

**AUGMENTED REALITY MODEL FOR PRESCHOOL LEARNING**

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## Abstrak

Subjek sains amat penting untuk membina pengetahuan saintifik di kalangan pelajar. Di Malaysia, pelaksanaan Kurikulum Sains dilaksanakan melalui pendekatan konvensional. Bagaimanapun, pendekatan ini kurang menarik minat pelajar dalam meneroka ilmu pengetahuan dengan lebih meluas. Di samping itu, pelajar hanya mempelajari pengetahuan asas tanpa dapat menggambarkan isi kandungan pelajaran tersebut. Justeru itu, kajian ini bertujuan untuk mengaplikasikan teknologi Realiti Tambahan (AR) dalam pengajaran dan pembelajaran subjek Awal Sains untuk menangani isu tersebut. AR ialah penambahan pada dunia nyata melalui penambahan objek maya tiga-dimensi (3D). Ini terbukti bahawa AR adalah satu kaedah yang berkesan dalam menyampaikan pengajaran kepada pelajar berbanding dengan kaedah konvensional. Kajian ini mengaplikasikan AR di prasekolah bagi subjek Awal Sains yang memfokuskan kepada organ dalaman manusia yang dikenali sebagai Sistem Otot. Kajian ini disesuaikan dengan teori Model Pembelajaran Berasaskan Pengalaman (ELM) untuk membina model keperluan Realiti Tambahan bagi Pembelajaran dalam Sistem Otot (ARMS). Model yang dicadangkan mengandungi tiga (3) komponen; i) Keperluan Melaksanakan AR di Kelas (R-IARC), ii) Prototaip Aras Tinggi (HLP) dan iii) ELM. Metodologi kajian ini melibatkan lima (5) fasa utama; i) kajian teori, ii) kajian awal, iii) pembinaan model keperluan, iv) pembangunan ARMS, dan v) penilaian model oleh pengguna serta pakar yang berkaitan. Keperluan model yang dicadangkan diperolehi melalui teknik carian fakta iaitu temu bual, pemerhatian, dan semakan dokumen. Model yang dicadangkan telah disahkan dengan menggunakan pendekatan prototaip. Penilaian terhadap prototaip ini telah dilaksanakan melalui penilaian pakar dan pengguna akhir yang terlibat. Hasil penilaian menunjukkan penggunaan ARMS sangat berkesan untuk dilaksanakan dalam pengajaran dan pembelajaran subjek Awal Sains. Ini kerana ia mampu untuk menerangkan topik yang sukar. Di samping itu, ia juga membuktikan integrasi teknologi AR dalam pengajaran dan pembelajaran dapat mewujudkan persekitaran yang menyeronokkan kerana sokongan penggunaan visual maya objek 3D. Hasilnya, pelajar boleh memahami dan mengenali fungsi, tip kesihatan dan penyakit yang berkaitan dengan sistem otot melalui ARMS. Kajian ini juga mendapati bahawa pelaksanaan ARMS mampu meningkatkan pembangunan kognitif pelajar dan meningkatkan kebolehan pembelajaran pelajar.

**Kata kunci:** AR, keperluan model, ARMS, pendidikan prasekolah, Awal Sains

## Abstract

Science subject is very important to create scientific knowledge among students. In Malaysia, the implementation of the Science Curriculum is normally done via conventional approach. However, this approach is not able to attract students' interests in exploring more knowledge. In addition, the students only acquire the basic knowledge without being able to visualize the subject matters. Thus, this study is aimed to apply Augmented Reality (AR) technology in teaching and learning of the Basic Science subject to overcome the issues. AR is the augmentation of the real world through the addition of three-dimensional (3D) virtual objects. AR has been proven as an effective method in delivering lessons to the students compared to conventional method. This study applied AR in preschool Basic Science subject that focused on the internal organ of human body known as the Muscular System. This study adapted AR with Experiential Learning Model (ELM) theory to construct the requirement model of the Augmented Reality for Learning in Muscular System (ARMS). The proposed model consisted of three (3) main components; i) Requirement to Implement AR in a Classroom (R-IARC), ii) High-Level Prototyping (HLP), and iii) Experiential Learning Model (ELM). The methodology in this study involved five (5) main phases; i) theoretical study, ii) preliminary study, iii) requirement model construction, iv) ARMS development, v) model evaluation by users and experts respectively. The requirement of the proposed model was collected using multiple facts finding techniques, namely interview, observation, and document reviews. The proposed model was validated using prototyping approach. The evaluation of the prototype was done by expert reviews and end-user acceptance study. The results of the evaluation showed that the ARMS was highly effective to be implemented in the teaching and learning of Basic Science subject. This is because it assists in explaining difficult topics. In addition, it has also been proven that the integration of the AR technology in teaching and learning is able to create an enjoyable environment because it is supported by the visualization of 3D virtual objects. As a result, the students were able to understand and recognize the functions, health, and diseases of the muscular system through ARMS. The study also found that the implementation of ARMS was able to increase the students' cognitive development and enhance the students' learning ability.

**Keywords:** AR, requirement model, ARMS, preschool education, Basic Science

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## **List of Abbreviations**

AC	Abstract Conceptualization
AE	Active Experimentation
ALE	Augmented Learning Environment
AR	Augmented Reality
ARMS	Augmented Reality for Learning in Muscular System
CD	Compact Disk
CE	Concrete Experience
ELM	Experiential Learning Model
HLP	High-Level Prototyping
HMD	Head Mounted Display
MoE	Ministry of Education
R-IARC	Requirement to Implement AR in Classroom
RO	Reflect Observation
VE	Virtual Environment
VR	Virtual Reality
VRML	Virtual Reality Modelling Language



# CHAPTER ONE

## INTRODUCTION

### 1.1 Overview

This chapter discusses the background of the study which is followed by the problem statement, research questions, research scope, theoretical frameworks, lists of significant and contribution of this study. Lastly, the definitions of the terminologies used throughout this study are presented.

### 1.2 Background

The ability to superimpose real-time computer animation onto the real world is commonly known as Augmented Reality (AR). AR differs from Virtual Reality (VR) where it requires real-time markers for it to function. It allows the merging of virtual information with the real environment to provide users with more immersive interaction with their surroundings. Unlike other computer animations, AR provides a new experience of the real world which draws the users away from the real world and onto the screen (Hainich, 2006).

The potential of AR technology is growing rapidly and it had been applied in many fields not limited to engineering (Webster, Feiner, MacIntyre, Massie, & Krueger, 1996), medicine (Li, 2005) and military (Julier, Baillet, Lanzagorta, Brown, & Rosenblum, 2001) but also in education (Billinghurst, 2002). Thus, this research is conducted especially for education, particularly for preschool students in the Basic Science subject in which one of the topics is human body. As mentioned by Zainun

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only

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