MONTSENSORY POCKET:

DYSGRAPHIA CHILDREN'S LEARNING TOOL USING MOBILE

APPLICATION

by

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Dissertation submitted in partial fulfilment of

the requirement for the

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Universiti Teknologi PETRONAS

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CERTIFICATION OF APPROVAL

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A project dissertation submitted to the

Information Systems Programme

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Approved by,

Dr Suziah binti Sulaiman

Date: 29TH September 2021

UNIVERSITI TEKNOLOGI PETRONAS

SERI ISKANDAR, PERAK

SEPTEMBER 2021

CERITIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements,and that the original herein have not been undertaken or don by unspecified sources orpersons.

Siti Nursabrina Binti Mohd Fadzil

Date: 28th September 2021

ABSTRACT

The fundamentals of writing are the most essential and crucial skill which all children must grasp. It is because with the ability of writing children will be able to perceive the skill of literacy andas well as other areas of life. On the other hand, some children still struggle with the capability of skill to write and this indicates them to be diagnosed with "Dysgraphia". Dysgraphia is a neurological condition that results in problems with written abilities and expression. Children with dysgraphia have writing abilities that are below the level anticipated of individuals based on their intellectual, age, and educational background. This clearly shows that "Dysgraphia" have affected on the children learning abilities. In this era, technologies are well developed and used in order to ease of our lives. The assistive technologies and gadgets such as smartphones, smartwatch and tablets help us in our daily life. For example, it is intended to assist individuals with impairments in navigating their learning difficulties and strengthening their skill sets. The primary goal of this project and study was to evaluate the efficiency and effectiveness of a mobile application for children who have dysgraphia and whether or not students' writing abilities increase as a result of using this learning tool. In this mobile development project, a Montessori method and approach were utilised to help children with writing difficulties to learn while also creating a centralised database that can be used by experts to discover and enhance the way for the Dysgraphia by utilising this application.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS AND NOMENCLATURES

MCO	Movement Control Order
FYP	Final Year Project
COVID-19	Coronavirus Disease 2019
UTP	Universiti Teknologi PETRONAS
ADHD	Attention Deficit Hyperactivity Disorder
VKAT	Visual, Kinesthetic, Auditory And Tactile
SDLC	System Development Life Cycle
RAD	Rapid Application Development
UI	User Interface
IDE	Integrated Development Environment
JSON	JavaScript Object Notion
HTML	Hyper Text Markup Language
3D	Three Dimensional
2D	Two Dimensional

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Learning disabilities is the umbrella term that include a broad range of learning disorders that exist in this current generation. The disorders are not caused by a lack of intellect or effort on the part of individuals who have them. Learning difficulties are most often associated with difficulties in reading, writing and calculating. The disorders in learning such as dysgraphia, may present themselves in a variety of ways. Most of the people have no awareness on this matter and it may lead to have a negative impression of them and label them as indolent or have low level of intelligence. In reality, the most majority of them are just as intelligent as everyone else, but their brains are wired differently, which has had an impact on how they perceive the information they receive.

Dysgraphia is a neurological condition that affects writing abilities and fine motor abilities. It is a learning condition that affects both children and adults, interfering with virtually every part of the writing process, including spelling, readability, word spacing and size, and expressiveness. Furthermore, Dysgraphia is typically identified when a child learns how to write which means it is identified at the age of 4 years old. However, a disorder of written expression may remain unrecognized through the early school years as a child's writing ability continues to develop; dysgraphia may remain undiagnosed until adulthood.

Fortunately, in every problem there is always a solution. In order to assist all children, achieve theirgreatest potential at their own individual pace, the Montessori method was developed. Montessori emphasised the importance of writing before reading. Later, by mixing these sounds together, youngsters can read phonetic words without strain. The method of Montessori involves three sensesight, hear, and touch. It stands in stark contrast to the traditional way of memorising letters by looking at them. A classroom whose children have varying abilities is a community in which everyone learns from one another and everyone contributes. Because the philosophy is developmental, with great respect for each child's abilities, Montessori is well suited for both giftedchildren and those with learning disabilities.

1.2 Problem Statements

It is estimated that Malaysia has 314,000 children with learning disabilities are in rehabilitationclasses who are suffering from the 3M (reading, writing, and calculating) difficulties. As reported by the Selangor District's LINUS NKRA Portal, two percent of the district's 15,600 students are having difficulty understanding the 3M. As a result, they are often mislabelled as indolent or have low level of intelligence, but what they do not realise is that they need a significant amount of additional time to improve their writing abilities. These children also should be taught to arrange their ideas and be encouraged to revise and review their writing. This shows that we need to raise the awareness of children from Dysgraphia. When the more people are aware of this disorder, the more understanding the society will be and they can help these children at the earlier age.

Furthermore, as a consequence of the current epidemic Covid-19, a significant number of students, including the average student, are adversely impacted by the situation and are forced to do their studies from their homes. Therefore, Dysgraphic students may find it more challenging to go through their educational experiences, especially if their specialised tutors or instructors are not

there in person. Most of the time, the caregivers do not have any knowledge about how to help their Dysgraphic children. This also implies to caregivers who are not familiar with the condition will beunable to recognise the signs and symptoms at an early age.

