Six to Ten Digits Multiplication Fun Learning Using Puppet Prototype

D’oria Islamiah Rosli¹, Azita Ali², Lim Soo Peng³, Imam Sujardi¹, Budi Usodo⁵, Fengky Adie Perdana⁶

¹,²,³ Faculty Of Technical and Vocational Education, Universiti Tun Hussein Onn Malaysia, Parit Raja, 86400 Batu Pahat, Johor Darul Takzim, MALAYSIA.

⁴,⁵,⁶ Mathematic Department Program of Sebelas Maret University,Jl. Ir. Sutami 36A Kentingan Jebres Surakarta 57126, INDONESIA

E-mail: doria@uthm.edu.my

Abstract. Logic and technical subjects require students to understand basic knowledge in mathematic. For instance, addition, minus, division and multiplication operations need to be mastered by students due to mathematic complexity as the learning mathematic grows higher. Weak foundation in mathematic also contribute to high failure rate in mathematic subjects in schools. In fact, students in primary schools are struggling to learn mathematic because they need to memorize formulas, multiplication or division operations. To date, this study will develop a puppet prototyping for learning mathematic for six to ten digits multiplication. Ten participants involved in the process of developing the prototype in this study. Students involved in the study were those from the intermediate class students whilst teachers were selected based on their vast knowledge and experiences and have more than five years of experience in teaching mathematic. Close participatory analysis will be used in the prototyping process as to fulfil the requirements of the students and teachers whom will use the puppet in learning six to ten digit multiplication in mathematic. Findings showed that, the students had a great time and fun learning experience in learning multiplication and they able to understand the concept of multiplication using puppet. Colour and materials of the puppet also help to attract student attention during learning. Additionally, students able to visualized and able to calculate accurate multiplication value and the puppet help them to recall in multiplying and adding the digits accordingly.

1. Introduction
In Eleventh Malaysia Plan, Ministry of Education Malaysia (MOE) has taken serious actions in regards to increase the quality of teachers and lecturers in several aspects, such as student oriented learning and at the same time enhance education delivery system. Education in Malaysia aims to produce generations that can think globally, committed and retain them to contribute back to the Malaysian society. In fact, MOE continuously review the curriculum in preschool to tertiary levels, as to ensure the school curriculum able to equip the students with knowledge, skills and values in the future.

Additionally, second phase of Malaysia Education Blueprint (2016-2020) also stated that Malaysian government is looking forward in planning and structuring in order to accelerate and improve Malaysia Education System so that the education system will continuously spur with
excellence [1]. Mathematic is a discipline that trains human mind to think logically and systematically in solving problems and making decisions. Mathematic in nature inherently promote meaningful learning and challenging thought. In relation to that, mathematic is one of the important efforts to be mastered by an individual to help them to think precisely and therefore perform appropriate actions.

Malaysia National Education Philosophy ensures that the curriculum remains relevant and in line with the current education trend for Malaysian society. For instance, Primary School Standard Curriculum (KSSR) for Mathematic was designed to consider continuous learning overtime. The measures are in line with the need to provide knowledge and skills in mathematic for students who have different background and multiple ranges of abilities in them. Through these knowledge and skills, it is hope that, students able to explore science, makes adaptations, modifications and innovations in 21st century learning.

Additionally, mathematic is one of the ways to develop individual intellectual proficiency in making logical reasoning, spatial visualization, analysis and abstract thinking. To learn mathematic, students able to develop learning skills in numeracy, reasoning, thinking and problem solving through mathematic applications [2].

In relation to that, KSSR goal is also to build students' understanding in numbering concepts, basic skills in calculation, understanding mathematical ideas and competent in applying the knowledge and mathematical skills in everyday life. Furthermore, mathematic provides opportunities for students to perform creative tasks and fun experiences and excited way in learning. Such experiences raise interest and become the driving force for students to learn mathematic in a fun way in the classroom.

