MOBILE APPLICATION OF THE NUMERACY UNDERSTANDING MODEL AS e-ASSESSMENT

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ABSTRACT: *This study aims to examine the use of the Mobile Application of the Numeracy Understanding Model As e-Assessment. Through e-Assessment, 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-Assessment 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. The respondents of the study consist of six Year Four students who were selected based on their monthly Mathematics test results. There were two students per level; good, average and weak. This study uses a qualitative design by applying interview methods for collecting data. The findings show that four students were at the application level that can solve all learning activities that involved mathematical concepts and facts, selecting and defining procedures and providing the reason for each answer given. Two other students were at the level of knowledge acquisition. The students' ability at this stage was able to elaborate on the basic facts, explain, define and formulate the operations used in learning activities. In conclusion, the e-Assessment app can identify the level of numeracy comprehension and the student can identify their error directly as well as the students enjoyed using this application. This study also implies the need to improve the numerical understanding of numeracy among pupils in primary schools*

Keywords Numeracy Understanding Model, mobile learning (M-Learning), e-Assessment, mobile app

INTRODUCTION

In the new paradigm of the education system from the 21st century to the revolution 4.0 era, the trend of teaching and learning is changing rapidly towards a better future. Learning and facilitating is not merely conducted in classroom settings with traditional method anymore as it has undergone a tremendous transformation. The evolution of this transformation in education technology occurs when a new approach and tool of learning was introduced, with the given name of mobile learning or Mobile Learning (M-Learning). This approach of learning was introduced to improve the impact and effectiveness of teaching and facilitating processes and outcomes. It also offered an alternative to replace the traditional method of learning)[1] as well as promoting digital learning (distance learning and electronic learning (e-Learning) [2].

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 provide 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 [3], in which they agreed that the learning process can be done without boundaries – to be specific, physical boundaries as it can be accessed anywhere and at any time.

The use of mobile devices such as smartphones, PDAs, iPods, PALMTOPs, laptops or digital cameras in the teaching and learning process is called M-Learning 4]. Align with the advancement of technology this has enables mobile devices to be used as learning tools that provide flexible, mobile, independent learning environments that allowed communication between students and their respective lecturers take place[6] 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 the learning models that utilize the usage of information and communication technology.

Mathematics is the least favorite subject among pupils in schools due to a lot of reasons. To create a new perspective of this subject as well as provide a conducive and attractive learning environment, e-Assessment is created. It is a mobile application that is used to determine the level of numeracy understanding based on the results obtained for each question. There are four levels involved in identifying pupils' numeracy understanding. Besides that, the researchers also introduced the use of the Numeracy Understanding Model to identify the numeracy level of each pupil. There are four stages that each pupil needs to go through to achieve numeracy understanding, which is the first stage; de-coding, second stage; knowledge acquisition, third stage; application and rating four; analysis. Therefore, students need to solve numerical problems using e-Assessment to determine the level achieved for each question.

This innovation was created based on the Numeracy Level of Understanding Module, whereby researchers have discovered that pupils can identify their level of understanding when using this application. As it is a systematic process, it begins with the uploading of questionnaires into the mobile application and students will answer each question using their mobile device to surpass the first stage. The same process applies until they reached the last stage which is stage four.

This learning process is in line with the needs of the latest learning concept that encourage limitless learning boundaries, enable students to learn numeracy anywhere not only in the classroom setting. The students can identify their level of numeracy understanding; in line with the Malaysia Ministry of Education (MoE) aspiration which stated that students' numeracy understanding needs to be attentive. The vital goal of the primary school mathematics curriculum is to develop students with a balanced understanding of the concepts and skills that can be applied in real-life situations [7].

According to the National Key Result Areas (NKRAs) in 2008, the level of numeracy achievement in Malaysia was still moderate. It was found that 24% of Year Four students still did not have good command in basic calculations. This was evident with the comparison of results between 2003 and 2007 which stated that an approximately 20% of students in Malaysia failed to achieve the minimum TIMSS benchmark for Mathematics This situation should be taken seriously, as the quality of education needs to be enhanced in line with the country's aspirations. This is supported by others[8], who found that students in Asia were weak in numeracy comprehension.

In short, Mathematical achievement is an interesting and very important thing to learn as well as it has often been seen as a major factor in ensuring the success of students in the school system both primary and secondary [9].