Individuals with Dysgraphia, often referred to as Dysgraphic, need a different approach to learning than an average person in general. According to Atkinson and Shiffrin (1968), the Montessori method to learning experiences may help individuals in improving their memory traces by increasing their recall of previously learned information. There are only a few numbers of current digitalize-based educational games for dysgraphia that utilise a Montessori approach and have a user-friendly interface which can be used to improve the circumstances of dysgrahic and learning impaired individuals, according to the findings of the survey. This clearly demonstrates that the educational gaming platform available to children with Dysgraphia is severely limited. It will be simpler to conquer this disorder and reduce the numbers down if the number of educational games applications is expanded, and this can be done from the comfort of their own homes.

1.3   Objectives

In order to guarantee that the problem statement can be resolved, I have developed three majorgoals that will be used in the development of this proposed project, where we will examine what can be done to overcome the issues identified in the problem statement.

- To investigate Montessori as a learning tool for Dysgraphia children which can alleviate their difficulties.
- To develop a mobile application that include tracing output in order to help the children to improve their writing skills, motor skills and memory at an early age.
- To assess the mobile application functionality and usability among the children age (5 to 6 years old).

1.4 Scope of Study

The scope of the study is one of the most essential components that must be considered since it serves as the framework within which the thesis will examine the research area of interest. Typically, it indicates what the analysis will cover and what it will be focusing on. There are two areas of research that will be addressed in my study, and they are as follows:

- To study the impact of Montessori on digital platform for children with Dysgraphia.
- To create a tool that allows the target user to practice their motor skills.

1.5 Significances of Project

- Being able to contribute a prototype as a learning tool for Dysgraphic children.
- To help children with Dysgraphia overcoming their learning difficulties at home.
- Able to create awareness and contribute to the society by producing application as tool for learning disabilities.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction to Dysgraphia

The term dysgraphia is derived from the Greek terms dys, which means "disabled," and graphia, which means "handwriting by hand." Dysgraphia is a deficit in the capacity to write, which manifests itself mainly in handwriting but may also manifest itself in coherence. According to Kushki, Schwellnus, Ilyas, & Chau (2011), the most frequent problem with Dysgraphic children is in the quality of their handwriting. Handwriting difficulties, unfortunately, may have serious consequences on students' academic achievement When it comes to learning impairments, it often overlaps with other conditions such as speech impairment, attention deficit hyperactivity disorder (ADHD), or developmental coordination problem (DCD).

According to Prunty & Barnet (2017), individuals with dysgraphia have difficulty expressing thoughts in written form, especially related to their ability to recall patterns of alphabets or symbols. People with Dysgraphia, on the other hand, tend to have exceptional thinking skills and to be successful as long as they are able to overcome their difficulties and make an attempt to better themselves via any other methods. For example, we can observe many renowned people such as Albert Einstein, Thomas Edison, Pablo Picasso, and many more who have achieved great success despite the fact that they have certain flaws in their own personalities and abilities.

According to Lexia Learners (2017), there are five different types of Dysgraphia is identified which acquired Dysgraphia from its development namely:

Table 1 Types of Dysgraphia

Element	Key Aspect
Dyslexic Dysgraphia	Dyslexic Dysgraphia causes illegible handwriting, good copying, and poor spelling. Speed of finger tapping is considered typical. Dyslexia and dysgraphia are two disorders that seem to be unconnected, yet they often occur simultaneously.
Phonological Dysgraphia	Phonological Dysgraphia is characterised by difficulties spelling newwords, non-words, and phonetically irregular words. Phonological Dysgraphia individuals are also unable to retain phonemes in memoryand blend them into the target word.
Motor Dysgraphia	Most written work is unreadable, even when copied from another source.It may be possible to create letters in extremely small samples of writing, but this involves great effort, takes a long time, and cannot be maintained. Holding a pen or pencil improperly slants writing.
Lexical Dysgraphia	Lexical Dysgraphia occurs when a person can spell but misspells irregular words. This is more prevalent in less phonetic languages like English and French than in Spanish. Dysgraphia in children is uncommon. Some children have multiple Dysgraphias. In reality, symptoms may differ from those mentioned here.
Spatial Dysgraphia	Spatial Dysgraphia is caused by a lack of spatial knowledge. This individual has unreadable handwriting, but normal spelling and finger tapping speed. Spatial Dysgraphia affects students' ability to maintain their writing on the lines and space words evenly.

2.2 Montessori And Multi- Sensory Approach In Learning Disabilities

The Montessori method of learning is characterised by its emphasis on self-directed exploration, experiential knowledge acquisition, and cooperative play among students. This type of learning is accomplished via the provision of a well-organized environment that is both pleasing and fulfilling. It is also simple and genuine in that every component of an item has a specific function to assist the child's development. According to Nruiz (2018), Dr. Maria Montessori believed that sensory experiences began at birth. Children explore their surroundings using their senses. Children may learn to categorise their environment by engaging in sensory exercises. These categories help youngsters develop structured intellect and adaptability to their surroundings.

