



**SERIOUS GAMES MODEL IN DIAGNOSING  
VISUAL PERCEPTION PROBLEM FOR AUTISTIC STUDENTS**

**HELMI ADLY BIN MOHD. NOOR**

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IN INFORMATION AND COMMUNICATION TECHNOLOGY**

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**Faculty of Information and Communication Technology**

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**HELMI ADLY BIN MOHD. NOOR**

**A thesis submitted  
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**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**2016**

## DECLARATION

I declare that this thesis entitled “Serious Games Model in Diagnosing Visual Perception Problem for Autistic Students” is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : .....

Name : Helmi Adly Bin Mohd. Noor

Date : 29 March 2016

## APPROVAL

I hereby declare that I have read this dissertation/report and in my opinion this dissertation/report is sufficient in terms of scope and quality as a partial fulfilment of Doctor of Philosophy in Information and Communication Technology.

Signature : .....

Supervisor Name : Assoc. Prof. Dr Faaizah Binti Shahbodin

Date : 29 March 2016

## **DEDICATION**

This project is dedicated to my parents for the full support that they gave me during my studies and to my beloved wife for always giving me the strength to fulfil all my goals.

## ABSTRACT

In order to minimize the negative effects of autism in students as well as to overcome future problems, early identification and diagnosis are the solutions to get students on the right road to dealing with the problems related to autism and overcoming them. A systematic manual has been developed and is used to diagnose visual perception problems in autistic students. Nevertheless, the technique to diagnose visual perception problems in autistic students is manually employed and the hands-on technique is utilised. This study aims to develop Vi-per games as a tool for special education teachers to diagnose visual perception problems in autistic students. These diagnostic tools can assist and help teachers to diagnose their students without the teachers needing to have any experience and knowledge of diagnosing visual perception. A model of serious games to enable diagnosis of visual perception problems was used in this research. Studies have shown that using games has many benefits and helps autistic students. However, none have yet been developed to diagnose visual perception problems in autistic students. In this research, the objectives are to propose a model for visual perception diagnosis by using serious games for autistic students, to propose a new serious game, namely Vi-Per games for diagnosing visual perception, to measure the accuracy of Vi-Per Games diagnosis results and generate a set of comprehensive and systematic reports in order to evaluate the visual perception problems of autistic students, and to obtain the perception of teachers towards the use of the Vi-Per Games. The participants were autistic students and special education teachers from SMK Bandar Baru UDA and SMK Tun Syed Nasir Ismail, both schools in Johor Bahru, Malaysia. The main participants were ten (10) special education teachers who participated in the questionnaire procedures. Ten (10) autistic students from special education classes were selected using pre-test and post-test procedures. The experiment measured the accuracy of using the developed serious games and to obtain the perception of the teachers towards the use of the games for diagnosing visual perception problems in autistic students. The results positively show that the use of Vi-Per Games can help teachers diagnose visual perception problems in autistic students and can replace manual and conventional tests. In addition, the measure of accuracy test was found to be accurate. Overall, the findings show that using the serious game approach effectively engages autistic students as compared to using the conventional approach. The use of Vi-Per Games successfully assists and facilitates teachers in the diagnosis of visual perception problems in autistic students, as compared to the conventional methods of diagnosis. Diagnosing visual perception using serious games gives teachers and students an enjoyable experience in a way that no other medium can offer.

