E-Numeracy: Mobile Application of The Numeracy Understanding Model for Primary School

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Abstract—The purpose of this study is to examine the use of e-Numeracy: Mobile Application of the Numeracy Understanding Model among primary school students. Through e-Numeration, it allows students to solve numerical problems in their respective smart devices and find out the solution for each question. This learning method supports the concept of 21st century learning and facilitates self-learning as well as fun learning. This e-Numeration can be accessed via a tablet or any digital device by using the bar code provided. The app is easy and mobile and can be accessed anywhere. Six Year Four students were selected for this study. They were chosen based on their monthly Mathematics test results. There were two students per level; good, average and weak. For data collection, this study applies qualitative design using interview methods. The result indicated that only four respondents were able to solve all the learning activities at the application level that involved concepts and facts of mathematics, procedures for selection and definition and giving reasons. Two respondents were at the level of knowledge acquisition. This level involved elaborating basic facts, defining and formulating operations that were used in the learning activities. In conclusion, through the e-Numeracy application, student is able to recognize his numeracy level of comprehension and the student can identify their error directly as well as the students enjoyed using this application. This study also indicates that the necessity to increase the level of numeracy understanding for students at elementary level.

Keywords—Numeracy Understanding Model, mobile learning (M-Learning), e-Numeracy, primary school, mobile app

1 Introduction

As time goes by, the trend of teaching and learning are changing rapidly towards the better future in our education system. Learning and facilitating is not merely conducted in classroom settings anymore as it has undergone a tremendous transformation. The evolution of this transformation in education technology occurs when a new type of learning was introduced, with the given name of mobile learning or Mo-

bile Learning (M-Learning) (Hendriwanto & Utut Kurniati, 2019). This type of learning was introduced in order to improve the level of teaching and facilitating. It also acted as an alternative to face-to-face traditional type of learning (Gal-Ezer at. El, 2003) as well as digital learning (distance learning and electronic learning (e-Learning) (Noraini Idris, 2009).

The implementation of M-Learning as a new concept of teaching and facilitating in Malaysia is appropriate as the ability of this country to provide ample service and facilities which provides the users with general electronic information as well as educational content that will enable them to search information regardless of time and place. This claim was supported by (KPM, 2010), in which they agreed that learning process can be done without boundaries – to be specific, physical boundaries as it can be accessed anywhere and at any time.

Basically, the use of mobile devices such as smart phones, PDAs, iPods, PALM-TOPs, laptops or digital cameras in the teaching and learning process is called M-Learning (. Align with the advancement of technology this has enables mobile devices to be used as learning tools that provi (Kukulska-Hulme &Traxler, 2005). des flexible, mobile, independent learning environment that allowed communication between students and their respective lecturers take place (KPM, 2011). Merriam (2002) defines Mobile Learning as follows: "... The intersection of mobile computing and e-learning: accessible resources wherever you are, strong search capabilities, rich interaction, powerful support for effective learning, and performance-based assessment. E-learning allows independent of location in time or space".

In short, it can be concluded that, mobile learning is one of learning model that utilizes the usage of information and communication technology. Mathematics is a least favorite subject among pupils in schools due to a lot of reasons. In order to create a new perspective of this subject as well as provide a conducive and attractive learning environment; the researchers have developed a mobile application called as e-Numeracy. The e-Numeracy is able to identify the level of students' numeracy based on the results obtained for each question. There are four levels involved in identifying their numeracy understanding. Besides, the researchers also introduced the use of Numeracy Understanding Model in order to identify the numeracy level of each pupil. There are four stages that each pupil needs to go through in order to achieve numeracy understanding, which is the first phase; de-coding, second phase; meaning making, third phase; application and ranking the last phase; analysis. Therefore, students need to solve numerical problems using e-Numeracy in order to determine the level achieved for each question (Siti Rahaimah Ali, 2017)

As for Year Four pupils, it was evident that there are weaknesses in terms of misunderstanding basic numerical concept, especially in solving problems particularly in the level of code interpretation and knowledge procurement process. This is supported with the study conducted by the Education Department of Kelantan State (2015) which showed that during the mid-year Mathematics exam, students were still weak in problem solving questions such as identifying the correct operations. It has been identified that students at primary level are having substantial weaknesses especially in basic mathematics skill (Patton, 2008). Furthermore, it is also found that students

tend to misinterpret, overlook or forget the problem solving strategies. Students tend to memorize the process rather than understand the procedures.