Mathematic plays an important role in the development of science. Malaysian government has identified basic skills of numeracy as part of a major initiative to improve student achievement in Malaysia. In fact, LINUS (Literacy and Numeracy Screening) Program is a recovery program for students [3]. As such the programs is driven through the Recovery Program-3M (PROTIM) which was initiated in 2008.

From the program, MOE have found that around 24% of the students do not reach standard 4-targeted numeracy skills. Additionally, the study also claimed that failure to master the literacy and numeracy skills at early stage showed that, students have difficulties in learning. In fact, there were about 32,000 students dropped out from schools at various levels in 2008 [4].

Basic knowledge in mathematic operations such as addition, negation, division and multiplication is crucial in order to master the numeracy skills in problem solving. Students in primary schools needs the basic knowledge skills as to ensure that they are able to apply the skills, in dealing with time, money, measurement, distance, time, scale or any other areas. To date, this study will focus on developing a puppet prototype for six to ten multiplication operation as an initiative to help students to master multiplication operation in a fun learning environment.

2. Fun Learning

Edutainment means educating while entertaining. Edutainment is an alternative to the current methods of teaching and learning. In primary schools, the government intends to introduce edutainment approach in order to support the 10th Malaysia Plan in making a transformation to the education system to become a reality. Indeed the focus of the edutainment is to embed interactive teaching methods, so that the teaching and learning will be more interactive and understood by the students.

In addition, edutainment can also reduce the level of anxiety and fear among the students to interact or communicate with the teachers and the students. In fact, edutainment also provide relaxing and entertaining environment. Thus students are always in a state of positive learning and eagerly wait for the learning session the next day.

Edutainment sessions provide the opportunity for the students to speak freely, express opinions and ideas logically but controlled to provide an attractive presentation. In addition, students are free to move, to act, sing and so on but manageable.
Edutainment is considered effective if the learning activities are structured and well planned [5]. However there are several features that should be considered by teachers when planning edutainment activities in the classroom. Activities should be tailored to the level of students to be taught such as the usage of puppet, to master students’ multiplication skills and to foster students' interest in learning mathematics. Absorption edutainment requires the implementation and provision of appropriate learning time or flexible hours. In addition, edutainment activities can be implemented resolved with the disciplines without any problems or obstacles. Clear rules, fun layout, easily understood instructions and need to be prepared. Additionally, planned edutainment activities will help students to actively participate in the learning environment and the students felt satisfied in learning [6]. Additionally, teaching method that is likely to maintain good motivation and retain students to be online is a method that involves them actively [7].

Jackmen thought puppet is one way to entertain and attract students towards creative thinking and imagination. Jackmen stated that, the puppet can help the development of affective, cognitive and physical skills [8]. In fact, the use of puppet also give an opportunity for the students to improve their communication skills, produce creative ideas, stimulate the imagination because of the intellectual development of students depends on the natural environment that stimulate [9].

3. Participatory Analysis
In this study, ten participants will closely involve in the process of developing the puppet prototype that help students to learn multiplication. Participants will take note on questions that given to them and feedback from the participants will be recorded in a form of checklist. The data then will be analyzed as an input to improve the puppet prototype. Inputs from the participants were crucial as it will be used by the researcher to design and progressively improved the prototype for the next phase of this study.

Furthermore, before the prototype evaluation proceeds the participants also will be briefed by the researcher on how they use the puppet for six to 10 digits multiplication to learn mathematics. It is hope that the participants will had a great and fun time in using puppet as a medium to help them in learning mathematic especially in learning basic multiplication operations. Figure 2 illustrates numbers that represents each finger. The process of using the puppet to learn six to ten digit multiplications will be elaborated in the next sub sections.