## ABSTRAK

*Usaha untuk mengurangkan kesan negatif pada masa depan kanak-kanak autisme memerlukan diagnosis pengesanan awal supaya penyelesaian dapat ditangani di jalan yang betul. Pada masa kini, kaedah manual secara sistematik telah diwujudkan untuk mendiagnosis masalah visual pengamatan. Walau bagaimanapun, teknik untuk mendiagnosis masalah ini masih dilakukan secara manual dan teknik secara amali masih digunakan. Di dalam kajian ini, satu alat mendiagnosis visual pengamatan menggunakan “serious game” untuk kegunaan guru dan pelajar pendidikan khas dibangunkan. Alat diagnostik ini dapat menyokong dan membantu guru-guru untuk mendiagnosis pelajar mereka walaupun tanpa mempunyai apa-apa pengalaman dan pengetahuan mendiagnosis visual pengamatan sebelum ini. Model diagnosis visual pengamatan menggunakan “serious game” telah digunakan di dalam kajian ini. Kajian telah menunjukkan bahawa menggunakan permainan digital mempunyai banyak manfaat dan membantu pelajar autisma termasuk masalah visual pengamatan. Objektif kajian ini adalah untuk mencadangkan satu model diagnosis visual pengamatan menggunakan “serious game”, membangunkan alat dinamakan “Vi-Per Games”, mengukur ketepatan keputusan diagnosis “Vi-Per Games”, menjana satu set laporan yang komprehensif dan sistematik untuk menilai masalah visual pengamatan dan untuk mendapatkan maklumbalas persepsi guru-guru terhadap penggunaan “Vi-Per Games”. Para peserta terdiri daripada sepuluh (10) pelajar autisma dan guru pendidikan khas daripada SMK Bandar Baru UDA dan SMK Tun Syed Nasir Ismail, Johor Bahru. Para peserta dikalangan guru mengambil bahagian di dalam prosedur soal selidik. Manakala peserta pelajar autisma adalah daripada kelas pendidikan khas. Mereka mengambil bahagian di dalam prosedur pra-ujian dan pasca ujian. Eksperimen ini adalah untuk mengukur ketepatan diagnosis menggunakan “serious game” dan untuk mendapatkan maklumbalas persepsi dikalangan guru terhadap penggunaan “serious game” untuk mendiagnosis visual pengamatan di kalangan pelajar autisma. Hasil eksperimen menunjukkan bahawa dengan menggunakan “Vi-Per Games” ianya dapat membantu guru mendiagnosis masalah visual pengamatan pelajar autisma dan boleh menggantikan kaedah manual dan pendekatan ujian secara konvensional. Selain itu, keputusan pengujian “Vi-Per Games” untuk mendiagnosis juga menunjukkan hasil yang tepat. Secara keseluruhan, hasil kajian menunjukkan bahawa penggunaan pendekatan “serious game” sangat berkesan berbanding dengan pendekatan konvensional dan berjaya membantu guru di dalam melakukan diagnosis visual pengamatan pelajar autisma. Diagnosis menggunakan “Vi-Per Games” dapat memberikan guru dan pelajar suatu pengalaman yang menyeronokkan berbanding kaedah yang digunapakai sebelumnya.*



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## LIST OF ABBREVIATIONS

ADDIE	Analysis, Design, Development, Implementation & Evaluation
CRIM	Centre of Research & Innovation Management, UTeM
EPRD	Educational Planning and Research Division
FICT	Faculty of Information & Communication Technology, UTeM
FTMK	Fakulti Teknologi Maklumat & Komunikasi, UTeM
ICT	Information & Communication Technology
ID	Instructional Design
IEP	Individual Education Plan
IT	Information Technology
MOE	Ministry of Education
MVPT-3	The Motor-Free Visual Perception Test: Third Edition
PBKI	Program Pendidikan Khas Integrasi
SPSS	Statistical Package for Social Science
TVPS-3	Test of Visual Perceptual Skills-3
UID	User Interface Design
UKM	Universiti Kebangsaan Malaysia
UNICEF	United Nations Children's Emergency Fund
UTeM	Universiti Teknikal Malaysia Melaka
UTHM	Universiti Tun Hussein Onn Malaysia
VPTDI-MOE	Visual Perception Diagnostic Test Instrument, Ministry of Education Malaysia

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## CHAPTER 1

### INTRODUCTION

#### 1.1 Introduction

The number of children diagnosed with autism is rising. In spite of great strides in early diagnosis, the outcomes for a majority of children with autism are still poor, with few being able to live independently when they reach adulthood (Billstedt et al., 2005; Eaves & Ho, 2008; Howlin et al., 2004; Billstedt et al., 2011; Gogolla et al., 2010). In view of that, research in using serious games to diagnose problems in autistic children is being conducted by many in the computing field.

