# ABSTRACT

The research project was conducted to develop a mobile application as a medium of communication between speech pathologists and the stutterers. This application involves storing data, retrieve data and it is a medium of communication between stutterers and their speech pathologists. This project will identify the appropriate ways for speech pathologists to retrieve their patients' results to evaluate their performances. Other than that, it is also to identify ways for speech pathologist to communicate with their patients rather than the patients need to meet them face to face regularly. Nowadays, there are lots of mobile applications available in the market that provide techniques to improve stuttering problem among children and adults. However, none of the application allows speech pathologists to access their patients' data based on the techniques provided or communicate with their patients through the mobile application. Current stutter mobile application only provide assessment and exercise for the stutterers but they did not allow the patient to save and store recorded files for sharing. This mobile application is targeted for speech pathologist in clinics or hospitals in Malaysia and it is built on Android platform. In this project, the method used to achieve the objectives is Rapid Application Development. From the survey that have been conducted with Speech Pathologists, most of them suggested that the application can be used as an exercise for stutterers. The Speech Pathologists stated that this application can assist them in providing results for them to monitor their patients' results. This Stutter Manager Mobile Application will be providing all the results for Delayed Auditory Feedback (DAF) & Mirroring technique, Metronome technique, Stutter Rate techniques and Add Word Game. As for DAF & Mirroring and Metronome results it will in the form of recorded file. While for Stutter Rate, it is in the form of graph where speech pathologists can review the progress of their patients. While for Add Word Game, the results will show the percentage word the patient could pronounce. Therefore, with the presence of this application, speech pathologists are able to communicate with their patients and also review their patient's results.

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# CHAPTER 1:

# INTRODUCTION

## 1.1 Background of Study

Stuttering or in other word is stammering is universal disorder of speech fluency. The word stuttering can be referred either to the certain speech interruptions that are normally delivered by individuals who stutter or to the whole communication problem that individuals that stutter will be facing. According to National Institute on Deafness and Other Communication Disorders (NIDCD, 2010), stuttering is a speech disorder in which sounds, syllables, or words are repeated or prolonged, disrupting the normal flow of speech. People who stutter are called stutterer and usually they begin to stutter since childhood and in some cases it might last throughout their life.

Usually, at third or fourth years of a children, they start to show that they are stutter. According to Yairi and Ambrose (1999), around 75% of children recover naturally from stuttering, mostly within two years of onset, with girls more likely to recover naturally than boys. Recovery is also reported to occur occasionally in adulthood, although the extent to which this can be regarded as “natural” is not known (Ingham, Finn, & Bothe, 2005).

A person who stutters may repeat the first part of a word or hold a single sound for a long time (Manjula & Shiva, 2014). There are two research being done that more than 68 million people worldwide stutter and has found to affect males and females in the ratio of 4:1. This disorder is characterized by disruptions in the production of speech sounds, called disfluencies (Cullinan, Prather & Williams, 1963; Oliver, 1995).

There are real reasons to have cause stuttering. The individuals who stutter however can fight the condition by themselves, and enhancing their fluency of speech by referring to speech pathologists and also doing self-treatment. Some of the cases, seeing a speech pathologists is recommended but mostly patients will be more comfortable by having personal vocal trainings and speech exercise rather than depending on speech pathologists. It can help and improve patients' confidence level by having this personal vocal training and fluent their speech. Since nowadays everyone has their own Smartphones or tablets, using mobile application may help stutterer recover or improve their stuttering problem by developing the personal vocal training and speech exercise

Therefore, this study proposes an application known as the "Exploring the Usage of Stutter Application from Speech Pathologist Perspective". The study is conducted to identify the usage of stutter application from speech pathologist point of view. From this study, the Stutter Manager mobile application have been introduced to speech pathologist. The application provide exercise for stutterers and also results from each techniques. The result will help speech pathologist to monitor their patients' progress. This application aims to create and design mobile application for speech pathologist to monitor their patients' vocal training results. Speech pathologist can access their patients' report daily, weekly, monthly and yearly in the recorded file in the mobile application. All the recorded file of the vocal exercises, speech recordings and pathologist analysis results of speech trainings are stored on cloud. Stutterers and pathologist are able to exchange information through the mobile application. Moreover, patient can track their own results from their own devices such as their smartphone or tablets.

## 1.2 Problem Statement

Speech pathologist or doctor play and important role to cure or help stutterers to improve and cure their stuttering. Stuttering is a situation where a person is having difficulty in their flow of speech. Stuttering is a speech barrier that is caused when the regular speech pattern is disrupted by repeated syllable or letter sounds.

According to the Stuttering Foundation of America (n.d.), it was stated that stutterers need to attend speech therapy. Therefore, it involve speech pathologist or doctor as they the one who will conduct the therapy. The problem that may occurred that doctor or speech pathologist may overworked and it will jeopardize patients' safety. According to Rettner (2013), about a quarter of doctors said their high workload prevented them from fully discussing treatment options with patients.

Other than that, Rettner (2013), also stated that minority number of doctor ordered unnecessary tests because they did not have enough time to examine the patients' cases due to high workload. This will disturb the therapy session and also the progress of the patients' stuttering.

Nowadays, doctor really need help from technology. Doctor also need help from technology as assistant to them. According to Baker (2015), many doctors choose to stay in large cities because that is where they completed their residency programs, he said. They are settled and comfortable in an urban center, and do not want to give that up. This will be difficult for people in rural area to get medical support from doctor. Therefore with the help of telemedicine which involved information technology, providing greater access to specialty care for patients in more remote locations (Weinstein, 2015).

Other than that, sometimes doctor cannot monitor the patients' progress at home. Therefore it will be a difficulty for doctor to know whether the patient eat the medicine ad being described from doctor or did the patient do the exercise regularly. Therefore it will be a problem in curing or treating the patient if the doctor cannot monitor their progress regularly. Doctor also need help from technology to help them monitor their patients' wellness. They should not think that the medical based technology created nowadays will replaced them as a doctor. Technology will help the doctor a lot in many perspective.

## 1.3 Objectives

The main objective of this project is to design a mobile application known as the "Stutter Manager Android Mobile Application". The objectives of this research are outlined as follows:

1. To design and construct a mobile application for speech pathologists to monitor their patients' vocal training results.
2. To incorporate real time features to further enhance the results and assessments of vocal training to allow speech pathologists to learn about and monitor their patients' wellness.
3. To evaluate speech pathologist's experience utilizing the mobile health application.

## 1.4 Scope of Project

For the study of exploring the usage of stutter application from speech pathologist perspective, the scopes of the application is stated as follows:

- **Include the treatment or methods which are Metronome, Mirroring and Delayed Auditory Feedback**

  This application is embeds these three treatment methods as recommended and guided by Pathologists in order to treat and help stutterers in reducing stuttering problem. Stutterers will use these three methods in this application as their personal practices at home.

- **Creating new methods as an exercise which are Stutter Rate and Add Word Game**

  This application is embeds other two methods as an exercise for stutterers to try and practise on their own. This help the stutterers to improve their stuttering and also they can practise at home.

- **Provide results for all techniques available.**

  This application provide results for techniques available in Stutter Manager application. For Delayed Auditory Feedback (DAF) & Mirroring, the results will be in the form of recorded file which user or speech pathologist can hear back the recorded file. For Stutter Rate, it is in the form of graph. As the graph decreases, it shows that the stuttering problem is improved. For last techniques, Add Word Games, the results will displayed the percentage of the word pronounce and also list of word the stutterers cannot pronounce.