![Figure 1: Representation of digits and fingers](image-url)
i) Representation of digits and finger (Figure 1)
   - The thumb represents number 6
   - The index finger represents number 7
   - Finger ghost representing number 8
   - The ring finger represents number 9
   - The little finger represents number 10

ii) Value for open and folded fingers
   - Each finger that opens equals to 10
   - Each finger that folded equals to 1

iii) Mastering the multiplication tables
   - Each finger that opens, equals to 10
   - Fingers that is folded on the right and left hand need to be multiplied
   - Multiplication tables value = total of open fingers value +
     total of multiplied folded fingers value

Figure 2 illustrates basic multiplication digits for 6x6 values. Two open fingers represents total of
20 values. 4 fingers were folded on the left and right hand side, which equals to 4x4 equivalents to 16
values.

Therefore the 6x6 multiplication tables value = 20 + 16
= 36.

Example 1:
6 x 6
Open Finger : 2 = 20
Folded Finger : \( \frac{4 \times 4}{6 \times 6} = 16 \)
\( 6 \times 6 = 36 \)

Figure 2: 6x6 values

Figure 3 shows the basic multiplication digits for 8x7 values. Five open fingers represents total of 50
values. 2 fingers on the left and 3 fingers on the right hand side were folded, which equals to 2x3 and
equivalents to 6 values.

Therefore the 8x7 6 multiplication tables value = 50 + 6
= 56.

Example 2:
8 x 7
Open Finger: 5 = 50
Folded Finger: \( \frac{2 \times 3}{8 \times 7} = 6 \)
\( 8 \times 7 = 56 \)

Figure 3: 8 x 7 values
4. Results and Discussion

At the earliest stages of designing and developing the puppet prototyping, there were several trials in selecting the best materials for the puppet. Figure 4 illustrates the selection begins from using the existing small puppet inserted on the finger, the hand woven gloves, the hand plastic gloves and finally the smooth white hand gloves. Due to the inconsistencies in using types of finger puppets, most of the participants felt confused because they may think that different finger puppet will represent different values. Indeed, each open finger actually represents the same value of 10 and folded finger represents a value of 1. Consistency in design is crucial as it help users to have a clear overview and understanding in using the system or applications. Furthermore, consistency helps users to understand the basic knowledge and retain the information in their Long Term Memory [10].

Additionally, the participants also reported that the drawing on the hand woven and plastic hand gloves was not clear. This is due to the rough materials and it was difficult to draw an image on the cloth. Whilst for the plastic hand glove, the drawing was easily removed and the participants having difficulties to recall the information. Information requires users to think and recall, and give mental workload for the users. Too much of information will give burden to users’ mind and give stress to the students [11]. As for the smooth white hand gloves, the participants reported that they can see a clear drawing on the puppet and they can easily fold their finger as compared to the hand woven and plastic gloves. However, participants claimed that the plastic gloves will sticks together, if the gloves kept in a hot temperature and can get easily torn.

In relation to the concept of using puppet for fun learning, the participants felt excited because by using the hand gloves puppet, the participants able to experience by manipulating their own fingers and do the calculation on their own. In addition these allow the participants to think and at the same time help the participants to memorize the multiplication operations. In fact thinking through actions will help users to master the skills effectively [12]. Cartoon characters and numbers on the puppet help the participants to recall the information such as representations in numbers and calculate the addition and multiplication easily.

![Figure 4: Puppet materials selection](image-url)
Furthermore, the participants also suggested that, the cartoon character and displayed numbers on the puppet can be improved if the design uses printed images. The participants also informed that they would prefer brighter colour for the cartoon characters because the colour may attract students’ attention as to ensure that the students will experience fun learning in the class. In fact, colour is a language capable of expressing emotion, and the drawing helps to convey the information in an artistic creation [13]. Most of the participants claimed that the puppet help them to do the calculation fast and they are having a great time in using the puppet for multiplication learning purposes.

Moreover, the participants also claimed that is easy for them to learn the concept of puppet multiplication operations since it only add the total of the open fingers values with the multiplication of the left and right folded finger values. Since the puppet multiplication steps is simple and easy for the users to understand, the participants does not need a longer time to learn the puppet multiplication operations. In fact students also felt that it is easy for them to memorize the multiplication table if they used the puppet to learn multiplication operations. Moreover user friendly elements may be helpful for the students to learn the system easily.

