LEARNING SOFTWARE USER INTERFACE DESIGN MODEL FOR CHILDREN WITH CEREBRAL PALSY

NURAINI HIDAYAH BTE SULAIMAN

A thesis submitted in fulfilment of the
requirements for the award of the degree of
Master of Science (Software Engineering)

Faculty of Computing
Universiti Teknologi Malaysia

MARCH 2015

To my beloved mother, late father and husband

ACKNOWLEDGEMENT

In the name of Allah, Most Gracious, Most Merciful

Alhamdulillah, praise to Allah S.W.T in preparing this thesis, I was in contact with many people, researchers, academicians, and practitioners. They have contributed towards my understanding and thoughts. In particular, I wish to express my sincere appreciation to my supervisor, Dr. Masitah Ghazali, for her guidance, advices, motivation, encouragement, critics and friendship. Without her continual support and inspiration, this thesis would not have been the same presented here.

Special thanks to my beloved parents for their advices, motivation, understanding and support. My fellow postgraduate students should also be recognised for their support. My sincere appreciation also extends to my husbandWan Mohd Nasri and others who have provided assistance at various occasions. Their views and tips are useful indeed.Unfortunately, it is not possible to list all of them in this limited space. Above all, the thanks and gratefulness go to Allah S.W.T for all the good gifts He offered.

ABSTRACT

Learning through games is one of the most impactful teaching tools for children with Cerebral Palsy (CP). The children are used to fun environment like playing activities and it has become a necessity nowadays to improve the education quality for children with CP. The current games that are available at Pemulihan Dalam Komuniti (PDK) are not attractive enough for the children with CP to play with frequently. They felt the existing games are very boring. This study investigates learning issues for children with CP. In order to solve the learning problem among children with CP, a systematic literature review was performed to identify the requirements required to develop a learning application user interface design model. The findings are translated into a Learning Software User Interface Design Model (LSUIDM), which would be used in developing other types of learning software user interface for children with CP. The LSUIDM consists of four components, which are determine type of application, get result achievement, result generation, and display of progress. Guidelines for designing and developing a learning prototype that are compatible with the limited capabilities of children with CP using LSUIDM are established to ensure children with CP are able to grasp the concepts of a learning software user interface prototype. The prototype is developed by using a game application and the GlovePie Tool. This prototype is evaluated by ten participants from PDK Tanjung Puteri, Johor Bahru. The findings from the user study show that the proposed LSUIDM can be applied in the design of learning software application for children with CP in order to improve their learning ability.

ABSTRAK

Pembelajaran melalui permainan adalah sebahagian daripadaalat pengajaran yang paling berkesan untuk kanak-kanak yang menghidap Palsi Serebrum (CP). Kanak-kanak lebih menyukai persekitaran yang menyeronokkan seperti aktiviti bermain dan ianya telah menjadi satu keperluan pada masa kini untuk meningkatkan kualiti pendidikan untuk kanak-kanak yang menghidap CP. Permainan yang boleh didapati di Pemulihan Dalam Komuniti (PDK) pada masa kini tidak cukup menarik perhatian untuk kanak-kanak yang menghidap CP bermain dengan kerap. Mereka merasakan permainan sedia ada sangat membosankan. Kajian ini mengkaji isu-isu pembelajaran untuk kanak-kanak yang menghidap CP. Dalam usaha untuk menyelesaikan masalah pembelajaran di kalangan kanak-kanak yang menghidap CP, kajian literatur sistematik telah dijalankan untuk mengenal pasti keperluan untuk membangunkan satu model reka bentuk antara muka pengguna aplikasi pembelajaran. Penemuan ini telah diterjemahkan ke dalam Model Reka bentuk Antara Muka Pengguna Perisian Pembelajaran (LSUIDM), yang akan diguna dalam membangunkan jenis-jenis pembelajaran perisian antara muka pengguna yang lain untuk kanak-kanak yang menghidap CP. LSUIDM terdiri daripada empat komponen iaitu menentukan jenis aplikasi, mendapatkan hasil pencapaian, penjanaan hasil, dan paparan kemajuan. Garis panduan untuk mereka bentuk dan membangunkan prototaip pembelajaran yang bersesuaian dengan keupayaan kanak-kanak yang menghidap CP yang terhad dengan menggunakan LSUIDM telah diwujudkan bagi memastikan kanak-kanak yang menghidap CP dapat memahami konsep prototaip perisian pembelajaran antara muka pengguna. Prototaip yang dibangunkan dengan menggunakan aplikasi permainan dan Alat GlovePie. Prototaip ini telah dinilai oleh sepuluh peserta dari PDK Tanjung Puteri, Johor Bahru. Hasil kajian menunjukkan LSUIDM yang dicadangkan boleh diaplikasikan dalam mereka bentuk aplikasi perisian pembelajaran untuk kanak-kanak yang menghidap CP bagi meningkatkan keupayaan pembelajaran mereka.