- **Developing a mobile application for Android platform**

  Stutter Manager is a mobile application which is developed for Android platform only. This is because by using mobile application it is the fast and efficient ways for stutterers to use this application as their personal speech exercise. Therefore, stutterers who are using Smartphone that have Android platform can use this application since the numbers of Android users in the world is ranked the highest. Based on an online article by McCracken (2013), it was stated that all companies that produce and making Android phones sell a lot more units as compared to other competitors worldwide.

- **Accessible by Speech Pathologists**

  Stutter Manager Android Mobile Application is accessible by the speech pathologist of each user. Speech pathologists can access each recorded file from Metronome technique, Mirroring technique, Delayed Auditory Feedback technique, Stutter Rate technique and Add Words Game. The speech pathologists can monitor each of their patient and also give feedback to their patient in each recorded file they received. The speech pathologists can access the data from the application itself where the speech pathologists need to login using their own username and password. Therefore only the speech pathologist that have been assigned to the patient can access their own patient's file. Speech pathologists can access all their patients' results anywhere with the help of internet access. It will be easier for the speech pathologist can access their patients' result not at work only but also at home. Figure 1 below shows that the highest percentage of user uses their smartphone at home, second highest is a work and then on the go which is wherever they go.

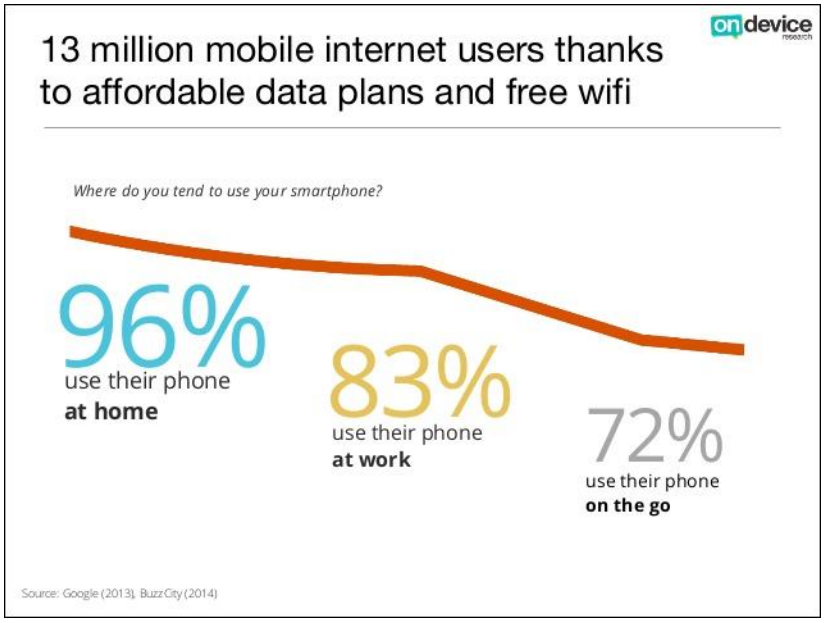



*Figure 1: Places where user tends to user their smartphone.*

### 1.5 Statistics of Stutterers in Malaysia (Extrapolated Prevalence)

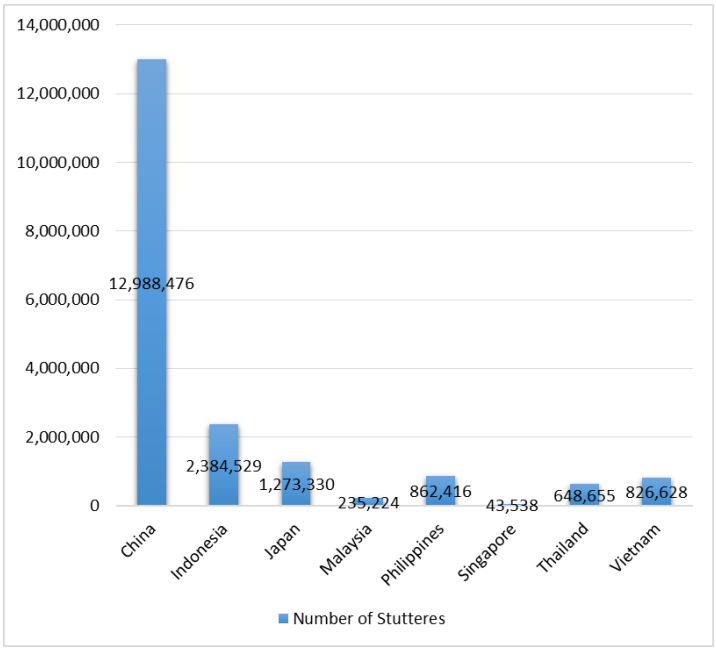



*Figure 2: Statistics of Stutterers in Malaysia (Extrapolated Prevalence). Retrieved from [http://www.rightdiagnosis.com/s/stuttering/stats-country.htm](http://www.rightdiagnosis.com/s/stuttering/stats-country.htm)*

Based on Figure 2, the statistics shows that number of stutterers (extrapolated prevalence) in Asia. Based on the size of population in each country, the statistics is being extrapolated. Therefore, the graph shows that China have the highest number of stutterers compared to other country. Malaysia have the lowest number of stutterers compared to others.

# CHAPTER 2:

# LITERATURE REVIEW

## 2.1 What is Stutter and Cause of Stuttering?

According to American Speech-Language-Hearing Association (n.d.) Stuttering affects the fluency of speech. It begins during childhood and, in some cases, lasts throughout life. The disorder is characterized by disruptions in the production of speech sounds, also called "disfluencies." Most people produce brief disfluencies from time to time. Interjections such as "um" or "like" can occur, as well, particularly when they contain repeated ("u- um- um") or prolonged ("uuuum") speech sounds or when they are used intentionally to delay the initiation of a word the speaker expects to "get stuck on". Kids who stutter may say that their words get stuck or describe their speech patterns as rough because that's how it sounds to them. What differentiates the person who stutters from someone with normal speech is the type and amount of the stuttering and also the behaviour of the person.

Nobody really knows what the causes for some people to stutter are. Genetics may play a role and because of this, children have a tendency to stutter if a parent also stutters. Possible conditions that may cause stuttering include in coordination of the speech muscles, family history of stuttering, rate of language development and head injury or unusual brain activity. Functional brain imaging research over the last 10-15 years has consistently shown that the speech of people who stutter is related with unusual brain activity. A study conducted by Packman, Code and Onslow (2006) has found that "stuttering typically begins in the third year and fourth years of life as children starts putting words together into short utterances". Some children stutter more

when they are excited and try to talk really fast, when they are afraid to talk to a certain people or when they are thinking about the word that they want to say. Other than that, when they feel shy because of the stutter problem, they might have tendency to stutter even more.

Other factor that might influence stuttering is environment. Example of environmental factors is parental attitudes and expectations, the child's speech and language environment, and stressful life events. In this factor, it does not imply that parents are doing anything wrong. Usually these things are not harmful to children who does not stutter, however can complicate stuttering in children that tends to stutter. This will lead to children's' fear and anxiety of stuttering will keep increasing and getting worse.

According to Medical News Today (2014), psychological factors used to be believed that the main reasons for long-term stuttering. Psychological factors may make stuttering worse for people who stutter, such as stress, embarrassment, etc., but they are not generally seen as underlying long-term factors. In other words, anxiety, low self-esteem, nervousness, and stress therefore do not cause stuttering per se. Rather, they are the result of living with a stigmatized speech problem which can sometimes make symptoms worse.

## 2.2 What treatments or methods can be used to treat stuttering?

There are many treatments currently available for stuttering, for both children and adults.