5. Conclusion

To conclude, the participants had a great time in using the puppet to learn six to ten digit multiplications. Learning in a fun way using puppet give a new dimension of fun learning because it allow direct manipulation with human physical fingers. Direct manipulation help the users for self experiencing the learning process and also help them in memorizing the multiplication table. Indirectly, teachers and students can interact with each other and the positive interactions during teaching and learning will contribute to a peaceful learning environment.

In fact, to come out with a user friendly design, the selection of materials, the image or drawings that used in the development of the product also help the students to have a fun learning in the environment. Information that is not appropriately displayed to the users will restrict them, to get a full access of the information that they need. Moreover, to have fun learning environment, materials or and the usage of colour also plays an important role as it help users to have a better understanding about the topic, a good design will help students to master their learning process. Additionally, thinking that leads to actions allow users to activate human sensory memories effectively and it is hope that, manipulation of puppet in learning multiplication will help students to learn multiplication easily and able to help them to excel in mathematic.

References

[1] Eleventh Malaysia Plan. Strategy Paper 10th: Transforming Education System. Retrieved from: http://rmk11.epu.gov.my/pdf/11MP-Brochure-B1.pdf
[2] Jonsson, B., Norqvist, M., Liljekvist, Y., Lithner, J., 2014. Learning mathematics through algorithmic and creative reasoning. The Journal of Mathematical Behavior. Elsevier. 36 20-32.
[3] Luyee, E. O., Roselan, F. I., Anwardeen, N., Mohd Mustapha, F. H., 2015. Suitability of the Literacy and Numeracy Screening (Linus) 2.0 Programme in Assessing Children’s early Literacy. The Malaysian Online Journal of Educational Science. Vol 3 (2), 36-44.
[4] Ministry of Education Malaysia. (2012). The Malaysia education blueprint 2013-2025: Preliminary report. Putrajaya: Kementerian Pelajaran Malaysia.
[5] Sauer, S., Osswald, K., Wielemans, X., Stifter, M. 2014. U-Create: Creative Authoring Tools for Edutainment Applications. Technologies for Interactive Digital Storytelling and Entertainment. Vol 4326 163-168.
[6] Robertson, D. 2007. Visual scenario representation in the context of a tool for interactive stortelling. Visual Stroytelling Using Virtual Reality Technology for Storytelling. Vol 4871. 3-12.
[7] Mohd Hatta., N. 2012. Keberkesanan Penggunaan Kaedah Bermain Dalam Pengajaran dan Pembelajaran Asuhan Tilawah Al-Quran Tahun 4. Seminar Penyelidikan Tindakan IPG
KBL, 34-44.

[8] Ab Yazid, N. 2012. Using Puppets in Classroom Improve Preschool Children Communication Skills. Seminar Pendidikan Johor 2015

[9] Piaget, J. 1999. Play, Dreams and Imitation in Childhood. New York: Taylor & Francis.

[10] James, R., Stephen., T & Lynn., E. 1997. Designing and validating a measure of moral judgement: Stage preference and stage consistency approaches. Journal of Education Psychology. Vol 89. 5-28.

[11] Chaouachi, M., & Frasson, C., 2012. Mental Workload, Engagement and Emotions: An Exploratory Study for Intelligent Tutoring Systems. Intelligent Tutoring Systems. 65-71.

[12] Tall, D. 2004. Thinking Through Three Worlds of Mathematics. Proceedings of the 28th Conference of the International Group for the Psychology of Mathematics Education. Vol 4 281-288.

[13] Zagalo, N., Gobel., Torres., Malkewitz, R., Branco, V. 2006. INSCAPE: Emotion Expression and Experience in an Authoring Environment. Technologies for Interactive Digital Storytelling and Entertainment. Vol 4326 219-230.