When it comes to teaching techniques, multisensory approaches and various learning styles are two of the most successful methods to use. It is not just relevant to the general public, but it is also applicable to those with learning disabilities. According to Fahringer (2014), previous research has shown that using the multi-sensory approach when working with children who have learning problems in general, and dysgraphia in particular, may have a beneficial impact. VKAT (visual, kinesthetic, auditory, and tactile) is another term for multisensory, which includes visual, kinesthetic, auditory, and tactile. According to Lexicon Reading Centre (2021), Students learn more quickly, quicker, and can remember and apply ideas more readily when taught according to their learning styles. Multisensory methods appeal to most students, regardless of ability. Below are some of the strategies to apply for multi- sensory approach in learning:

Table 2 Multi Sensory Method and Strategies

Visual reasoning and learning simulation	Text and/or pictures on paper, posters, models, projection screens, computers or flash cards Use of colour for highlighting, organizing information or imagery Graphic organizers, outlining passages Student created art, images, text, pictures and video The above mentioned techniques often include visual teaching methods and strategies.
Auditory techniques	Books on tape, peer assisted reading, paired reading and computerized text readers Video or film with accompanying audio Music, song, instruments, speaking, rhymes, chants and language games
Tactile teaching methods	Sand trays, raised line paper, textured objects, finger paints andpuzzles to improve fine motor skills Modelling materials such as clay and sculpting materials Using small materials called manipulatives to represent numbervalues to teach math skills
Kinaesthetic methods	Games involving jumping rope, clapping or other movements paired with activities while counting and singing songs related toconcepts. Any large movement activity for students involving dancing, beanbag tossing or other activities involving concepts, rhythmic recall and academic competition such as quizzes, flash card races and other learning games.

2.3 Montessori And Multi- Sensory Approach In Learning Disabilities

Electronic technology is a sophisticated kind of technology that makes use of electric circuits to achieve a purpose that may range in complexity from simple to very complicated. Wireless data transmission and sync, quick downloads and many more are among the benefitsof electronic technology. Instead of learning on paper, doctors recommend that kids study on a computer. Both in terms of assessment improvement and proof of practical benefits, the useof computers to aid rigorous repetitive practise has been proven to be beneficial. (Dimauro, Bevilacqua, Colizzi & Di Pierro, 2020).

Technologies for Dysgraphia and learning disabled are used for a variety purposes especially in supporting the area of learning and skill practices that enable them to perform functions that are normally challenging. Using application technology is the alternative to assistteachers and Dysgraphic children as it provides an interesting approach to writing using a stylusor touch surface using fingers. (Rahim & Jamaludin, 2019). By having touch screen applicationfor Dysgraphia, it will help them in the sense of learning and practicing their motor skills. Thevibration on the touch screen interactive application will trigger the brain and the memory skills. Thus, with a lot of practice on the touch screen application Dysgraphic children will ableto overcome their difficulties.

Handwriting is a difficult skill that requires practise and refinement over time. Childrenmust combine fine motor skills, linguistic skills, memory abilities, and attention in order to acquire handwriting. They must also put forth the effort to practise and adhere to the rules. Drawing and scribbling are the first steps in learning to write by hand, followed by the formation of letters and words. According to a recent study, tracing and copying letters on a tablet utilizing finger construction is great for kids learning to form letters evenly (Tanimoto, Thompson, Berninger, Nagy & Abbott, 2015; Steele, Weber, McLaughlin, Donica, Derby, & McKenzie, 2015) This shows that with the help of having a touch screen interactive with Montessori and multi-sensory approach application for Dysgraphia, they can improve their motor skills, memory skills and increase attention span when overcoming their writing difficulties.

9

CHAPTER 3
METHODOLOGIES

3.1 Development Methodology

A systems development life cycle (SDLC) is comprised of multiple clearly defined and specificwork stages that systems developers use to plan for, design, build, test, and deliver data systems. An SDLC, like anything else that is manufactured on a production line to bedeveloped, aims to create high-quality systems that meet or exceed user expectations, based onuser requirements, by conveying systems that move through each clearly defined phase withinscheduled time outlines and cost estimates. The development technique that I want to utilise tocomplete this project is known as Rapid Application Development (RAD). Rapid Application Development (RAD) is a type of agile software development process that produces the final result in a short period of time. Furthermore, one of the benefits of employing this process is that it does not require as much time or money to produce the final output.
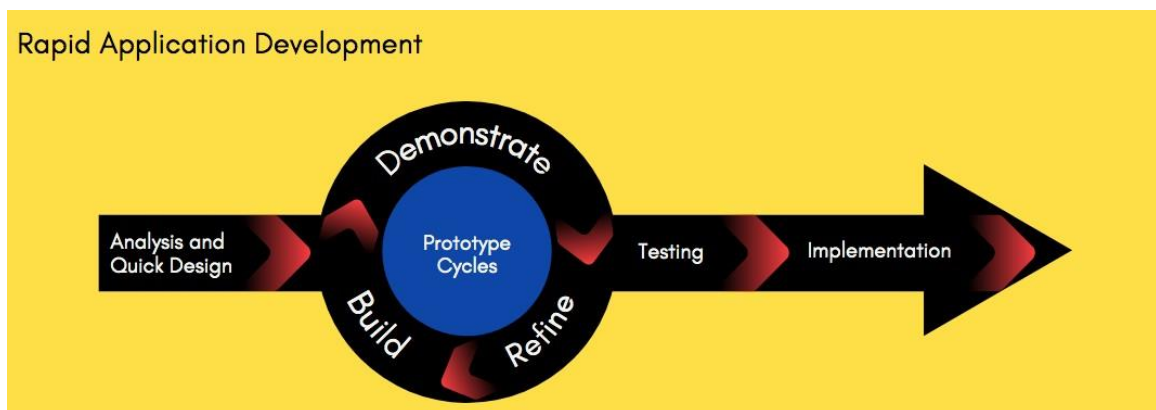

Figure 1 RAD Methodology

Systems Development Life Cycle (SDLC) involve seven phase which are planning, analysis, design, development, testing and integration, implementation, and maintenances. Theseven phases will not stop but keep on looping if any changes must made.