- **Speech Therapy**

  Many people who stutter from children until adults have been to speech therapy for reducing stuttering at least once in their lives. Some people have been through years of therapy. Speech therapy can reducing the flow of the speech, decreasing the tension and struggle of stuttering moments, working to decrease word or situation avoidances, build confidence and using effective communication skills such as eye contact or phrasing. According to article by Stuttering Foundation of America (n.d.), wrote that speech therapy for people who stutter means involve in switching the behaviours of speech, emotions, and attitudes about talking and communicating in general. Based on another online article by Dodge (2008), he mentioned that speech

therapy used approaches that are effectives such as ability to modify speech motor movements and lower negative effect during stuttering.

Speech therapy is a two way communication between the stutterer and the pathologist. In this project, the author will try to apply the speech therapy but only focusing on communication between the stutterer and the mobile application. People who are stutter can use this application to practice alone by using methods that been recommended by pathologist.

- **Metronome**

The second treatment that is effective in reducing stuttering is Metronome. Metronome is a high tech, neurologically based treatment tool. Metronome is a technique to encourage fluency of the speech using rhythm that requires stutter people to speak one syllable word to each beat of a metronome. Based on research paper by Botterill (2011), he stated that, in early 1840, rhythm was already been used when Colombat dal'Isere used syllable timed speech and developed the use of the metronome to regulate the rhythm as fluency shaping therapies. Andrews, Guitar, and Howie (1980) found that the next largest effect sizes for stuttering treatment outcome is by using metronome stimulation after prolonged speech type procedures during the treatment studies for meta-analysis. London R. (2006) stated that after going through some readings on stuttering, based on the knowledge that he get and the experienced with behaviour modification techniques, he used the metronome technique because this technique can offer a relearning/behavioural approach.

Other than that, based on studies conducted by specialist under the Stuttering Foundation of America (2007), William, a six years old boy start to recover from stuttering when he had less stuttered-like disfluency (SLDs), less sound repetitions and a greater number where whole word is pronounce without repetitions after using Metronome therapy. Based on this result, it shows that Metronome therapy is efficient for stuttering treatment.

- **Mirroring**

Another treatment that can be used in order to cure stuttering is by standing in front of a mirror while practicing pronouncing words and imagining speaking

in public or with another person. Stutterer can choose any topic while speaking in front of the mirror. This activities need to be done regularly until their stuttering appearance in front of the mirror disappear. This technique could help to boost the level of confidence within stutterers because it is mimicking public speaking (Wikihow, n.d.; Stop Stuttering, 2011).

- **Delayed Auditory Feedback (DAF)**

One of the stuttering treatments that have always been used by pathologists is Delayed Auditory Feedback (DAF). According to Fraser (2007), DAF allows people to listen back to what they have said after a short period time. Dan Slater (2010) further mentioned that DAF can be accompanied by hearing gadgets such as the MP3 players that play back stutterer's speech after a delay of time. Other than that, John Haskell, a speech therapist in New York stated that, DAF will be more effective if the device is used with another technique such as breathing or mirroring.

According to a research conducted by students of Uppsala University Sweden, they clarify that by using DAF, the sound from the speech is transmitted to a headphone in one or two ears with a delay of about 50 to 250 ms. Short delays, about 50 ms, may reduce stuttering but at the same time allows speech with a normal rate. Longer delays require progressively slower speech, with stretched speech sounds: one has to wait for the sound to reach the ear before beginning the next one. Long delays may be used for training of a speech technique with soft and slower speech.

While implementing a DAF application on Android, it will happen that a delay is being added even though the application is configured to add no delay. In other words, the app reads audio data from the microphone of the mobile device and writes them to the audio playback device without adding any delay. As an initial debugging step, the delay will be measured and added by using an audio recording application that runs on an external computer. Metronome application will be used and runs on the same external computer to generate periodic tick sounds and record the output of the mobile phone at the same time.

## 2.3 Current scenario of stutterers visiting speech pathologists

According to Brenda Carey et al. (2008), for the current situation where stutterers visit the speech pathologists through:

- Face-to-face treatment
  - Individual Teaching Sessions.
  - Group Practice Day.
  - Individual Problem Solving Sessions.
  - Maintenance.

- Telehealth treatment
  - Conducted by telephone.
  - The prolonged speech pattern and the nine-point severity and naturalness scales were taught by means of exemplar audiotapes mailed to participants.
  - A dedicated, designated telephone voicemail line was provided for recording of participant speech samples.
  - Instruction and feedback were provided by the speech pathologist as needed.
  - Home practice replaced the face-to-face programme group intensive day.

## 2.4 Create an Android Mobile Application

Android can be considered as the world's most popular mobile platform. Millions of people already use Android because it makes the mobile devise so much powerful and useful. According to an online article, it was described that Android is the largest installed base of any mobile platform and growing fast every day (Android Developers, n.d). Other than that, McCracken (2013) also stated that all companies that produce and make Android phones sell a lot more units than other competitors worldwide.

There are many reasons why Android is better than iOS. One of the reasons is that Android has better features as compared to iOS. This supported by Piltch (2013), who has found that Android can beats iOS for many reasons, including the following:

- By default, iOS shows only one app on the screen at a time; however Android is better than iOS where it allows developers to either create floating apps, which appear in their own windows on top of the primary app, or to split the screen between two different apps.

- Android offers variety of screen sizes as compared to iOS which only offers two choices for new iOS phone: the 3.5 inch iPhone 4S and the 4 inch iPhone 5.
- Android offers many choices of widgets and applications. There are thousands of widgets and applications available from Google Play, giving the users tones of flexibility that iOS cannot match.
- Since Android platform is used by many Smartphone such as Samsung, Sony, Motorola and many more, user can share data with many devices. For iOS, however users are only allowed to share data within Apple devices only

Figure 3 below shows that the Android platform, a research conducted by Euromonitor presented that there was about 65% of Android user in Malaysia followed by Windows and iOS operating system.

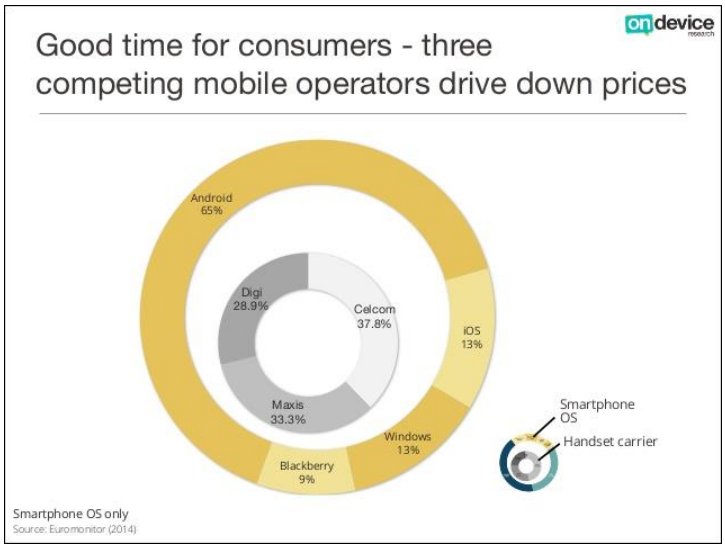



*Figure 3: Breakdown of Smartphone OS in Malaysia.*

## 2.5 Comparative Study of Features between Different Applications for Stuttering

| Mobile Application Features |  Stuttering Help Trial |  DAF Delayed Auditory Feedback |  Stutter Rater |  Stutter Manager |
|---|---|---|---|---|
| Provide Exercise | ✓ | ✓ | ✓ | ✓ |
| Provide Result | | | | ✓ |
| Result DAF | | | | ✓ |
| Result Metronome | | | | ✓ |
| Result Stutter Rate | | | | ✓ |
| Result Add Word Game | | | | ✓ |
| Speech Pathologists' Feedback | | | | ✓ |
| Accessible by Speech Pathologists | ✓ | ✓ | ✓ | ✓ |
| Speech Pathologists Login/Logout | | | | ✓ |

***Figure 4: Comparison between existing stutter application and Stutter Manager.***

Based on the comparative study in Figure 4, there are few similar product offerings from different parties both in local and international scenes. Three existing commercial products have been chosen Stuttering Help Trial, DAF Delayed Auditory Feedback and Stutter Rater. All applications serve the same objective with the same target which is provide exercise for stutterers only to differ from one another in certain criteria.