As for Year Four pupils, it was evident that there are weaknesses in terms of misunderstanding basic numerical concepts, especially in solving problems particularly in the level of code interpretation and knowledge procurement process.   This can be further verified with the analysis conducted by KELANTAN State Education Department (2015) which showed that in the mid-year Mathematics test, for problem-solving questions especially in identifying operating bases to use in problem-solving, students were still weak in identifying which operations should be used. Pupils at the primary level have been identified as having significant weaknesses in the basic skills of math. [10]. Additionally, some students misunderstood the concept, easy forgetting, do not know problem-solving strategies, and careless. They also tend to learn algorithms through memorization techniques.

Therefore, the main purpose of this research is to find out to what extent that the e-Assessment mobile applications are used effectively to improve students' numeracy levels and thus acted as supporting learning and teaching tools towards the 21st century. Specifically, the objective of the study is to evaluate the level of numeracy understanding for Year Four pupils based on the Numeracy Understanding Model by using the e-Assessment mobile application.

Literature Review

Luke and Freebody [11], have identified four levels or stages in the Numeracy Understanding Framework model which include the interpretation of the code (decoding), the acquisition of knowledge (meaning-making), application, and analyzing.   As each of these levels has to be acquired differently and it also involves many levels or stages, it is understood that learning and teaching numeracy is a complicated and vigorous process, to begin with (,)[12]. This particular model will emphasize the understanding of numeracy based on the levels or stages as portrayed above in which will also provide an opportunity for students to grasp the basic concept of the subject matter without any problem before they can venture into the more complex concept. Secondly, it will give students exposure to working in groups and pairs for discussion purposes where different views can be shared and gathered. Finally, this model also will benefit students in terms of creating new knowledge and the ability to explain the results and decisions to peers and teachers alike. At the same time, this model can help in eliciting and associating ideas as well as provide a link between each other to solve the problem.

Numeracy model has several advantages that can benefit students as this model are user-friendly, can be applied in a real-life situation as well as it can be utilized as a checklist which can be used in verifying the levels of numeracy understanding, exploring thinking processes and analyzing questions. This model is very easy to employ because each level or stage has its specific characteristics. Both teachers and students can deliberate various strategies that can be applied at the specified levels or stages.   At the beginning of the initial application of this model, ample time is needed to adapt to this type of learning process as it is new, but gradually it will fall into a routine once teachers and students are familiar with all of the stages involved.   Also, the numeracy model can be used in other subjects besides mathematics. It is a fact that students frequently experience a setback in solving mathematical problems as they had difficulties in identifying the initial steps and to immerse in determining the further steps that should be taken to solve problems [13]. The Numeracy model suggests that there is more than one way to obtain a correct answer as it involves different techniques to solve it. There are four steps to be followed which can facilitate the students in solving problems. The framework of this model is consistent or aligns with the constructivist learning approach where new information is related to prior knowledge, as a result, it will help in building their understanding as well as creating new meaning. This approach will ensure students can identify the characteristics of numeracy in everyday situations [14].

The understanding of numeracy in the environment among students can be developed based on the numeracy framework model. This also will enhance their intelligence so better judgment and decisions can be done in social, environmental and everyday life. Besides, the same model can be applied as an alternative transformation teaching tool that can be used by teachers as it will give exposure to more innovative and creative teaching methods. Students are very curious by nature, using this framework model it can give incentives in terms of triggering numeracy ideas in detail on various topics in mathematics subject. The application begins with students will be provided with some examples of questions to be familiarised with and assist them in the interpretation of the code (decoding) as well as the acquisition of knowledge (meaning-making), then to the next stage of the application, and analyzing[11]. In short, this model can also help students creatively use their acquired knowledge to solve questions.

In conclusion, it is clearly shown that the android mobile operating system (OS) is an entertaining and fun learning tool that makes it easy for students to comprehend their level of numeracy understanding. The advancement of technology makes it easier for the Malaysian Education System to use this service and facility as it supplies users with general electronic information and educational content that facilitates search with no boundaries. The usage of mobile learning indirectly can improve both the learning and facilitating a process which is true to the definition of mobile learning as a learning model that utilizes information and communication technology.

Methodology
This study involved two groups of respondents. The first group consists of 20 pupils while the second group consists of 5 experts. The 20 pupils applied e-Assessment mobile apps in learning to determine the effectiveness of this innovation and the five experts were appointed to evaluate e-Numeracy based on five main criteria.