Therefore, the main purpose of this research is to explore to what extent that the e-Numeracy mobile applications is used effectively in order to improve students' numeracy level and thus acted as a supporting learning and teaching tools towards 21st century. Precisely, this research is to identify the level of numeracy understanding for Year Four pupils based on the Numeracy Understanding Model by using the e-Numeracy mobile application.

2 Literature Review

There are four levels involved in Numeracy understanding framework model as stated by KPM, (2003) which consist of Decoding code, meaning-making , application and analysis. Due to the variety of levels involved, the teaching, learning and understanding of numeracy are a complex process (Ball, 2002; Kilpatrick, 2001). This model emphasizes the four level of numeracy understanding and in addition to give chance for students to comprehend the basic idea and background of numeracy before understanding further complex thinking. Secondly, it offers chances to explore diverse interpretations from class activities such as duos, group or entire students. Thirdly, it also offers chances for pupils in generating new information in order to clarify the outcomes that they have decided to their teacher and friends. Thus, this e-numeracy concept can relate between one another in order to find the solution for the given tasks (Ludlow, 2004).

The numeracy structure allows students to improve their numeracy understanding that will benefit them to improve their thinking especially in decision- making skills in their social and everyday life (Deni Darmawan at all, 2019). This model act as another type of teaching aid for teachers as to assist them to apply another type of teaching methods creatively and innovatively. The numeracy model can also generate numeracy ideas in teaching mathematics. Students will be given sample questions in order to allow them to be familiar with the questions. This will help them to interpret the code (de-coding), to meaning-making and the next phase of applying and analyzing (KPM, 2003). Thru this model, it can also assist students to be more creative using their acquired knowledge to solve questions.

The android mobile operating system (OS) is a fun learning tool that makes it easy for students to know their own level of numeracy understanding. Overall, M-Learning can be implemented in the Malaysian education system as it is a service and facility that supplies users with general electronic information and educational content that facilitates search regardless of time and place (Chitralada at all, 2019). Through the use of mobile learning indirectly it can improve both learning and facilitating process which is true to the definition of mobile learning itself as a learning model that utilizes information and communication technology.

3   Methodology

For the purpose of this study, six students of Year Four were selected as the samples based on three categories student; good, moderate and weak which are two students for each group. They were chosen according to their monthly Mathematics test score. They have been learning KBSR for three years. The selected samples also were chosen based on the paper consent attained from the school, the pupils, and their close relative as well as from advice of the school's Mathematics teachers. Nevertheless, the result of this study will not represent the Year Four students' population in general. Therefore, the probability sampling method is unnecessary (Khaddase at el. 2009). The samples were carefully selected based on their skill, readiness, obligation, and their enthusiasm to deliver the data required in the current study.

This qualitative study is conducted to identify the Year Four students' numeracy level of understanding using the e-Numeracy application. This research applies discussion processes to answer the research questions. This method is most appropriate to obtain answers for the research question. This method is significant because it has its own benefits and drawbacks. The framework of this model is built with the aim of determining the level of numeracy understanding, generally primary school students and especially the Year Four students.

This research instrument was developed based on a critical numerical modeling framework (KPM, 2003) involving numeracy. After the pilot study was done, modification and adaptation of the research instrument was made. The numeracy activity on each question was based to the Year Four KBSR Syllabus, textbooks, and previous studies. The questions are modified and uploaded to e-Numeracy via Android OS platform. Bar code is provided to enable respondents to access to each question at each level. Generally, to answer the research questions, five interview sessions were formed. The durations of each session were between 30 to 35 minutes.

4   Data Analysis

This research used interview method to gather data. Interview processes according to the Numeracy Understanding Model were used to obtain the findings in parallel with the research objective, which is to identify the students' numeracy level of understanding and students' errors during answering the questions given using the e-Numeracy application. Based on the guided questions, researchers use e-Numeracy to view and interview students according to the applications developed by researchers.

