

## **E-TRANSFORM: HIGH SCHOOL EDUCATIONAL KIT FOR LEARNING MATHEMATICAL TRANSFORMATION**

Zabidi, M.I.Z.M.<sup>1\*</sup>, Yung, L.T.<sup>3</sup>, Rifin, R.<sup>4</sup>, Kadiran, K.A.<sup>4</sup>, Abidin, A.F.Z.<sup>1</sup>, Harun, M.H.<sup>1</sup>, Azahar, A.H.<sup>1</sup>, Karis, M.S.<sup>2</sup>, Ali, N.M.<sup>2</sup>, Yusoff, Z.M.<sup>4</sup>

<sup>1</sup>) Faculty of Electrical & Electronic Engineering Technology, Universiti Teknikal Malaysia Melaka, 76100 Durian Tunggal, Melaka, Malaysia.

<sup>2</sup>) Faculty of Electrical Engineering, Universiti Teknikal Malaysia Melaka, 76100 Durian Tunggal, Melaka, Malaysia.

<sup>3</sup>) School of Science & Technology, Wawasan Open University, 81300 Skudai, Johor, Malaysia.

<sup>4</sup>) Faculty of Electrical Engineering, Universiti Teknologi MARA Cawangan Johor Kampus Pasir Gudang, 81750 Bandar Seri Alam, Johor, Malaysia.

Corresponding Author e-mail: izzat.zakwan@utem.edu.my

### **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 proposed an educational kit that can be used to study the topic of Transformation in Mathematics. The educational kit displays question at the LCD screen in which the 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 results shows the potential of the educational kit.*

**Keywords:** educational kit; mathematical transformation, translation, reflection, rotation

---

## **1. INTRODUCTION**

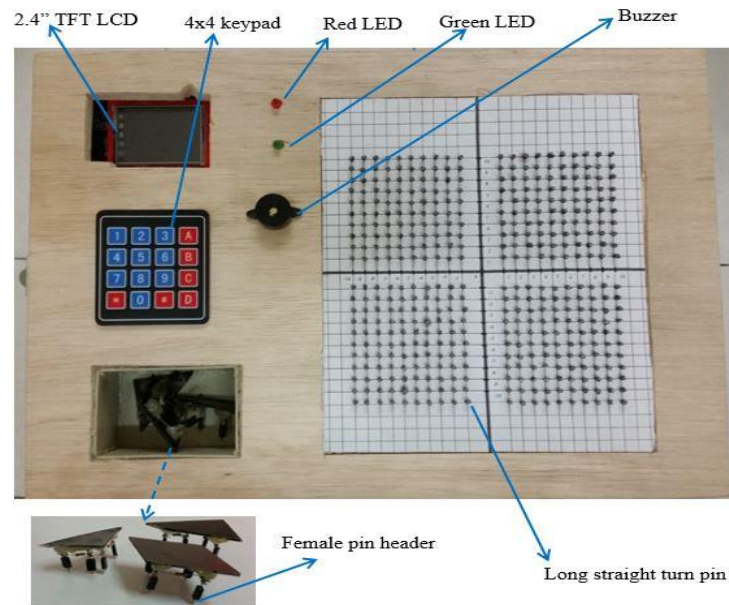
‘Transformation’ is one of the main topics in the Mathematics subject. It consists of a few important sub-topics such as translation, reflection and rotation. Nowadays, most of the students in high school are unable to answer those questions which are related to this topic due to their weak imagination. 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.

Currently there are two educational tools that related to this project. Math Warehouse is a website that enables students to learn transformation through animation [1]. IXL Learning is a website that allows high school students to learn transformation in different kind of levels via online [2]. 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.

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.

## 2. METHODOLOGY

e-Transform is an electronic board that test student the high school students' knowledge in Mathematical Transformation. Students can easily insert the female pin header (attached below the shapes) 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. Figure 1 shows the project prototype from the top-view of the educational kit.



