A Conceptual Framework for Designing Mobile Augmented Reality in Learning Basic Numbers

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Abstract: Teaching and learning sessions for LINUS students need improvement while conducting the session which requires more teaching aids using new technology. However, LINUS modules still utilize traditional methods to teach students. Students cannot focus and do not enjoy the learning session. Mobile devices are becoming ubiquitous in the world today and have become a learning tool in both inside and outside the classroom. Mobile learning can be an alternative learning tool for special needs students. Therefore, this paper aims to propose a framework for designing mobile augmented reality (AR) in learning basic numbers especially for LINUS students. This framework consists of cognitive load theory, intrinsic motivation approach, compensatory approach and multimedia elements as an interactive learning method to learn basic numbers for LINUS students.

Key words: Teaching and Learning • Mobile Application Technology • Augmented Reality • LINUS

INTRODUCTION

LINUS stands for Literacy and Numeracy Screening. The program has been implemented by the Ministry of Education (MOE) under the National Key Result Area (NKRA) mandate since 2010 to ensure students master literacy and numeracy. The numeracy in mathematics is closely related to the ability of students to perform basic mathematical operations and to understand simple mathematical ideas and to apply mathematical knowledge and skills in daily life [1]. Numeration is a new term in Mathematics education in Malaysia. Attention to numeracy began in the Primary School Standard Curriculum (KSSR) for primary education [1]. The LINUS program is created by the MOE to address the low achievers students problem in Understanding Literacy and Numeracy Screening amongst stage 1 students [1]. Among the factors that caused the difficulty of teachers to teach the students in the classroom are the stigma of the low interest student’s attitude when using the traditional learning materials [2]. Furthermore, teachers should have the latest teaching aids to conduct solid pedagogy foundation [3].

Information Communication Technology will enhance how teaching and learning happens. Students will be able to access a wider range of content that is more engaging and interactive. ICT will be an ubiquitous part of schooling life, with no urban-rural divide and with all teachers and students equipped with the skills necessary to use this technology meaningfully and effectively [1]. Therefore, teachers should have the latest teaching aids to attract their students in teaching and learning the 21st century with intent learning environment [2]. Hence, there is a need to have a teaching aid to facilitate the teacher and the LINUS student during the LINUS session [3]. In relation to this, an application in mobile phone using augmented reality technology is created based on the proposed framework. The purpose of this paper is to discuss the framework to enhance learning and teaching for LINUS students.

Mobile Application Technology: Nowadays, mobile learning has become an emerging tool in education. Today's sophisticated technological era utilizes the mobile phone which makes teaching and learning exciting to parents and teachers, who are able to use applications via mobile phone technology. [4]. With the prevalence of mobile application technology, teachers are able to use it as a teaching aid to conduct lessons. Mobile learning itself has been claimed to be effective and engaging for young children and can also improve their learning [5]. It has been proven that
Fig. 1: Conceptual Framework For Designing Mobile Augmented Reality (AR) In Learning Basic Numbers

by using mobile application technology, teachers and parents can assist and support students in the learning process [6].

**Proposed Conceptual Framework:** The conceptual framework was proposed for designing mobile augmented reality (AR) in learning basic numbers. The combination of learning theories, multimedia and interactivity as well as clear learning process will make LINUS sessions more effective.

**Learning Theories:** Learning theories are the key components in this conceptual framework. It needs to be in the framework and applied in the application developed. It is to assist the learning process to be more effective [7]. The learning theories that will be implemented in the framework are cognitive load theory, intrinsic motivation and compensatory approach.

**Cognitive Load Theory:** Cognitive load theory is a theory that focuses the load on working memory during instruction and the element interactivity is central to the theory [8]. It is pointed out that cognitive load theory deals with learning and problem solving difficulty that is artificial in that it can be manipulated by instructional design [9] [10]. There are three components in cognitive load which are sensory memory, working memory and long-term memory. [11]. To achieve this goal, cognitive load researchers attempt to engineer the instructional control of cognitive load by designing methods that substitute productive for unproductive working memory load. This approach has been very successful, as Cognitive Load theory over three decades has identified a number of learning environments that are problematic and provided strategies to make them more effective [12]. This theory is suitable for teaching basic numbers so that LINUS students can be motivated to learn. This theory will be implemented in the conceptual framework to reduce cognitive overload in the application to students so that LINUS students can absorb and retain information effectively.