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LIST OF ABBREVIATIONS

CP	–	Cerebral Palsy
PDK	–	Pemulihan Dalam Komuniti
SWEBOK	–	Software Engineering Body of Knowledge
GCSH	–	Gillette Childrens Specialty Healthcare
ADHD	–	Attention-Deficit Hyperactivity Disorder
ADD	–	Attention-Deficit Disorder
AVG	–	Active Video Game
DDR	–	Dance Dance Revolution
CBR	–	Community-Based Rehabilitation
SLR	–	Systematic Literature Review
LCL	–	Learner Centred Learning
LSUIDM	–	Learning Software User Interface Design Model
TUI	–	Tangible User Interfaces
UCP	–	United Cerebral Palsy
ALS	–	Amyotrophic Lateral Sclerosis
RAS	–	Rhythmic Auditory Stimulation
SQL	–	Structured Query Language
GUI	–	Graphic User Interface
TDD	–	Test-driven Development
SSMSE	–	SQL Server Management Studio Express
VR	–	Virtual Reality

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CHAPTER 1

INTRODUCTION

1.1 Introduction

With popularity rates ranging from 1.5 to 3 for every 1000 live births, Cerebral Palsy (CP) is one of the three most common lifelong developmental disabilities (Sankar and Mundkur, 2005). It is described as a group of disorders affecting the development of movement and posture, causing activity circumscription, which is attributed to non-progressive disturbances. Injuries responsible for CP are believed to occur during fetal development or infancy. According to Conde-Agudelo and Romeo (2009) the most prevalent chronic childhood motor disability in 2003 with an estimated lifetime cost about $1 million per person is CP.

According to Pharoah and Cooke (1996), the main cause of childhood deformity and the second cause of critical mental retardation is CP. Children with CP have an raised prevalence of associated comorbidities, including intellectual disability. Children with CP have an increased prevalence of associated comorbidities, including intellectual disability (52%), epilepsy (45%), speech and language deficits (38%), vision impairment (28%), and hearing impairment (12%) (Ashwal *et al.*, 2004).

According to Iona *et al.* (2013) across the world there are 17 million people living with CP. CP is the most common physical disability in childhood. Children with CP have a long lasting disability that affects movement. Until now, there are no known cure for CP and CP is a lifelong disability. CP ranks as the top disorder of childhood with a prevalence of 260 per 100 000 children, as seen in comprehensive rehabilitation settings followed by traumatic brain injury (210 per 100 000). In the United State there are nearly 660 000 of the 70 million children ages 17 and under have impairments to their neuromuscular system that impact their ability to engage fully in school (DeLisa *et al.*, 2005).

In Malaysia, the government take this issue seriously. There are various government and private organizations and medical centers that provide support in managing the situation and help the people affected by it and their families such as Malaysian Advocates for CP (MyCP), *Pemulihan Dalam Komuniti*(PDK), and many more. It is also very important to consult a doctor as often as a new treatment option may be more widely available to help people affected by cerebral palsy and down syndrome to be members of an active community (PDKNet, 2013).

One of the most common causes of physical disability in early childhood is CP and children with CP constitute the largest clinical group seen in paediatric occupational therapy (Rassafiani and Sahaf, 2011). It is generally agreed that all individuals with CP have problems with movement and posture (Jones *et al.*, 2007), but the diversity that exists across individuals must be recognized. Specific impairments result from lesion location, amount of damage, and stage of brain development at the time of injury.

Types and classified of CP are different depending on the type of symptoms, which in turn likely reflects which parts of the brain are not working as they should (Rosenbaum *et al.*, 2007). The types of CP and description are shown in Table 1.1.

Table 1.1: The types of CP and description

Types of CP	Description
Spastic CP (about 70% of all cases)	• Some of the muscles in the body are tight, stiff and weak, drawing the limbs in • Making control of movement difficult.
Athetoid (Dyskinetic) CP (10% of cases)	• The muscles used for speech may also be affected, interfering with communication. Control of posture is also disrupted.
Ataxic CP	• Have difficulty with balance, shaky movements of hands or feet, and difficulty with speech.
Mixed CP	• A mixture of two or more of the above.

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