**Figure 1: Project prototype**

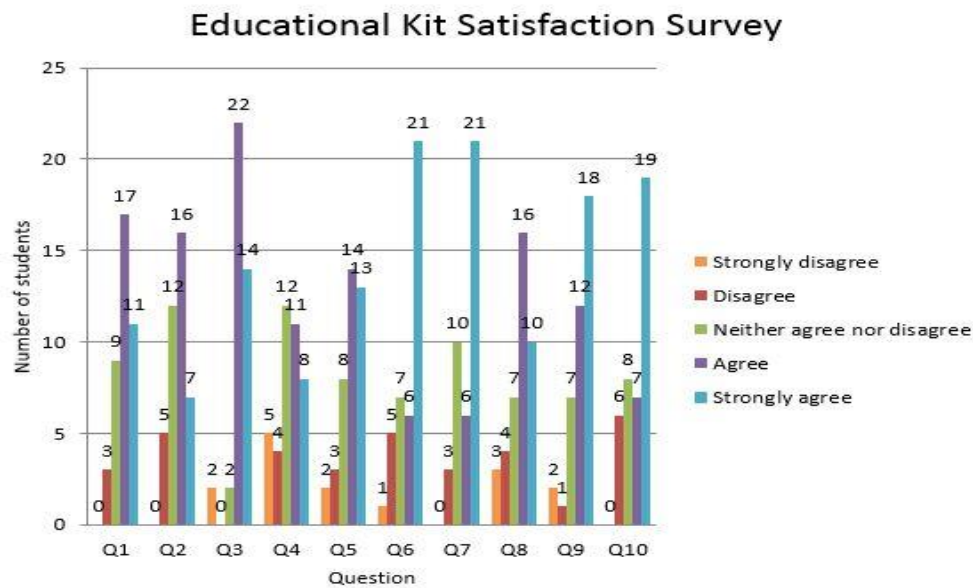
Firstly, students need to select the type of questions (reflection, translation or rotation) that they want and follow the instructions that displayed on the TFT LCD by entering the indicated value on the 3x4 keypad. Then, the students need to slot the shape or point that they want by using female pin 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 statements. 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.

## 3. RESULT AND DISCUSSION

In order to gauge the effectiveness of the educational kit, a brief satisfaction survey has been conducted among 40 students at Potensi Jaya Tuition Centre. The reason of choosing this tuition centre is because it's best location surrounded by 12 private and government schools, specifically among the Form 2 and Form 3 students because the students have learned the topic 'Transformation' according to the syllabus. The questions of the survey are shown in Table 1. Figure 2 and Figure 3 shows the satisfaction on the educational kit according to the question asked to the students and teacher, respectively.

**Table 1: Survey questionnaire**

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



**Figure 2: Students' satisfaction for each question**

Figure 3 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 rate that this kits could generate interactivity for the learning process. None of the teacher disagree when asked about whether students need guidance when using this kits and whether this kits could give better understanding to the students to learn transformation topic through this kit. Meaning, for the learning process majority teachers believe that students can understand more when expose

to this kit. None of the teachers also disagree that this kit could stimulate student imagination and preferred to learn through this method as compared to traditional method.

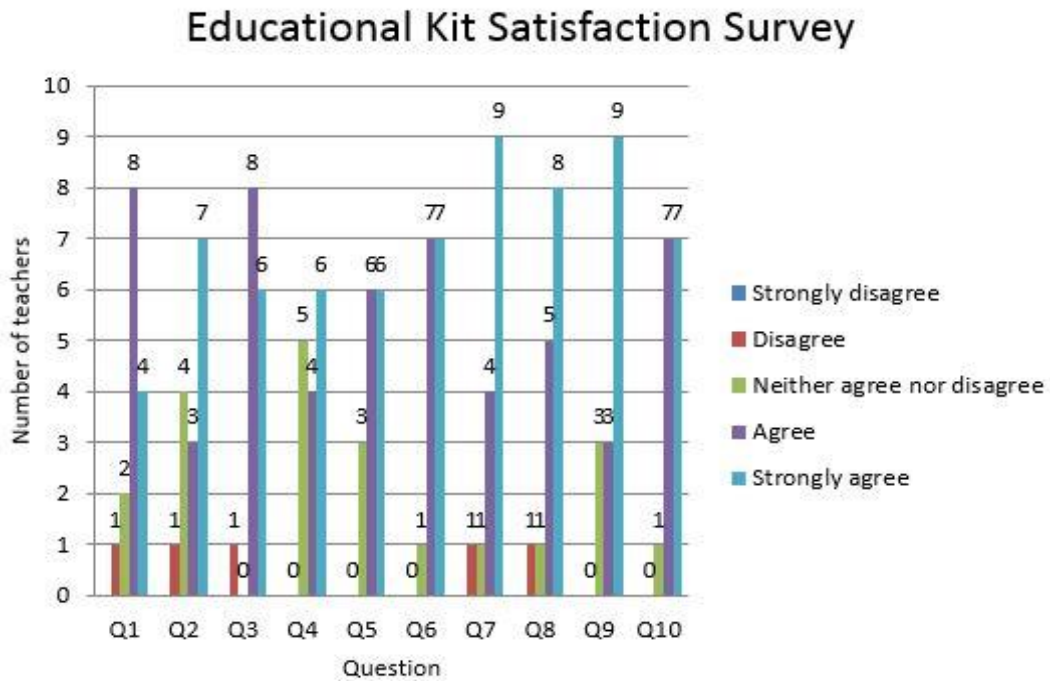


Figure 3: Teachers' satisfaction for each question

#### 4. CONCLUSION

This paper presented the development of an electronic-based educational kit to test student knowledge on Mathematic Transformation called e-Transform. The finished prototype is then presented to a group of target audiences which then a survey is done to gauge the effectiveness. The feedback obtained shows the potential of the proposed prototype. The authors believed a further analysis needs to be done in order really examined the relevancy of the prototype to real used.