i. Planning: The problem statement has been identified, and the initial objective has been set forth in order to conduct a preliminary analysis, provide potential solutions, identify costs and benefits, and submit a preliminary plan with recommendations to the project manager.

ii. Analysis: The objectives, as well as the nature and scope of the problem, are investigated in this step. It is necessary to determine what the development system's objectives are. After that, it is necessary to determine how the problem under investigation relates to the project. At this point, Google forms will be distributed to the members of the targeted group. Interviews with specialist teachers from learning handicapped schools will also be undertaken as part of the investigation to gain a deeper grasp of the problem.

iii. Design: The Gantt Chart is used to describe in detail the required features and procedures, which may include screen layouts, software rules, process diagrams, and other supporting documentation. A comparison between various applications on the internet that are already available will be conducted at this phase in order to provide a better and more unique User Interface (UI) for youngsters. Aside from that, the letter trace itself will be designed utilizing the Unity development platform.

iv. Development: The actual code is developed in C++, Java, or C# at this point, and it is then performed to ensure that the design assets are working properly.

v. Integration and testing: During this step, I have brought all of the components together in a specific testing environment, where I have checked for mistakes, bugs, and usability testing. From the user's viewpoint, usability will be determined by whether or not it is able to run with proper function and in a smooth manner.

vi.   Implementation: Deployment is the stage of initial development during which the project is placed into development and is allowed to operate in its current form.

Maintenance: It is at this phase which the system is evaluated to ensure that it does not become obsolete. This is also the stage during which modifications to the original project phase are made. Involved in this process is a continual assessment of the project in terms of its performance and functionality.

In information system development, structural methodology refers to the framework that is used to organise, plan, manage, and sustain the development process of an information system. As a result, selecting the most appropriate methodology is critical to ensuring that the process development process runs smoothly. For example, selecting the most appropriate approach may save both time and money throughout the development process.

3.2 Development Tools

The development of the mobile application's prototype for this study required some ofthe software tools to ensure that the development phase can be done successfully as per planning. Below are some of the software tools that be used to develop the prototype of this project.
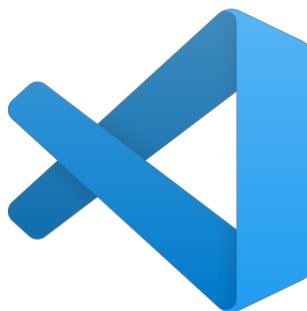
i.   Visual Studio Code

Figure 2 Visual Code Studio Logo

Visual Studio Code is a simplified code editor that includes debugging, task execution, and version control functionality. This programme is a lightweight but capable source code editor that has been used by a large number of developers on a variety of projects. It is available for Windows, Mac OS X, and Linux. Additionally, this project incorporates this tool as a component of the source code editor throughout the development period, allowing the developer to create the source code in an orderly way.

ii.   Android Studio

Figure 3 Android Studio Logo

Android Studio is an Android Integrated Development Environment (IDE). Android Studio is the greatest integrated development environment (IDE) that will provide the best results. This is because it is compatible with Windows, Mac OS X, and Linux. There are several benefits to this programme, including an Intelligence Code Editor, Instant App Run, and a Fast Emulator. Throughout the development of this project, Android Studio was used to guarantee that the source code was displaying the same result and was aligned with each other.

iii. Firebase Database

Figure 4 Firebase Logo

Numerous tools and services are available to aid developers in creating high-quality apps utilising Firebase, a NoSQL database platform. The programme is built on Google's infrastructure, which includes a cloud-hosted database where data is saved as JSON and synced in real time to the connected user. For the most part, I will be keeping my database on Firebase for my proposed project.

iv. Flutter

Figure 5 Flutter Logo

Flutter is Google's user interface toolkit for creating stunning natively built apps for mobile, web, desktop, and embedded devices from a single codebase. Additionally, Flutter may be created for iOS, Android, or web. This toolkit is incredibly attractive and simple to use for those developing their first mobile application. Apart from that, Flutter is the quickest development environment for displaying an expressive and adaptable UI throughout the development process. Thus, the creation of the MontSensory Pocket App used the Flutter programme to

create a mobile application that needed two distinct platform versions: Android for the mobile application and HTML for the website.

v.   Unity

Figure 6 Unity Logo

Unity is a cross platform game engine that is to design a real-time 3D development platform using .NET and the C# programming language. The engine has since been gradually extendedto support a variety of desktop, mobile, console and virtual reality platforms. It is particularlypopular for iOS and Android mobile game development and used for games. It is cited to be easy to use for beginner developers. The engine can be used to create three-dimensional (3D) and two-dimensional (2D) games, as well as interactive simulations and other experiences. This software will use to design the alphabet letters tracing and vibration. Sound also will be input using this software.

