the 4x4 keypad. Then, the students need to slot the shape or point that they want by using female pin headers on the Cartesian coordinate (composed of straight pin headers). Next, the students have to enter and check their answer. If the answer is correct, green LED will turn on and TFT LCD will display true statement. Else, the buzzer and red LED will turn on together and TFT LCD will display false statement which indicates the wrong answer. The whole process keeps repeating until the students switch off the educational kit.

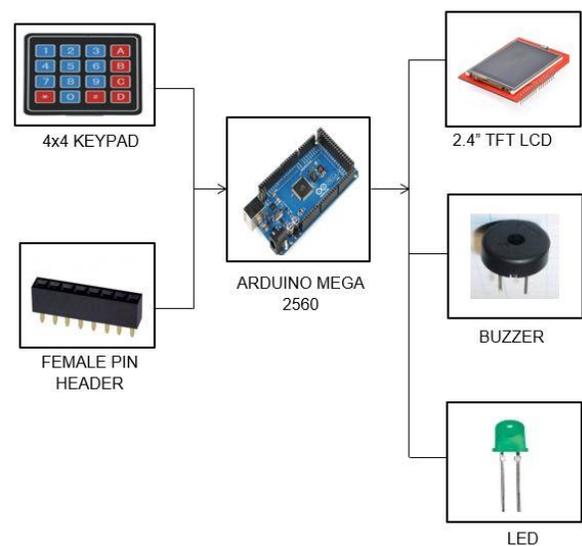


Fig. 2 Block diagram of educational kit

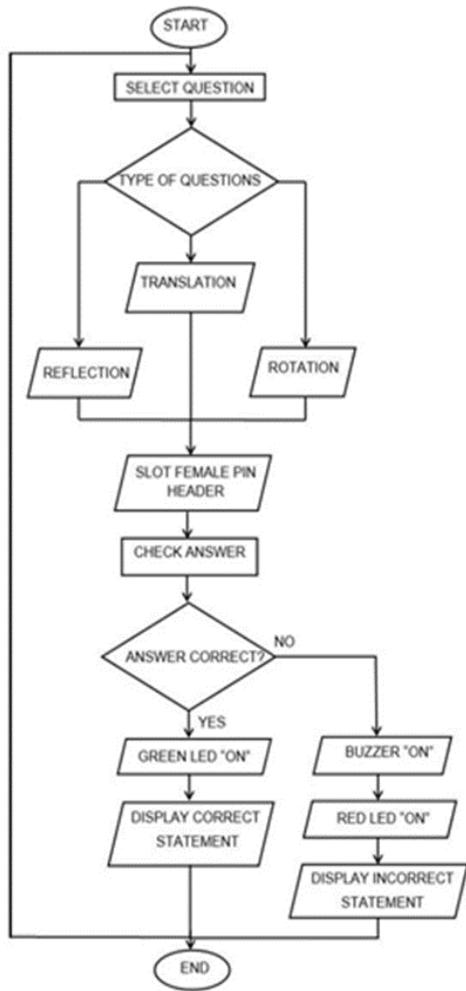


Fig. 3 General flowchart of the educational kit

III. RESULT & DISCUSSION

For the results, a brief satisfaction survey has been conducted from 19th until 21st April 2017 among 40 students and 15 educators at Potensi Jaya Tuition Centre in order to gauge the effectiveness of the educational kit. Due to its strategic location, this tuition centre had been selected where it surrounded by various schools and hence, consist of students from private and government schools. Basically, the students come from different schools such as SMK Taman Selesa Jaya 1, SMK Taman Universiti 2, SMK Taman Mutiara Rini 1, SMK TBI, Tenby International School, SMK Bandar Uda Utama, SMK Taman Universiti 1, SMK Dato' Usman Awang, SMK Infan Jesus Convent, SMK Taman Bukit Indah, SMK Taman Selesa Jaya 2 and SMK Taman Tun Aminah, specifically among the Form 2 and Form 3

students. The selection of students are based on their school syllabus where they already learned the topic of 'Transformation'. The questions of the survey are shown in Table 1 while Fig. 4 and Fig. 5 shows the satisfaction on the educational kit according to the question asked to the students and teacher, respectively. All paragraphs must be indented. All paragraphs must be justified, i.e. both left-justified and right-justified.