Stuttering Help Trial application does not provide the results from each techniques and also it is accessible by all user. DAF Delayed Auditory Feedback application only provide DAF techniques. For Stutter Rater application provide only stutter rate techniques which provide tapping on fluent and stuttered words button.

Thus, the Stutter Manager mobile application has those features that could help to encounter those weaknesses revealed from other technologies. It also aims to close the gaps of the existing applications by providing combination of techniques available in one

application. First, it provides user and speech pathologist login and logout features. Second, combination of all techniques available in one application. Third, user or speech pathologist able to record, saved and view the results from each techniques

## 2.6 Hospitals and Clinics in Malaysia which provide treatment for Stuttering

There are many treatments available for stuttering which involved children and adults. One of the treatments for stuttering is by going to speech therapy for speech treatment. Speech therapy is a two way communication between the stutterer and the speech pathologist. By going to speech therapy session, there are activities that can help stutters to control their flow of speech, decrease the tension and struggle of stuttering moments, work to decrease word or situation avoidances, build up confidence and learn to use effective communication skills such as eye contact and phrasing.

During speech therapy sessions, a person could also learn how to control their behaviours that include switching the mode of speech, emotions, and attitudes when talking to someone and communicating in public. Dodge (2008) mentioned that speech therapy used approaches that are effective such as technique to modify speech motor movements and lower negative effect during stuttering. A research conducted by American Speech Language Association reveals the clinical evidence showing that individuals who stutter can benefit from treatment provided by speech language pathologist at any time in their life span. Treatment can be scheduled on an intensive (several hours per day for several weeks) or extended (1–2 hours per week for several months or longer) basis. Techniques that appear to have the greatest efficacy for reducing the frequency of stuttering in adults and older children include those that change the timing of speech (e.g., slowing down, stretching out sounds) or reduce physical tension during speaking (e.g., gentle onsets of speech movement).

While comprehensive treatment approaches focus on improving the person's attitudes toward communication and minimizing the negative impact of stuttering on their life. Many stutterers report that they receive greater benefits from comprehensive approaches than from those that focus only on changes in speech fluency. More than 100 studies on adults who stutter concluded that significant improvement typically occurs as a result of treatment in 60 to 80% of cases and while studies of school age children reveal an average reduction in stuttering frequency of approximately 61%.

According to data from ASHA's National Outcomes Measurement System (NOMS), 79% of adults who stutter showed gains of one or more levels on the Fluency Functional Communication Measure (FCM) following speech-language pathology intervention. FCMs are a series of seven-point rating scales ranging from least functional (Level 1) to most functional (Level 7) designed to measure improvement in a variety of clinical areas. Nearly one half of these individuals made multiple levels of FCM progress resulting in increased communicative competence. This has shown that speech therapy is one of the treatments which capable to treat stutter.

Have conducted user testing with four speech pathologist from Bahagian Pendidikan Khas at Pusat Pentadbiran Kerajaan Persekutuan Putrajaya. During the meeting session, the stutter manager being introduced and questionnaire being distributed to get positive and negative feedbacks regarding the results from each techniques.

## 2.7 Gap analysis and way forward

According to Australian Stuttering Research Centre (n.d.), treatment for stuttering can be done face to face with a speech pathologist, or in telehealth format either by telephone or Skype over the internet.

By this type of this communication, it will be difficult to people in the rural area to visit the speech pathologists. Because of the location of the rural area is far from the city, it is difficult for them to make an appointment with the speech pathologist due to the less transportation available, lack of knowledge in terms of where they should refer to and also lack of money to the medical fees. Therefore, it will be easier for people in the rural area having stutter mobile application for them to improve their stuttering by doing the exercises provided and also can communicate with their own speech pathologists.

Based on the research, doctors' are very demanding and require them to be on the move most of the time. Most of the doctors said that they have high workload and it prevent them from fully discussing treatment options with patients. Therefore having assistance such as mobile application technology would help them to focus more on each patient remotely. Other than that, telemedicine help them by providing greater access to specialty care of patients in more remote locations.

Other than that, for speech pathologists, most of them prefer to access all their patients' result at anywhere they go. Therefore with the help of mobile application, they can access all their patients' result in their mobile phones with the present of internet

access. Other than that, speech pathologists can communicate with their patients through the mobile application without meeting them face to face.

In future, probably will create the same application but in different platform such as for iOS and Windows in order the application can be access by stutterers.

# CHAPTER 3:

# METHODOLOGY

## 3.1 Project Management Life Cycle

For this final year project, the discussion is focused on the method that will be used to develop this mobile application. Author will use conventional project management life cycle which separates the project into five (5) phases which consists of initiation, planning and design, executing, monitoring and controlling and closing.

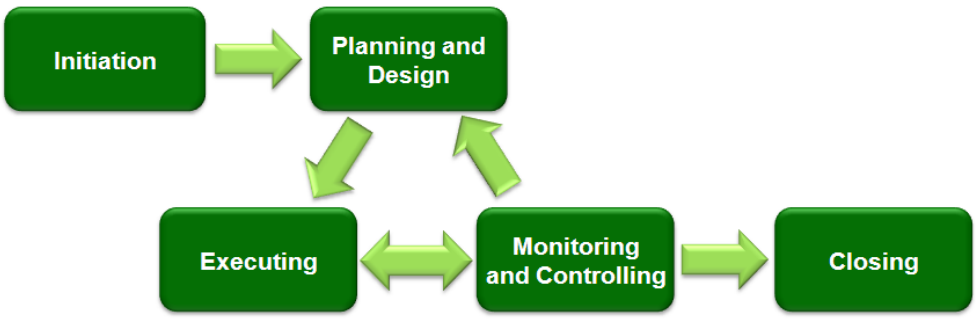



*Figure 5: Conventional Project Life Cycle*

### 3.1.1. Phase 1: Initiation

A discussion with supervisor is being conducted which the author choose to continue the Stutter Manager Mobile Application development. Author need to create this mobile application for the speech pathologists' side. Therefore it will provide results from each techniques and to be saved in their own devices. During this phase, author has already identified the software and the hardware

that will be used to develop this application. Author also creates a Gantt chart in order to have a proper timeline during the development of the project.

### 3.1.2. Phase 2: Planning and Design

At this phase, using the requirement gathering from the experts at phase 1, author will start to draft each interface and those related functionalities. In order to design the interfaces, author used storyboard to get a clearer view for each interface and function in the application. This application has been designed to help speech pathologists to access all of their patients' result.

### 3.1.3. Phase 3: Executing

In the Executing phase, author developed the prototype of the application. Author already completed demonstration to the supervisor and it is already being approved. After get approval, the author demonstrate to the speech pathologists and make sure that they review the application. From this, author conduct user testing. The purpose of user testing is to test the prototypes to ensure that the prototype function well as required and also meet the speech pathologists' requirement.