The Numeracy Understanding Model is introduced in order to identify the student's numeracy level. There are four levels that students need to pass in order to attain the numeracy level of understanding, Students solve numeracy problems using e-Numeracy where through this app students can find out directly at which point each question is solved. Researchers can also see the excitement of students using e-Numeracy in their learning.

5   Results

The findings from this research are to estimate the numeracy level of understanding based on the Numeracy Understanding Model when the student answered the questions during the interview. It was evident that when the students answered the questions using this app the students seems to enjoy doing it and at the same time it creates a fun learning environment that can be summed up in Table 1 below:

Table 1. Level of Numeracy Understanding for six Year Four students

De-coding Level	Meaning Making Level	Application Level	Analysis Level
PK5 PK6	PK2 PK3 PK4	PK1	-

These numeracy levels of understanding were attained from the five tasks given and samples were questioned during the activity. Based on Table 1, only PK1 reached the application level stage, while those who achieved the knowledge acquisition stage were PK2, PK3, and PK4. While PK5 and PK6 reached the interpretation level only. In the analysis stage, none of the respondents able to respond to the activities given based on the Numeracy Level of Understanding Module. Overall, students were eager to use e-Numeracy application to learn.

R :   This is the application of e-Numeracy on the mobile phone.
PK1: (looking excited) Oh! Really. What can I do with it?
R :   You could try to answer the questions given in this e-Numeracy apps.
PK1: (excited). Let me try please....

R : Okay. You could try to solve the questions
PK1: (Following the instructions on the screen and anxiously doing the exercises).
R :(Focusing on the pupil's excitement and engagement answering the questions)

R :   (Observing other students was using the e-Numeracy application)

PK2 : Madam, I'm trying to use this application

R : Okay go head and try
R :   (observing the students using the application). How do feel when you are us-
      ing this e- Numeracy application?
PK2: It was fun
R : Why do you say it was fun?
PK2: Well, I could identify which question that I can solve and which question
      thatI couldn't answer.

Based on the dialogues and observation on table 1 and 2, the students were able to answer the questions in each level and they were able to identify the questions that they were not able to answer. Therefore, form this; the researchers were able to identify the students' level of numeracy understanding.

6   Discussion

Tackling technology in today's education system is deem to be necessary as it can enhance learning and facilitates teaching processes. The creation of e-Numeracy, a mobile application that is based on Numeracy Understanding Model is the answer to

fulfill the needs of Malaysian curriculum. This method is in-line with the implementation of School-Based Assessment (PBS) that has been practiced widely in all schools.

Based on the interview and observation of the students also indicates that this e-Numeracy application is able to help teachers to identify the students' level of numeracy understanding. Therefore, it is found that an objective of this study is achieved and the research question has been answered. The findings also showed that the use of M-learning is one of the medium that can be used towards the 21st century learning, where students' achievement can be seen as a result of various approaches and methods of teaching and facilitating as well as in terms of assessment (Soh Hon Mun, at all. 2019).

7   Conclusion

In conclusion, M-learning is a new paradigm that was created in the field of education which is seen as more relevant to the needs of the students and in line with today's technology developments. With the technology advancement, it is possible to change the form of learning methods to create a broad learning community, to connect people in real-time or virtual worlds, to provide the necessary expertise and support lifelong learning (Van de Rij at el. 2011) .The use of mobile learning indirectly can improve and enhance the teaching and learning process. Based on this innovation, it can create excitement and students are be able to know their level of numeracy understanding that they acquired. The e-Numeracy has the potential to be one of the alternative teaching materials in the future to support learning activities as well as becoming one of the information delivery medium. This study also indicates the technique of numerical understanding among pupils in elementary schools need to be improved through the e-Numeracy applications.

8   Limitation

In this study, the researchers did not focused on the entire Year Four students in relation to the numeracy understanding level using e-Numeracy as a tool to know their level of numeracy comprehension. The findings of this study were limited to six students only. So the result of this study cannot be generalized to represent the entire Year Four students' population. The use of e-Numeracy needs to be further expanded so that fun learning can be nurtured from an early stage and students will enjoy learning.

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