3.3 Project Gantt Chart

3.3.1 Detailed Gantt Chart for FYP1

No	Detailed Work / Project Activity (FYP1)	Week 1	2	3	4	5	6	7	8	9	10	11	12
	Project Formulation												
1	Project Title Selection MONTSENSORYPOCKET: DYSGRAPHIACHILDREN'S LEARNING TOOL USING MOBILE APPLICATION	■	■										
2	Project Proposal Submission			■									
	Requirement Analysis												
3	Project Research Work		■	■	■	■							
4	Background Study about Dysgraphia and Montessori Method				■	■	■						
5	Literature Review				■	■	■	■	■	■	■	■	
6	Data Analysis using Survey, Interview, Internet Research					■	■	■	■	■	■	■	
7	Project Methodology using RAD						■	■	■	■			
8	Proposal Defense								■				
9	Interim Report Submission												■

Table 3 Gantt Chart FYP I

3.3.2　Detailed Gantt Chart for FYP2

Table 4 Gantt Chart FYP II

No	Detailed Work / Project Activity (FYP2)	Week											
		1	2	3	4	5	6	7	8	9	10	11	12
Project Design													
1	Flowchart and Storyboard												
2	Project Pre-Design												
3	Finalize Design	█	█										
Development process													
4	Program the code using Android Studio	█	█	█	█	█							
5	Develop UI for MontSensory Pocket using Unity	█	█	█	█	█							
6	Connect Database to Firebase	█	█	█	█	█							
7	Review MontSensoty Pocket	█	█	█	█								
System Testing													
8	Usability Testing MontSensory Pocket					█	█						
9	Debugging Error						█						
Deployment													
10	Deploy System							█					
Documentation													
11	Feedback Review and Documentation								█				
12	Dissertation Report								█	█	█	█	
13	Viva Presentation											█	█

*During Semester Break

3.4 Data Analysis

A study of an online application for Dysgraphia that is accessible in the Google Play Store, which is the most popular digital distribution channel for Android devices. There are many apps available for Dysgraphia sufferers to download and utilise on their computers. However, for this proposed research, I only included 20 applications in order to analyse the landscape of apps that were promoted for Dysgrahia individuals.

Using "Dysgraphia for kids" in the search box, I was able to determine that the vast majority of the applications that showed were intended to be used for instructional reasons. As shown in the attached Figure 5, the bulk of the genres accessible on the Google Play Store are for the Educational purposes of dysgraphia children, representing for 50 percent of the total number of genres available. It was followed by the Games genre, which got a 30 percent percentage of the genre application. The Lifestyle genre for dysgraphia is the third most popular genre of application, making for 10 percent of all available applications.
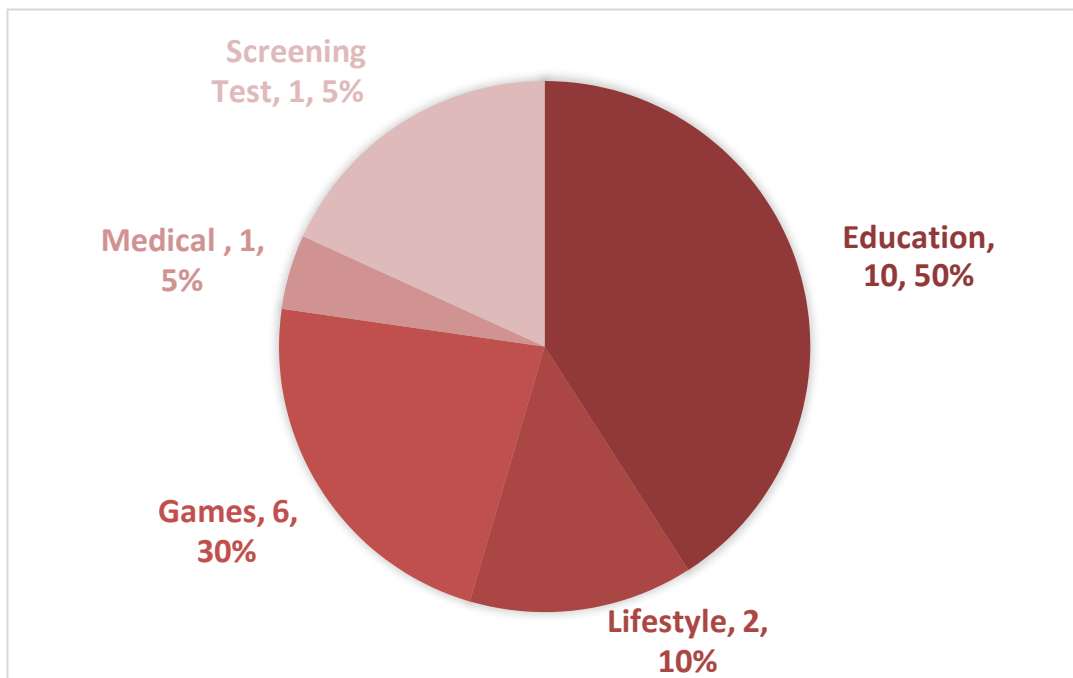

Figure 7 Dysgraphia genre application

In addition, I performed a comparison of the current dysgraphia applications that are accessible on the Google PlayStore. For the most part, I have included the top five dysgraphia applications that are now available and suggested for use by those who have dysgraphia. Table5 compares the two applications in terms of functionality. Following is a list of the application'sfeatures, along with each of its limitations and advantages. All of this comparative research isbeing utilised to determine what may be improved in MontSensory Pocket in order to make comparisons.