### 3.1.4. Phase 4: Monitoring and Controlling

After completing user testing, author identify and removes errors in the application that occurred during testing. Author also improved the system to meet the requirement of the speech pathologists. This process continues in a cycle until users agree and are satisfied with the application interfaces and functionalities in the application.

### 3.1.5. Phase 5: Closing

At this phase, author already completed the development of the application. The application will be commercialized and will be introduce to speech pathologists. This application can be accessed or downloaded from Google Play Store.

## 3.2 System Development Methodology

Project methodology represents technique that can be used to conduct research prior to developing a system or an application. It includes the type of data to be collected, the method of data collection, the number of sample in the population and other variables that can help to the research and development process

There are some model that is being implemented in developing a mobile application such as waterfall model, agile model and also the rapid application development model.

| SDLC | Waterfall Development | Agile Development | Rapid Application Development |
|---|---|---|---|
| Characteristics | According to Munassar & Govardhan (2010),<br>▪ Linear sequential<br>▪ Complete each phase before moving to the next phase.<br>▪ Systematic model but inflexible and rigid.<br>▪ Does not allow return to the previous step. | According to Susan (2009),<br>▪ Able to return back to the previous phases in case any changes<br>▪ It has a high flexibility in terms of developing the application.<br>▪ Drawback of this model is the project can easily get taken off track. | ▪ Prototype is being created as a method to understand about the customer's requirements.<br>▪ The prototype will be refined up until the customer reach the satisfaction.<br>▪ Focus more on development phases<br>▪ Help to avoid from developing a mobile application that fails to align with the customer expectations. |

*Figure 6: Comparison of System Development Life Cycle*

Based on the comparison of three types of the development models, the author has chosen Rapid Application Development (RAD) to implement in creating Stutter

Manager mobile application. This is because it could increase the understanding of the developer about what kind of end product does the customer expect to receive and also to overcome the time constraints due to short period of development and also other commitment to complete the project .

## 3.3 Data Collection

### 3.3.1 Survey – Questionnaire

During FYP1, the author had used questionnaires to obtain feedback concerning the interface of the application and to increase the knowledge about current process of keeping patients' results. Questionnaires consist of written set of questions where respondents can record and choose their answer. The author also used the answer from respondent to expand knowledge about the current process the speech pathologist used.

During FYP2, questionnaire being distributed to normal user in order to understand the usage of Stutter Manager mobile application in users' perspective. Therefore 31 respondent have answered the questionnaire. The feedback from normal user help the author to understand what the normal user think about health mobile application.

### 3.3.2. Survey – Interview

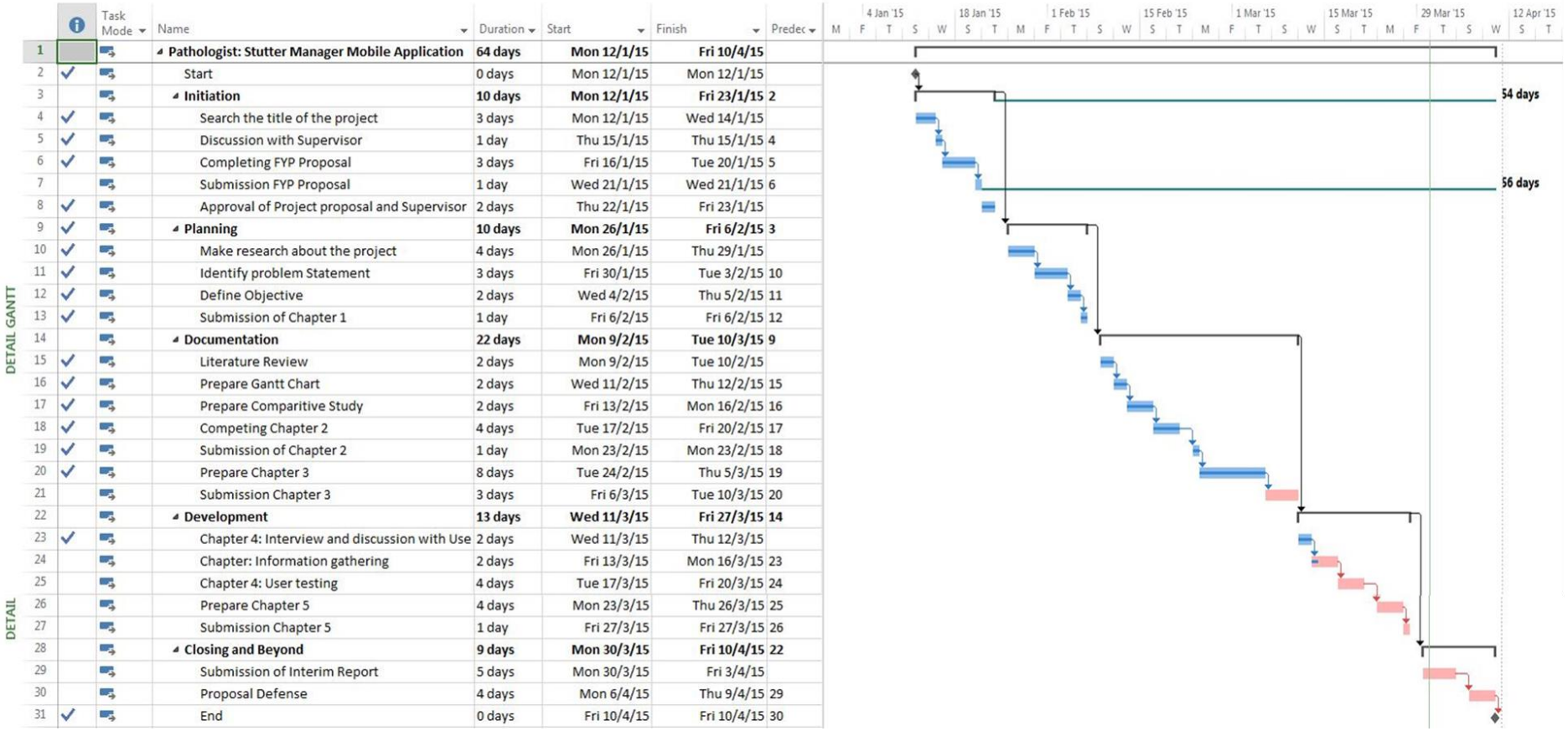
During FYP2, the author conducted interview session with four speech pathologist who is specialized in stuttering from Pusat Perkhidmatan Pendidikan Khas, Kementerian Pelajaran Malaysia, Putrajaya. These sessions are conducted to gain more knowledge about current process that speech used to keep track of their patients' results and also get positive and negative feedback of the results from each techniques and overall application. From this interview session, the author identify that speech pathologist would like to use this application to assist them to identify the progress of their patients. Other than that, as an exercise for the patient at home to improve their stuttering. Based on the interview, the result from application help to assist them in identify the patients' progress. The results from the interview is being discussed more in Chapter 4.