## REFERENCES

- Transformation in math. (2016). Math Warehouse Website. Retrieved on 2 August 2016 at <http://www.mathwarehouse.com/transformations/>
- Rotations: find the coordinates. (2016). IXL Webiste. Retrieved on 2 August 2016 at <https://www.ixl.com/math/grade-7/rotations-find-the-coordinates.>
- Faseh, M. H. A. H. A. M., Ismail, F. N., Majid, M. A., Abidin, A. F. Z., Yusoff ,Z. M., Rifin, R., Hasan, K. K., Ali, N. M., Rizman, Z. I. (2018). E-PLC The Development of a Programmable Logic Controller Trainer that Translates Mnemonic Codes to Hardware Simulation. *Journal of Fundamental Applied Science*, 10(2S), 499-513.
- A. Anuar, A. F. Hussin, M. A. Majid, A. F. Z. Abidin, Z. M. Yusoff, K. K. Hassan, N. M. Ali, M. H. Harun, Z. I. Rizman, “*E-Tester: The Development of an Electronic Board that Check Commonly Used Arduino-Based Electronic Components and Modules*”, *Journal of Fundamental Applied Science*, vol. 10, no. 2S, pp. 514-523, 2018.
- M. F. Z. M. Zakaria, S. A. C. Aziz, A. F. Z. Abidin, M. A. Adip, N. Rahim, W. H. W. Hassan, “*The Development of an Electronic Educational Quiz Board that Test Student Knowledge on Control Principle’s Second Order Transient Response by Using DC Motor Speed Control as Application*”, *ARPN Journal of Engineering and Applied Sciences*, 2018.
- M. R. Yaacob, A. I. M. Diah, A. F. Z. Abidin, K. A. Kadiran, R. F. Mustapa, M. Abdullah, M. I. Ismail, S. N. A. H. Zaiton, “*e-Flowchart: An Electronic Educational Quiz Board that Test Student Knowledge on C Programming Concept using Flowchart Command*,” *ARPN Journal of Engineering and Applied Sciences*, 2018.
- M. I. Z. M. Zabidi, L. T. Yung, K. A. Kadiran, A. F. Z. Abidin, M. H. Harun, M. S. Karis, N. M. Ali, Z. M. Yusoff, “*e-Transform: High School Educational Kit for Learning Mathematical Transformation*,” *Proceeding of Innovative Teaching and Learning Day 2018*, 2018.
- F. Hafizan, A. F. Z. Abidin, N. Z. N. Suhaimi, M. M. Mustam, K. A. Kadiran, S. A. Saleh, W. N. A. Rasid, “*E-Congkak: The Development of an Electronic Congkak Board Game to Promote Traditional Board Game to Younger Malaysian Generation*,” *ARPN Journal of Engineering and Applied Sciences*, 2018.
- Daniel C. Jeronymo, Rejane de Barros Araújo, Antonio A.R. Coelho, Julio E. Normey-Rico, *An Approach for Improving Student Performance in a Feedback Systems Course for Process Control Education*, *IFAC Proceedings Volumes*, Volume 47, Issue 3, 2014, Pages 10574-10579

Arduino.cc, Arduino Mega 2560. Retrieved on 9 August 2016. Retrieved from <https://www.arduino.cc/en/Main/ArduinoBoardMega2560>.

Elprocus.com, *what is LCD: Construction and Working Principle of LCD Display*. Retrieved on 9 August 2016. Retrieved from <https://www.elprocus.com/ever-wondered-lcd-works/>.

R. Rifin, T. E. Fang, A. F. Z. Abidin, A. Adam, M. A. Majid, A. Zainuddin, S. H. Mohammad, M.H. Harun, Z. I. Rizman, “Examwiz: A Development and Implementation of an Android Based Examination”, *Journal of Fundamental Applied Science*, vol. 10, no. 6S, pp. 965-976, 2018.

R. F. Mustapa, A. F. Z. Abidin, A. A. N. M. Amin, A. H. M. Nordin, M. N. Hidayat, “Engineering is Fun: Embedded CDIO Elements in Electrical and Electronic Engineering Final Year Project”, *Proceeding of the IEEE 9th International Conference on Engineering Education*, 2017.