Table 5 Comperative Study of Application

Application	Limitation	Strength
Ghotit Real Writer	The user interface design isnot effective for kids with Dysgraphia. Require the use of a desktop computer's Internet connection	Functionality is veryspecific and precise.
Learn to Read, Write & Spell	Need to purchase full version User interface design is notsuitable for Dysgraphia	Has various lessons such asalphabet, reading, writing, spelling, and language.
DragonDitaction	User interface design is notsuitable for Dysgraphia Guidance (tutorial) is notprovided Less educational features, more to usability	User interface design issuitable for kids with Dysgraphia
HexaDysgraphia	User interface is not suitablefor Dysgraphia Guidance (tutorial) is notprovided	White background Used multiple font coloursto help readability More suitable for Dyslexiachildren

Fono3	User interface design is notsuitable for Dysgraphia Children	Has various exercises such as reading, speech, thinking and memorising
	Used bright colors	
	Used too many colors	
	Crowded and complexed background	
	Medium of instruction:English Require Internet connection	

CHAPTER 4:
RESULTS AND FINDINGS
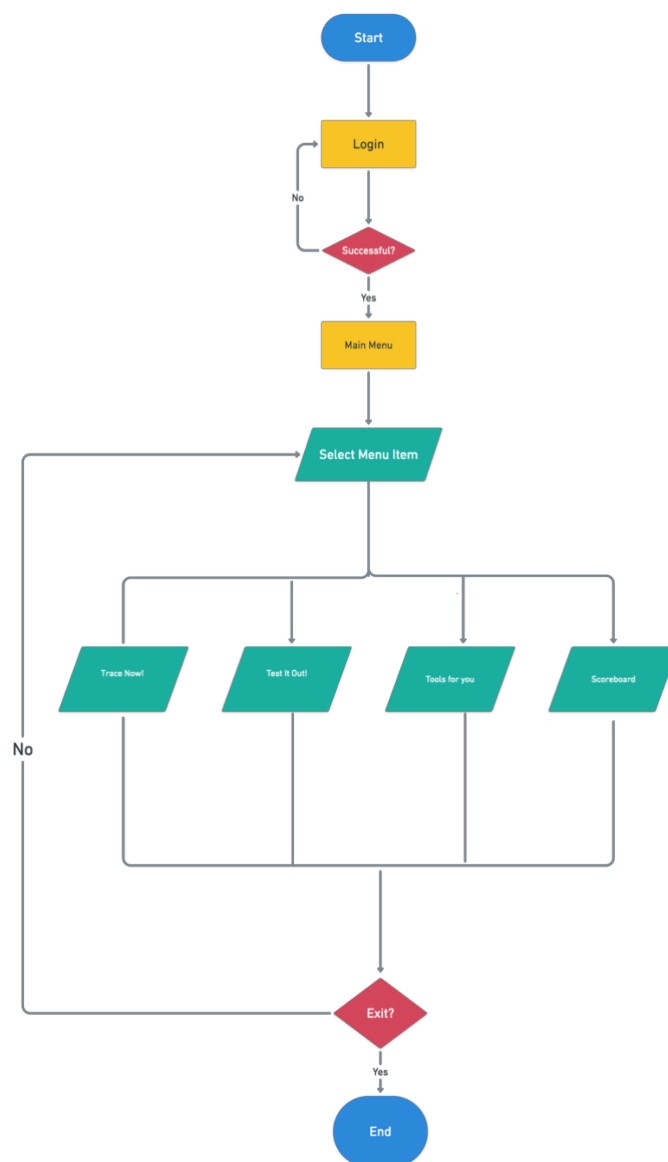
4.1 Flowchart

Figure 8 MontSensory Pocket Flowchart

A flowchart is a chronological representation of the different phases of a process. It is a general tool which may be used to define many procedures, including

a website workflow or services procedure. As shown in the figure above, the general user known as children will have a choice to choose from the Main Menu after Logging in. In the "Trace Now!" section, user will be able to do tracing. In "Test It Out!" section user will be able to test their skills from practicing in "Trace Now!". In "Tools for you.", there will displays of tools and lastly in "Scoreboard" section, scores will be shown after user have completed their traces and tests.

4.2 Interview Questions and Answers

I have conducted an interview session with a teacher from Sekolah Pendidikan Khas Alor Setar to understand better about Dysgraphia. Ms Mazni is a teacher who have worked with a child who had dysgraphia before. Her expertise is teaching blind and deaf students. Below are some questions that I have asked her during the interview.

Table 6 Interview Session

Questions	Answers
Does poor handwriting always associate with dysgraphia, how true is it?	Contrary to popular belief, this is not always the case. While some individuals with dysgraphia are suitable to write nicely, they must spend a great amount of time and effort to accomplish it.
How can you tell if your child has dysgraphia?	Most of the time the child will be far better at communicating ideas verbally than he or she will be at communicating ideas in writing.
What are the symptoms of dysgraphia shown physically?	• An uncomfortable pencil grip. • An unusual posture of the wrist, torso, or paper.

	• Getting bored of writing quickly and/or complaining of pain while writing.
What are the symptoms of dysgraphia shown in hand writting?	• Letters that are poorly shaped or inconsistently formed • Copying or writing that is laborious or takes a long time. • Uneven spacing between letters or words, trouble keeping writing on the line, and difficulties preserving left and right margins are all signs of poor spatial planning on paper. • Misalignment of the letters on the page.