### 3.4 System Testing

| | User Testing | Usability testing |
|---|---|---|
| Speech Pathologist | Allow the Speech Pathologist to review the mobile application prototype and provide questionnaire to them to identify the positive and negative feedback of the application from speech pathologist perspective. | - |
| Potential Users | - | The testing being conducted by distribute the questionnaire to potential user. First the user will be demonstrate the application then the questionnaire being distributed based on the:<br>▪ User interface<br>▪ Functionality<br>▪ Accuracy<br>▪ Acceptance<br>▪ Overall rating<br>▪ Comments and feedback for future improvement |

*Figure 7: User Testing and Usability Testing*

## 3.5 Gantt Chart and Key Milestone



| | Task Mode | Name | Duration | Start | Finish | Predec |
|---|---|---|---|---|---|---|
| 1 | | **Pathologist: Stutter Manager Mobile Application** | **64 days** | **Mon 12/1/15** | **Fri 10/4/15** | |
| 2 | ✓ | Start | 0 days | Mon 12/1/15 | Mon 12/1/15 | |
| 3 | | **Initiation** | **10 days** | **Mon 12/1/15** | **Fri 23/1/15** | 2 |
| 4 | ✓ | Search the title of the project | 3 days | Mon 12/1/15 | Wed 14/1/15 | |
| 5 | ✓ | Discussion with Supervisor | 1 day | Thu 15/1/15 | Thu 15/1/15 | 4 |
| 6 | ✓ | Completing FYP Proposal | 3 days | Fri 16/1/15 | Tue 20/1/15 | 5 |
| 7 | | Submission FYP Proposal | 1 day | Wed 21/1/15 | Wed 21/1/15 | 6 |
| 8 | ✓ | Approval of Project proposal and Supervisor | 2 days | Thu 22/1/15 | Fri 23/1/15 | |
| 9 | ✓ | **Planning** | **10 days** | **Mon 26/1/15** | **Fri 6/2/15** | 3 |
| 10 | ✓ | Make research about the project | 4 days | Mon 26/1/15 | Thu 29/1/15 | |
| 11 | ✓ | Identify problem Statement | 3 days | Fri 30/1/15 | Tue 3/2/15 | 10 |
| 12 | ✓ | Define Objective | 2 days | Wed 4/2/15 | Thu 5/2/15 | 11 |
| 13 | ✓ | Submission of Chapter 1 | 1 day | Fri 6/2/15 | Fri 6/2/15 | 12 |
| 14 | | **Documentation** | **22 days** | **Mon 9/2/15** | **Tue 10/3/15** | 9 |
| 15 | ✓ | Literature Review | 2 days | Mon 9/2/15 | Tue 10/2/15 | |
| 16 | ✓ | Prepare Gantt Chart | 2 days | Wed 11/2/15 | Thu 12/2/15 | 15 |
| 17 | ✓ | Prepare Comparitive Study | 2 days | Fri 13/2/15 | Mon 16/2/15 | 16 |
| 18 | ✓ | Competing Chapter 2 | 4 days | Tue 17/2/15 | Fri 20/2/15 | 17 |
| 19 | ✓ | Submission of Chapter 2 | 1 day | Mon 23/2/15 | Mon 23/2/15 | 18 |
| 20 | ✓ | Prepare Chapter 3 | 8 days | Tue 24/2/15 | Thu 5/3/15 | 19 |
| 21 | | Submission Chapter 3 | 3 days | Fri 6/3/15 | Tue 10/3/15 | 20 |
| 22 | | **Development** | **13 days** | **Wed 11/3/15** | **Fri 27/3/15** | 14 |
| 23 | ✓ | Chapter 4: Interview and discussion with Use | 2 days | Wed 11/3/15 | Thu 12/3/15 | |
| 24 | | Chapter: Information gathering | 2 days | Fri 13/3/15 | Mon 16/3/15 | 23 |
| 25 | | Chapter 4: User testing | 4 days | Tue 17/3/15 | Fri 20/3/15 | 24 |
| 26 | | Prepare Chapter 5 | 4 days | Mon 23/3/15 | Thu 26/3/15 | 25 |
| 27 | | Submission Chapter 5 | 1 day | Fri 27/3/15 | Fri 27/3/15 | 26 |
| 28 | | **Closing and Beyond** | **9 days** | **Mon 30/3/15** | **Fri 10/4/15** | 22 |
| 29 | | Submission of Interim Report | 5 days | Mon 30/3/15 | Fri 3/4/15 | |
| 30 | | Proposal Defense | 4 days | Mon 6/4/15 | Thu 9/4/15 | 29 |
| 31 | ✓ | End | 0 days | Fri 10/4/15 | Fri 10/4/15 | 30 |



*Figure 8: Gantt chart for FYPI and FYPII*

### 3.6 Tools Required

The tools required to develop this mobile application are:

- Smartphone – To install and run the application
- Personal Laptop – To install software and develop the application
- Fluid UI – Develop interface of the system

In the design phase, the author has designed the interface of the application using Fluid UI. The author could design the interface by dragging and dropping each item on the blank interface.

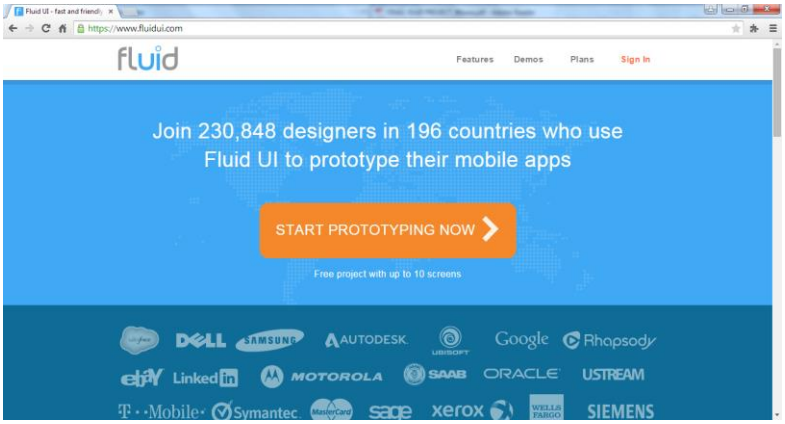



*Figure 9: FluidUI Homepage*

- Eclipse Juno – Software to develop this mobile application.

Stutter Manager Mobile Application is developed using Eclipse Juno software. Eclipse Juno is an Android development tools that is designed to give a powerful, integrated environment in which to build Android application. Figure below shows the interface of Eclipse Juno:

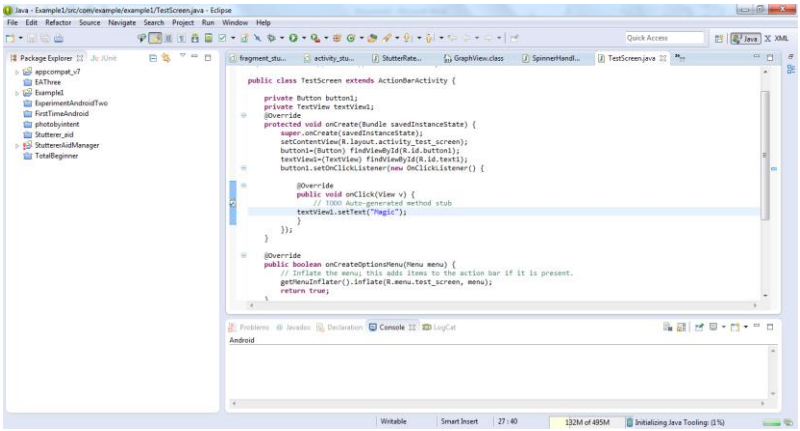


*Figure 10: Eclipse Juno Workspace*

- Microsoft Project 2013 – To develop Gantt chart and display the activities of the project.