For the purpose to determine the effectiveness of e-Assessment in this study, twenty students of Year Four were selected based on three categories, namely seven good students, seven moderate and six weak students. They were chosen according to their monthly Mathematics test score. They have been studying KSSR for three years. The selected participants also were chosen based on the written consent obtained from the school, the pupils themselves, and their parents as well as from the advice of the school's Mathematics teachers. As a result of this study did not represent the Year Four students' population. Therefore, the probability sampling method is unnecessary [15]. The participants were selected based on their ability, willingness, commitment, and motivation to provide the information required in the current study.

This quantitative study is conducted to identify the Year Four students' numeracy level of understanding using the e-Assessment application. This study uses interview procedures to answer the research questions. This approach is most appropriate to answer the research question. This method is meaningful because it has its advantages and disadvantages)[16]. Therefore, this study has the potential to explore the numeracy comprehension level for Year, Four students, by using the Numeracy Understanding Model consisting of four stages, namely coding, meaning-making, applying, and analyzing)[11]. This model framework is built to determine the level of numeracy understanding, generally primary school students and especially the Year Four students.

This research instrument was developed by researchers based on a critical numerical modeling framework ()[11] involving numeracy. Modification and adaptation of the research instrument were conducted at some stage during and after the pilot study was conducted. 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-Numeration via the Android OS platform. Bar code is provided to enable respondents to access to each question at each level. Overall, five interview sessions were formed to answer the research questions. The duration of each session were between 30 to 35 minutes.

Data Analysis
This study used two methods in data collection namely test (pre-test and post-test) involving the 20 pupils and survey involving the five experts.

A study on the effectiveness of e-Assessment has been conducted involving 20 pupils of Year 4 from a primary school in Perak. A pre-test was carried out before the implementation of activity-oriented learning where the e-Assessment mobile application was applied. Post-test was carried out after the usage of e-Assessment in learning. All the data from both tests were collected to analyze descriptively. Then, the pre-test and post-test results were compared to determine the effectiveness of the e-Assessment mobile application. This innovation considered effective if the post-test mean is greater than the pre-test mean.

On the other hand, a survey with appointed experts was conducted where the experts evaluated e-Assessment based on a questionnaire given. All the data from the questionnaire was collected to analyze descriptively. From the mean, interpretation could be derived to identify the level of e-Assessment from experts' views.

Table 1. Mean and Standard Deviation from Pre-test and Post-test

Test	Mean (M)	Standard Deviation (SD)
Pre-test	60	0.83
Post-test	75	0.32

Table 2. A score of Experts Evaluation on e-Assessment Mobile Application

Criteria	Mean (M)	Interpretation
Motivation and experience	4.8	Very appropriate
Knowledge and practice	4.7	Very appropriate
Feedback	4.7	Very appropriate
Evaluation	4.8	Very appropriate
an e-Assessment mobile application is appropriate to be used by pupils in primary school	4.9	Very appropriate

RESULTS

The findings from the tests on the 20 pupils. The pre-test score and post-test score were presented in mean and standard deviation values in Table 1

According to Table 1, result from post-test (M = 75; SD = 0.32) is higher than the result of pre-test (M = 75; SD = 0.32). The finding shows the effectiveness of od e-Assessment mobile application in improving pupils' performance in learning mathematics.

The second result is based on the data collected from experts evaluation on the e-Assessment mobile application. Table 2 shows the evaluation scores.

According to Table 2, experts show very high evaluation value for each criterion where they highly agreed that e-Assessment mobile application is fulfilling the criteria of motivation and experience (M = 4.8), knowledge and practice (M = 4.7), feedback (M = 4.7) and evaluation   (M = 4.8). Overall, the experts highly agreed that e-Assessment mobile application is very appropriate to be used by pupils in primary school (M = 4.9)

Based on both findings from pupils and experts, we can conclude that the e-Assessment mobile application is effective and recommended to be used in mathematics learning in primary school.

DISCUSSIONS

Tackling technology in today's education system is deemed to be necessary as it can enhance learning and facilitate teaching processes.   The creation of e-Assessment, a mobile application that is based on the Numeracy Understanding Model is the answer to fulfill the needs of the Malaysian curriculum. This method is in line with the implementation of School-Based Assessment (PBS) that has been practiced widely in all primary and high school schools. The findings showed that the use of M-learning is one of the media 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.

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)[17]. 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-Assessment 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 media. This study also implies the need to improve the method of numerical understanding among pupils in primary schools through e-Assessment applications.

Limitations and Future Studies

In this study, the researcher did not focus on the entire Year Four students with 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-Assessment 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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