TABLE I
SURVEY QUESTIONNAIRES

No	Survey Question	Survey Type
1.	This educational kit explained very well in kind of answers.	5-scale Likert Scale
2.	The questions asked by this educational kit are easy to be understood.	5-scale Likert Scale
3.	This educational kit can be a highly interactive activity.	5-scale Likert Scale
4.	Students are able to operate this educational kit without the guidance of educator/ teacher.	5-scale Likert Scale
5.	Students gained better understanding after answering the entire questions in this educational kit.	5-scale Likert Scale
6.	All the sub-topics that performed by this educational kit is related to secondary school's syllabus.	5-scale Likert Scale
7.	This educational kit definitely can catch students' attention.	5-scale Likert Scale
8.	The contents of this educational kit are suitable for higher secondary school's students.	5-scale Likert Scale
9.	This educational kit can stimulate students' imagination.	5-scale Likert Scale
10.	Students prefer to learn this subject by using the educational kit rather than in theoretical way.	5-scale Likert Scale

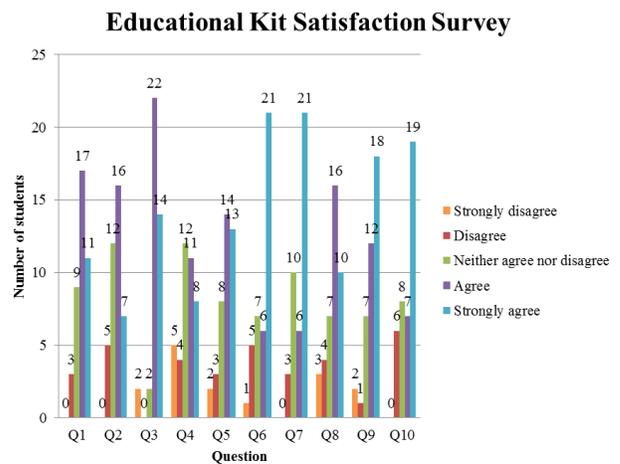


Fig.4 Students' satisfaction for each question

The survey results conducted to the students from several schools mentioned specifically to students Form Two and Form Three had shown in Fig. 4. 70% of the students felt that this educational kit had explained well in term of the answer while only 7.5% disagree. On the question of whether the kit is user-friendly or not, 57.5% students rate it as easily to be understood. Meanwhile, 90% of the students rated that by learning through this kit, it had exposed them to the interactivity hence could generate interest to learn. However, 22.25% students rated that they need guidance to operate this kit. 67.5% students felt that learning through this kit gets better understanding for learning transformation topic. 75% students also believed that learning through this kit could stimulate imagination and 65% students preferred to learn transformation topic using this educational kit.

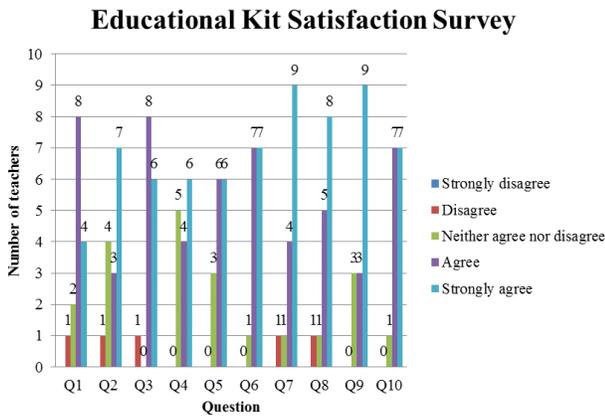


Fig.5 Teachers’ satisfaction for each question

Fig. 5 shows the survey conducted to the teachers that teach the subject. 80% of the teachers felt that this educational kit had well explained in term of the answers. Besides, 66.67% teachers also felt that the questions asked in this kit were easily understood. Meanwhile 93.3% teacher rated that this kit could generate interactivity for the learning process. None of the teacher disagreed when asked about whether students need guidance when using this kit and whether this kit could give better understanding to the students to learn transformation topic. Meaning, for the learning process, majority teachers believe that students can understand more when they are expose to this kit. None of the teachers disagreed that this kit could stimulate student imagination and they preferred to learn through this method as compared to traditional method.

From the surveys conducted to both teachers and students, it can be seen that both teachers and students strongly agreed that; 1) the educational kit definitely can catch students’ attention; 2) the contents of this educational kit are suitable for higher secondary school’s students. While for Q10, the student highly agreed that the statement “Students prefer to

learn this subject by using the educational kit rather than in theoretical way” while most teachers only rated agreed to the statement. Besides, the kit also help students exposing their thinking and imagination further for the mathematics subject hence could generate more interest to learn math. Noticeably, that a few students find the proposed education still require supervision. Based on this finding, the authors believe that the educational kit needs to be more instructive.

IV. CONCLUSION

In this paper development of an electronic-based educational kit to test student knowledge on Mathematic Transformation called e-Transform had been presented. The hardware construction and the flowchart of the algorithm of the educational kit had been explained. In order to get the feedback from users about this hardware, the finished prototype was then presented to a group of the targeted audiences which then a survey is done to gauge the effectiveness. The feedback obtained shows the potential of the proposed prototype. Yet the authors believe a further analysis needs to be done in order to really examine the relevancy of the prototype to real application.

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