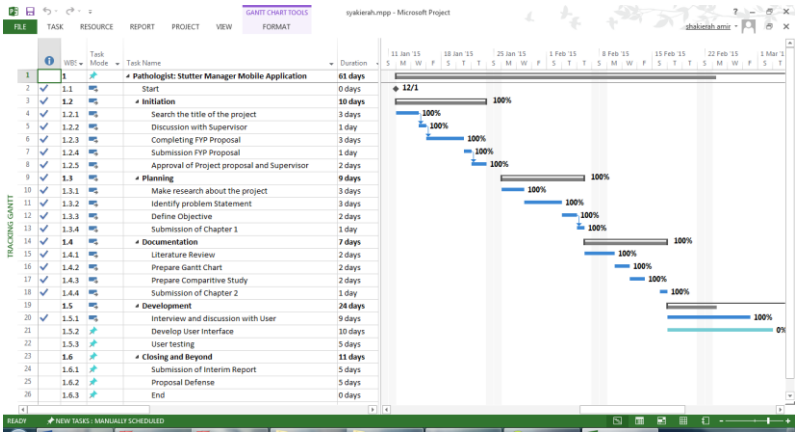


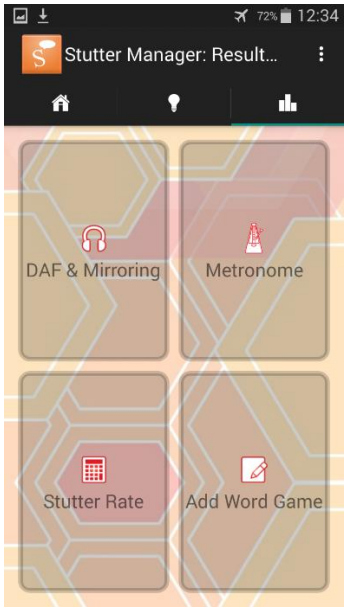
*Figure 11: Microsoft Project*

# CHAPTER 4:

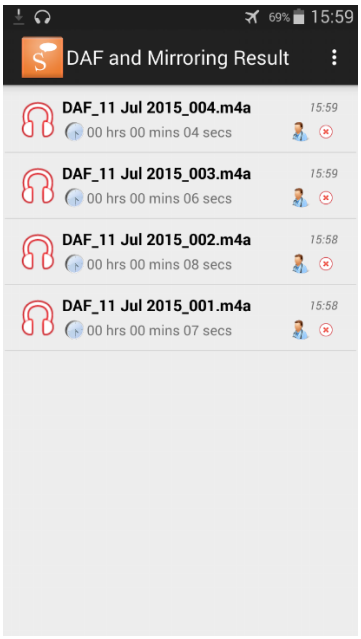
# RESULTS AND DISCUSSIONS

## 4.1 Graphical User Interface (GUI)

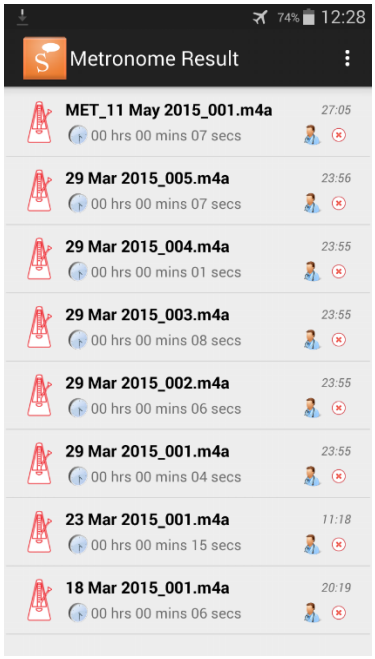
The following GUI are the interface for the application developed. These GUIs (Screen 1 – Screen 6) are being presented to users for validation and data gathering from potential users and speech pathologist. The results of data gathering will be discussed in the next following sub-section.



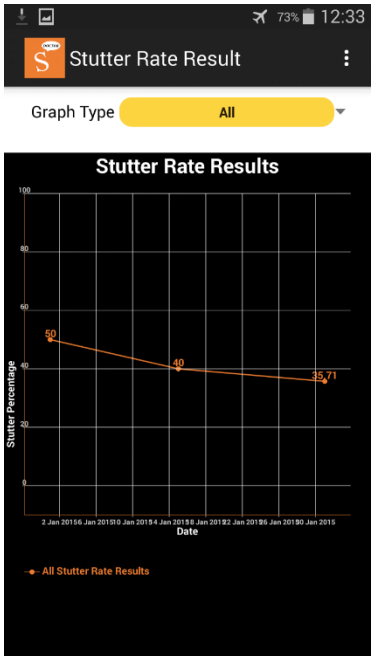

Screen 1: Homepage for Results which consists of DAF & Mirroring, Metronome, Stutter Rate and Add Word Game.




Screen 2: Result in a form of recorded file for Delayed Auditory Feedback (DAF) & Mirroring techniques.

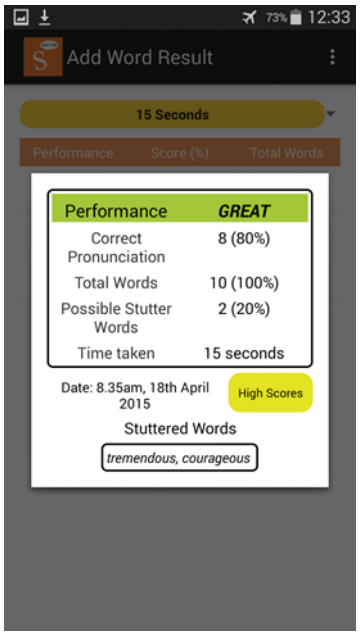



Screen 3: Result in a form of recorded file for Metronome technique.




Screen 4: Result in a form of graph for Stutter Rate technique.


Screen 5: List of results from Add Word Game




Screen 6: Result in a form of percentage for Add Word Game

## 4.2 Data Finding Analysis

This sub-section discusses the results gathered from data gathering. The results are divided into two sections. The first section (4.2.1) presents results gathered from potential users which has been conducted during FYP 1. The second section (4.2.2) presents data gathered from speech pathologists and a few other potential users which are gathered during FYP II.

### 4.2.1. Data Gathering with Potential User during FYPI

One of the requirements elicitation methods conducted is survey among Potential user. The survey aims to validate the proposed interface and each functionalities of the Stutter Manager mobile application in providing efficiency and productivity to their needs and requirement. The following are the interpretation results from the survey conducted.

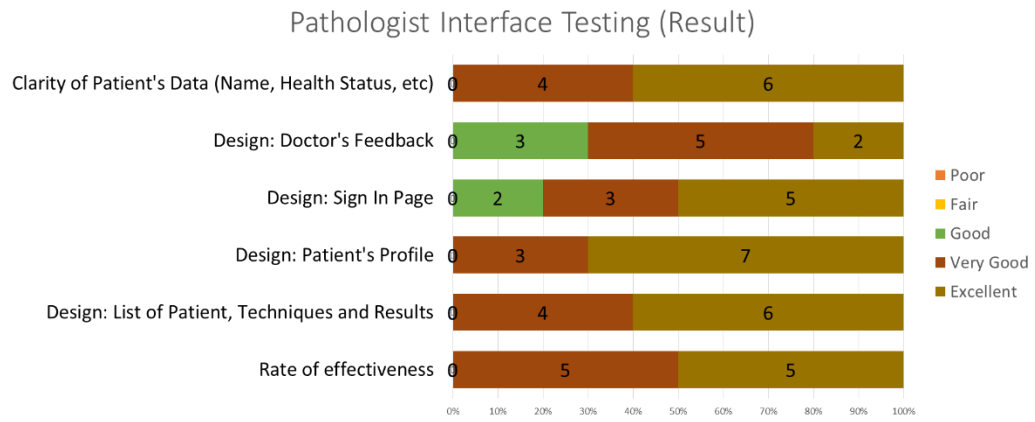



*Figure 12: Result from GUI Testing with Potential User*

Based on Figure 12, first criteria which is clarity of patients' data, most respondent agree that the patients' data provide clearer information of the patient. The design for doctors' feedback page, most respondent rate very good as they think the page is being design properly for easy access. Most of respondent prefer a better and simple form of sign in page. The patients' profile being designed to provide information clearly. The overall design of the application is being designed properly and easy to be accessed by patient and also speech pathologist. Last criteria, user rate it excellent as it can manage effectively the patients' data in each devices.