**Intrinsic Motivation Approach:** Using the intrinsic motivation approach, the student have fun and are more positive as they become part of the learning process [13] [14] [15]. When students are involved and engaged in a behaviour because it is personally rewarding, they essentially perform activities for its own sake rather than the desire for some external reward. This can make students willing to learn more by themselves [13] [16]. Interestingly, learners who learn using this mobile application technology can enhance learning relative to other students. In addition, self-modelling result in greater intrinsic motivation and satisfaction with performance [17]. Most of the LINUS students need to be motivated as they feel like they are part of the learning session with the use of the mobile application technology. Intrinsic motivation needs to be in the proposed framework because personal performance expectancies are likely enhanced [17]. Intrinsic motivation can be implemented into applications by using multimedia technology that will make students become more interested in interacting with provided lessons such as using mobile application and augmented reality. Many students have more fun in learning [14] and also voluntarily get involved in the learning session. It will develop students’ interest internally and that will help low achievers gain self motivation for being involved in any learning activities. It is important because conventional style of teaching despite the rewarding scheme, will have a difficulty to attract the student if the student have no self interest at all [18]. Any teaching lesson will be hard for low achievers because the nature of their understanding is not the same as a normal student, so by using intrinsic motivation method we can develop self interest in learning and every teaching session can be eased by internal interest from students themselves.

**Compensatory Approach:** Many programs using compensatory approach are used in schools to help low achievers [18]. Compensatory approach is an instructional approach, which is used for slow-learners in transforming the way of presenting the form of a word entirely to the way of presenting the form of pictorial images by doing
the activity with their teachers in cooperative learning with guided number cards that have been provided [19]. Compensatory approach recognizes content, transmits through alternate modalities (pictures versus words) and supplements it with additional learning resources and activities. The compensatory approach is a reactive approach in the sense that students are given basic knowledge before the onset of previous teaching sessions or existing skills required for students to understand prior instruction, such as student-centered discussions and question-and-answer sessions. Compensation is a method of teaching that makes pupils with less basic knowledge or skills better and more balanced [20]. Based on the construct in LINUS content, pupils interact by looking at the visual 3D object and understanding the value and then call the numbers as observed by a teacher. This step repeated until they really understand the value of the numbers. This approach should be in this conceptual framework and it is very important to ensure that LINUS student can learn, understand and recognize the numbers. This approach will be implemented in the conceptual framework to transform the way of the presentation in the application to students so that LINUS students can understand information effectively.

Multimedia Elements: Multimedia has been used in many aspects in our lives, especially in education. “Multimedia” comes from the word “multi” and “media”. “Multi” means various while “media” refers to any hardware and software used for communicating. It is an integration of different elements such as text, graphics, audio, video and animation [21]. For this conceptual framework, the elements of text, audio, 3D image and animation are important to give significant impact in assisting the teaching and learning [22]. Text involves the use of text types, size and colours. The use of images is to emphasize directed attention. 3D objects help to illustrate ideas and it is used to show the whole number. The use of 3D objects can help sharpen learners’ memories and students pay more attention while the sound for each numbers help attract learners. The animation is also included in learning numbers to improve understanding of LINUS students and to attract their attention [23]. Audio is also used in order to increase the focus of the student during the session with the teacher. The background sound is also being used to make them more relaxed and make them enjoy the LINUS session.

Augmented Reality Technology: Augmented Reality (AR) is a variation of virtual environment technology which is also called virtual reality [24]. The AR applications were monitor-based; however, with the latest technology, mobile devices are now used to operate AR technology [24]. It might help teachers gain their students’ attention and motivation, whereas the normal flash cards will show only a three-dimensional object [25]. A majority of the teachers interviewed expressed interest in the potential of using AR as part of the range of learning tools. They saw the potential of AR as an exciting and fun teaching aid for the learners to engage their attention [26]. By using AR technology, it enhance learning motivation especially for children with special needs. [27] [28] [29].Based on the problems encountered, many studies have reported the application of augmented reality (AR) has a favorable impact on education in primary schools in terms of student’s motivation, interaction, learning attitudes, collaboration and enjoyment [30].

RESULT AND DISCUSSION

The main finding of this research is a conceptual framework for designing a teaching aid in learning basic numbers using augmented reality technology for LINUS students. The proposed conceptual framework will be validated using a prototype of the application.

In summary, by adapting the theories and the technique, the conceptual framework proposed are applied in the design phase.

Figure 2 shows an interface for main menu. Teachers may choose the module for their LINUS session. Besides the button for “number” and “money”, users can also click the button “about us” and the “exit” button.

![Fig. 2: Main Menu for Teachers](image-url)
and engages learners in learning. The combination of the learning theories, learning techniques and multimedia elements are very important and provide an effective session to students and teachers especially for LINUS students. Based on the validated proposed conceptual model, AR Belajar Asas Nombor Secara Interaktif (ARBEST) application has been successfully designed. It is hoped that through this application, it can provide a more enjoyable experience and good motivation in learning. As for future work, the application will be evaluated for its usability to obtain perception from learners.

REFERENCES