The word 'autism' is derived from the Greek word 'autos' that means 'alone' and a scientist named Kanner officially introduced it in 1943. Autism is a complex disorder involving aberrant growth of the neurological system and is maintained throughout the lifetime. Clinically, it is known as Autism Spectrum Disorders (ASDs). Even though billions of dollars have been spent on research, the factors contributing to this disorder are still unknown (Huang & Wheeler, 2006; Jansiewicz et al., 2006; Rao, Shaila & Gagie, 2006; Leonard et al., 2011; O'Roak et al., 2012; Ravindran & Myers, 2012). Autism is prevalent globally and it does not discriminate between one's faith, ethnicity, and social and economic situation (Perko & McLaughlin, 2002). According to the United States Department of Education (USDE, 2001), autism is a mental disorder. It is characterized by deficiencies in social and communication skills. This includes a lack of imaginative ability and playing that exhibits limited and repetitive behavior, commonly related to interest, activity and posture.

Studies on autism have revealed an escalation in the frequency of autism (Croen et al., 2002; Grossman et al. 1997). In the early 70s, the frequency of autism cases was three or four in every 10,000 children in the United States. According to Bryson et al., (2003) the ratio of individuals having autism in the U.S. was 6 to 7 out of 1000. However, it is now much more common, occurring in at least 1 out of every 100 children in the U.S. (Nazeer & Ghaziuddin, 2012). According to Ganz (2006), an autistic individual has to spend USD 3.2 million throughout his or her lifespan. The United States has to multiply the cost exponentially because it is estimated that the total number of people with autism in the country is 1.5 million and hence it has to spend the lifetime price of USD 35 billion a year. Based on the official statistics given by the Malaysian Ministry of Health in 2004, 1 out of 600 children were diagnosed with autism. However, as the statistics are dated, the current prevalence is undetermined.

Students with autism have a high incidence of visual perception problems. They often have difficulty recognizing, remembering, organizing and interpreting visual images. As a result, they are easily confused in situations that involve using written or pictorial symbols for learning. The relationship of visual perception problems with reading disorders is well understood, but students with these problems also have difficulty with other symbolic learning, such as the use of graphs, charts, tables, measurements, etc. They may also have a poor sense of direction and get lost easily, or have difficulty coordinating body movements in time and space, resulting in clumsiness. They may have difficulty recognizing non-verbal aspects of social interaction, and as a result may have difficulty negotiating friendships and communication with others (Kurtz, 2006). At present, a systematic method of diagnosis has been developed to assess visual perception problems in autistic students. However, the method of diagnosis still uses a manual and hands-on technique.

This section outlines the background of the research, provides the problem background of the study, problem statement, research objectives, research questions, research hypothesis, research approach, the scope of the study, the significance of the study, limitation of the study and lastly, the summary.

## **1.2 Background of Study**

Early identification and diagnosis of autism is the key to minimizing its negative effects and to getting the child on the right road. Furthermore, early diagnosis of autism in children is an important key to reducing adult autism. Autism detection games are important because millions of children with autism go through the school system undetected. That means there are millions of people who probably cannot develop their full potential because they lack knowledge of their condition. Autistic in a child is difficult to detect because children dislike tests, especially if they know that they are the ones being tested.

Recently, the validity of the present methods of assessment has been questioned. The present assessment tools used in Malaysia are based on the experience and knowledge of experts like occupational therapists and special education teachers. Most of these diagnostic tools to detect visual perception of autism in students are formal in nature and are not user friendly to autistic student to use and do not provide instant feedback. Many of the present methods of assessment are manual, like paper-based assessment requiring autistic students to answer questions, and use a manual for teachers to make complicated calculation to obtain the results.

In Malaysia, the Department of Special Education, Ministry of Education has developed a book for the diagnostic testing of visual perception problems in students with special education needs, including students with autism. This instrument was developed in