### 4.2.2. Data Gathering with Speech Pathologist and Potential User during FYPII

#### 4.2.2.1 Potential User

During FYPII, the author conducted another survey among few potential user. The survey aims to validate the overall application which provide results from each techniques such as Delayed Auditory Feedback (DAF) & Mirroring, Metronome, Stutter Rate and Add Word Game. The following are the interpretation results from the survey conducted.

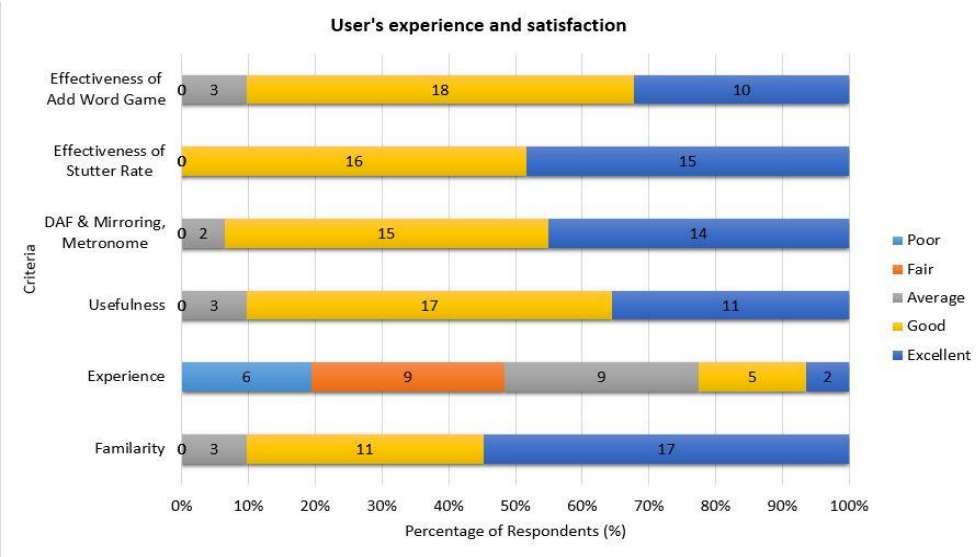



*Figure 13: Results from users' experience testing with Potential User.*

Based on Figure 13, most respondent are familiar with mobile health application available in the market. Most of the respondent haven't experienced using Stutter Manager mobile application and during the session with user, author let them use and try the application. User mostly agree that the application is useful no for stutterers but for children which having difficulty to talk. Most respondent like the result structure from the Delayed Auditory Feedback (DAF) & Mirroring and Metronome. Most respondent agree that the result from stutter rate and add word game is effective to be used.

#### 4.2.2.2 Speech Pathologist

The author also conduct testing with four speech pathologist. The aims of the interview to validate and verified the overall application with speech pathologist which include the techniques and also the results of Delayed Auditory Feedback (DAF) & Mirroring, Metronome, Stutter Rate and Add Word Game. The following are the interpretation results from the interview conducted.

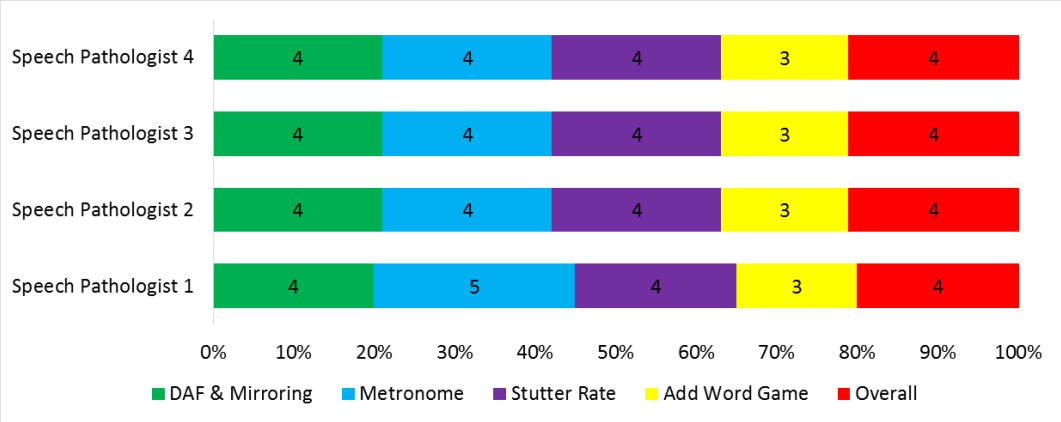



*FIGURE 14: Review from Speech Pathologists*

Based on Figure 14 above:

Speech Pathologist 1 rate excellent for the overall application. Other than that, Speech Pathologist 1 also provide positive feedback based on the application.

- ✓ Can be used for children to talk fast.
- ✓ Can assist Speech Pathologist

Speech Pathologist 2 rate good for the overall application. Other than that, Speech Pathologist 1 also provide positive feedback based on the application.

- ✓ Good for parents involvements in building up parents/child awareness
- ✓ Great for kids and teenagers with fast rate of speech.

Speech Pathologist 3 rate good for the overall application. Other than that, Speech Pathologist 1 also provide positive feedback based on the application.

- ✓ Good for providing graph for monitoring progress.
- ✓ Good for providing recording, graph storage function.

Speech Pathologist 4 rate good for the overall application. Other than that, Speech Pathologist 1 also provide positive feedback based on the application.

- ✓ Good for student with fast speech rate or cluttering
- ✓ Good for adult with awareness

*FIGURE 15: Demonstration with Speech Therapist*


*FIGURE 16: With Speech Therapist at Pusat Perkhidmatan Pendidikan Khas Putrajaya*

# CHAPTER 5:

# CONCLUSIONS

## 5.1 Relevancy of the Objective

- **Mobile application is designed for speech pathologist to monitor the patients' vocal training result.**

  The application has been developed with working interface and functionality. The application then being introduced to speech pathologist in order for them to monitor their patients' vocal training result and also other features in the application.

- **Enhancing the results and assessments of vocal training that incorporate real time features which allowing speech pathologists to learn about and monitor their patients' wellness.**

  Each assessment conducted from each techniques will be saved as a result in a form of recorded files, graphs and also percentages. This also allow the speech pathologist to learn about and monitor their patients' wellness through results from each techniques. Each techniques provide relevant result for monitoring the progress.

- **Experienced utilizing the mobile health application has been evaluated with Speech Pathologist.**

  As the application being introduced, only minority of speech pathologist just experienced using mobile health application but most speech pathologist has been experienced using it.

## 5.2 Suggested Future Works for Continuation

For future Stutter Manager project work, the author would like to suggest few recommendations to enhance its functionality and improve the effectiveness of the mobile application. The author suggests that to develop this mobile application separate between patient and speech pathologist. Author also recommend that the application being developed in Bahasa Malaysia. Therefore it will be easier for pathologists to use the application in English or Bahasa Malaysia. Other than that, the application should allow storing data on the cloud so that it is easy to be access by speech pathologist. Lastly, speech pathologist has recommended to add more attractive exercise to attract children to use the application.

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# APPENDICES