4.3 Deliverables Interface
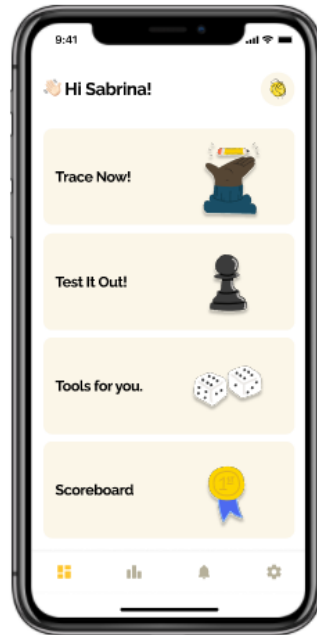
4.3.2 Main Menu Screen

Figure 9 Main Menu Screen

When user have successfully entered the application with the correct password and email or signed up, they will be able to see the main menu screen. There 4 sections which is Trace Now!, Test It Out!, Tools for you and Scoreboard.
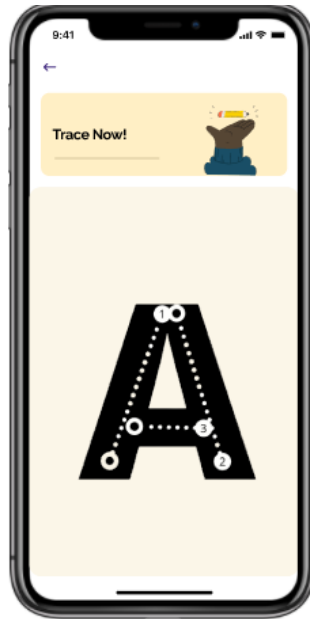
4.3.3 Trace It Screen

Figure 10 Trace It Screen

For the following section shown in Figure 10, users are supposed to trace the letter displayed on the screen according to the order of the number that have shown.

4.3.4 Correct Answer Tracing Screen

Figure 11 Correct Answer
Tracing Screen

4.3.4 Test It Out Screen

Figure 13 Test It Out Screen

In this section user are supposed to test their writing, motor, memory skils after practicing skills by tracing before. User are asked to write the letters on the line given to make sure it is written correctly.

4.3.5 Test It Out Answered Screen

Figure 12 Test It Out Answered Screen

4.3.7 Other Screen
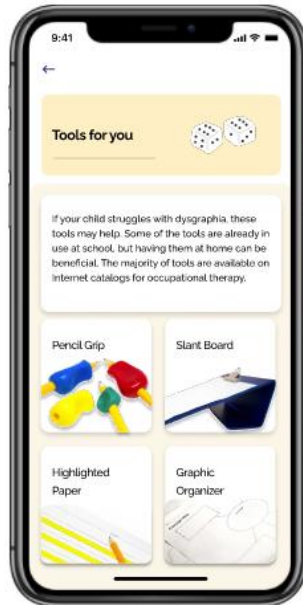

Figure 14 Tools for you Screen
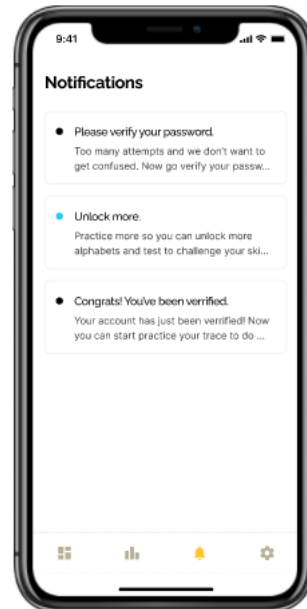
Figure 15 Settings Screen   Figure 16 Notification
Screen

In "Tools for you" Screen user can have a walk through and read on the tools that is needed for Dysgraphia children. Next is Settings screen where user can set the account ,notification, appearance, privacy and security. On the other screen is the Notification screen, user can see the displayed notifications recienved from the MontSensory Pocket Admin.

4.4 Usability Testing

Tables below shows all the result of the testing done.

Role: User

Table 7 Task 1

Task 1	
Goal	Log In and View Main Menu
Inputs	E-mail and password
Assumptions	View Main Menu
Steps	Fill out e-mail and password Click Login Main Menu will be shown
Fail/Success	Success
Notes	Successfully viewed Main Menu with the correct email and password.

Table 8 Task 2

Task 2	
Goal	Sign Up and Log In

Inputs	Full name, e-mail and password
Assumptions	Log In with verified e-mail
Steps	Fill out full name, e-mail and password
	Click Login
	Fill out again verified e-mail and password
	Main Menu will be shown if sucess
Fail/Success	Success
Notes	Successfully viewed Main Menu with the verified email and password.

Table 9 Task 3

Task 3	
Goal	Trace Letters
Inputs	Movement of fingers
Assumptions	Complete tracing
Steps	View Main Menu
	Click "Trace Now!"
	Trace the letter displayed
	Completion letter image will be displayed
Fail/Success	Success
Notes	Successfully viewed completion letter image

Table 10 Task 4

Task 4	
Goal	Do Test on Test It Out
Inputs	Tracing of word
Assumptions	Complete test
Steps	View Main Menu

	Click "Test It Out!"
	Trace the word displayed
	Completion word image will be displayed
Fail/Success	Success
Notes	Successfully viewed completion word image

Table 11 Task 5

Task 5	
Goal	Click and View Tools for you
Inputs	Click
Assumptions	View Tools for you
Steps	View Main Menu
	Click "Tools for you"
	View all of items displayed
Fail/Success	Success
Notes	Successfully viewed Tools for you

CHAPTER 5
CONCLUSION AND RECOMMENDATION

5.1 Conclusion

The following is an overview of the three primary goals achieved:

Objective 1: To investigate Montessori as a learning tool for Dysgraphia children which can alleviate their difficulties.

- The MontSensory Pocket Application has been developed as a result of this effort. It has been designed to help children with dysgraphia learn. Dysgraphia symptoms in children have been reduced by using this application. A total of five people were involved in an application functioning test, which was carried out by the author. All five responders were satisfied with the application's performance.

Objective 2: To develop a mobile application that include tracing output in order to help the children to improve their writing skills, motor skills and memory at an early age.

- The materials in the mobile application, MontSensory Pocket are designed and intended to able the children to experience learning with sensory at an early age. It has been proved that the children can improve their writing skills together with their memory skills and motor skills. This is because when multiple trace their movement on the screen with practice the respondent will remember easily

Objective 3: To assess the mobile application functionality and usability among the teachers and caregivers.

- The MontSensory Pocket has been assessed successfully of its functionality and usability among teachers and caregivers. In this project the research on the suitable way the caregivers and teachers to monitor the Dysgraphic children progress has been identified which is by having scoreboard and rewards program which is for future work. In the current phase the author focuses more on the tool that it is using to help alleviate the symptoms.

5.2 Recommendation

Several components of this project may be expanded in the future. With virtually any project that has a software component, the potential for future expansions is virtually limitless. This advice would just highlight the critical areas where more work may enhance the project.

• Investing in the application's gamification, which includes scoreboards and leader boards that increase user engagement.

• The next stage might be to incorporate an in-depth analysis report of the user for teachers or caregivers that the programme can create automatically, which can be extremely beneficial for monitoring and measuring the children's symptoms and performance.

To completely review all of the application's additional capabilities that may have an effect on the learning and usage of children, additional time is required to analyse and assess everything thoroughly and appropriately, as well as divide appropriate talents. While the overall notion of how this may be performed is discussed, the specific work required would be better suited for a different project. Apart from that, the major functions of the goals have been met.

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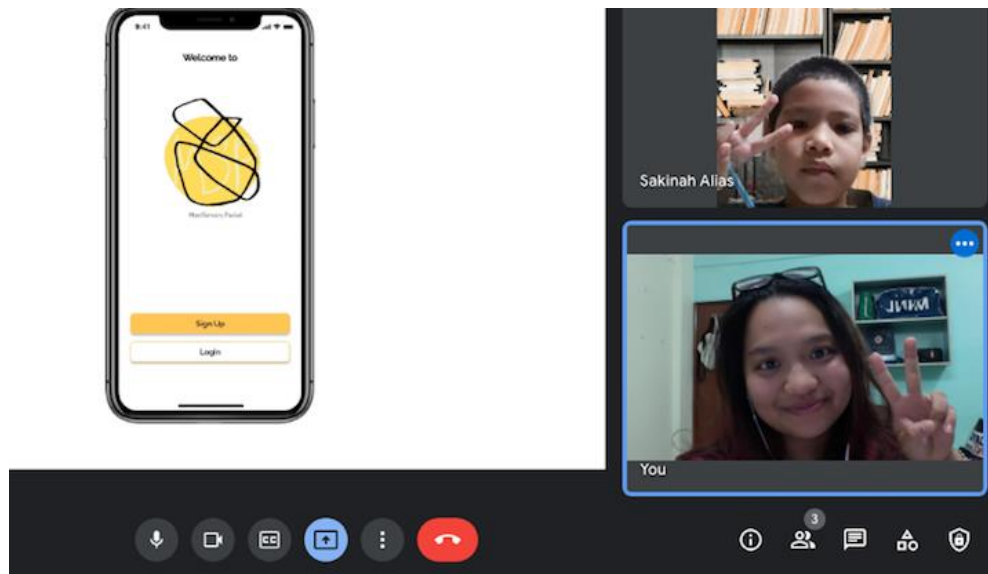
APPENDICES

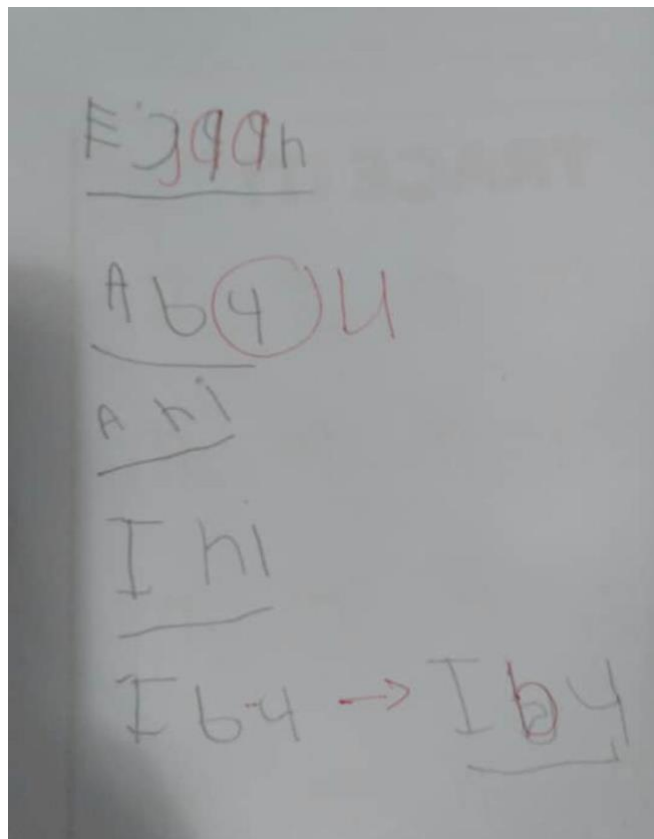Figure 17 Application Testing with Hanif (6Years Old)

Figure 18 One of the students (Iqa) having dysgraphic symptoms handwriting

Figure 19 Luqman doing the tracing letters activity using Montessori Method