Therapeutic Learning Software for Down Syndrome

by

Nik Nor Ernina binti Nik Ab Rahman

Dissertation submitted in partial fulfillment of
the requirements for the
Bachelor of Software Engineering (Hons)
(Information & Communication Technology)

MAY 2011

Universiti Teknologi PETRONAS
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CERTIFICATION OF APPROVAL

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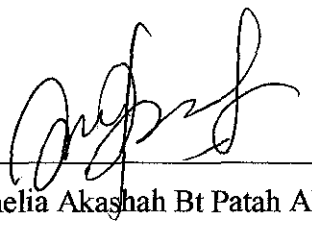

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CERTIFICATION OF ORIGINALITY

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 work contained herein have not been undertaken or done by unspecified sources or persons.

NIK NOR ERNINA BINTI NIK AB RAHMAN

ABSTRACT

Nowadays, children with Down Syndrome are not left behind in terms of education. One significant finding is that to utilize 'early intervention principle', which sated that learning process for Down Syndrome children will be more effective if it is conducted when the children are still young. Older children who have passed the age for 'early intervention principle' program or those who did not have the opportunity to join the program earlier will be enrolled into 'kelas pendidikan khas' at government school. However, one of the entry requirements is the children must know how to take care of themselves without help from others. In order to help these children, the 'Therapeutic Learning Software for Down Syndrome' is developed. The term therapeutic means the results of medical treatment that is beneficial and desirable. The main objective of this project is to design a software that focuses on occupational therapy and language therapy for older Down Syndrome children. The software will be designed to be in an interactive manner, as the studies proved that using visual aids and sounds will make the learning process more effective. The methodology used for this project is Prototyping methodology. As for the data gathering methodology, the technique chosen are interviews and questionnaires. Overall, the system is aimed to address the learning process of Down Syndrome children, through therapeutic learning, and to take advantage of the information technology which is to use visual aids and sounds in order to make the learning process more interactive and effective.

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INTRODUCTION

1.0 INTRODUCTION

1.1 Background of Study

Down Syndrome is a disease caused by the presence of an extra chromosome, which is having 47 chromosome instead of 46 chromosome for normal human being. In most cases, Down syndrome occurs when there is an extra copy of chromosome 21. This form of Down syndrome is called Trisomy 21. This extra chromosome will result to physical abnormalities and mental retardation. Children with Down Syndrome is said to face many challenges, be it health problems, hearing impairments and learning disabilities. While modern advances in medicine have encountered the problems regarding the physical conditions of these children, a concern remains about the learning and mental development of these children.

The term therapeutic means the results of medical treatment that is beneficial and desirable. It often relates to physiotherapy, occupational therapy, language therapy and speech therapy.

Nowadays, many care centers for children with Down Syndrome focuses teaching children aged three to six, and adapting the 'early intervention principle'. During the 'early intervention principle' program, Down Syndrome children are taught speech, language, and living skills. Older children who have passed the age for 'early intervention principle' program or those who did not have the opportunity to join the program earlier will be enrolled into 'kelas pendidikan khas' at government school. However, one of the entry requirements

is the children must know how to take care of themselves without help from others.

The software implements therapeutic learning technique which focuses on occupational therapy to teach basic living skills to the children and language therapy as the extension from the 'early intervention' program.

1.2 Problem Statement

As stated earlier, older Down Syndrome children needs to know how to do daily tasks independently before they can enroll in 'kelas pendidikan khas' at government school. Besides, these children also need to learn language skills as means to express themselves, follow instructions, and enhance vocabulary as a preparation for them to enroll in school later. Furthermore, these children are older children, thus therapeutic learning method is the most suitable method for them. Thus, the problems identified are as follows:

1.2.1 The software should teach the children basic living skills so that they can comfortably do daily tasks without help from others.

As stated above, Down Syndrome children who wish to enroll in 'kelas pendidikan khas' must know how to take care of themselves and do daily tasks without the help from others. Thus, the software should teach and make these children comfortable with things and tasks they encounter every day.

1.2.2 The software should cover language learning as an extension for the 'early intervention' program.

Language learning for Down Syndrome children differs from that of normal children. Down Syndrome children have difficulties in learning grammar, thus the software will only cover learning vocabulary as well as learning to follow instructions.

1.2.3 The software should highly emphasize on user involvement, such as maximizing mouse click, encourage the movement of body parts such as clapping, and singing to implement the therapeutic element in the system.

The need for therapeutic element is for the Down Syndrome children to feel that learning is fun and desirable. By adding therapeutic element mentioned above, the children will have more desire to learn and they can pay attention more to learning thus increasing their mental development.

1.2.4 The software should be interesting and exciting to attract the attention of Down Syndrome children as they are easily distracted.

Traditional method for teaching Down Syndrome children are through card game and verbal communication by the teacher itself. However, the children get easily bored. Thus, the use of colourful animation and sounds can attract them to learn through the software.

1.3 Objectives

1.3.1 To develop a software that focuses on occupational therapy and language therapy for older Down Syndrome children

The main objective of this project is to design a software that focuses on occupational therapy and language therapy. Occupational therapy teaches the children basic living skills, how to act independent and do daily tasks without help from others. Language therapy on the other hand includes learning vocabulary, following instructions and expressing emotion in words.

1.3.2 To investigate how therapeutic element can benefit the mental development of Down Syndrome children

As stated before, therapeutic means treatment that is beneficial and desirable. Although there are many types of therapy that is suitable for Down Syndrome children, the software focus on occupational therapy and language therapy. However, how can these two types of therapy can be made desirable to the children?

1.4 Scope of Study

In order to complete the system, several scope of study needs to be achieved. The major scopes are as follows:

1.4.1 To analyze the learning process of Down Syndrome children

The learning process of Down Syndrome children varies from one to another. Some six years old able to do simple counting in mathematics, but some nine years old do not yet know how to count. It is crucial to understand the learning process of these children to create a software that satisfy their needs later on.

1.4.2 To get in depth information on occupational therapy and language therapy

The purpose of operational therapy is to encourage the Down Syndrome children to do their daily tasks independently, without help from others. Language therapy on the other hand includes learning

1.4.3 To design an interactive software that emphasize on user involvement

Down Syndrome children is easily distracted whenever it comes to learning or focusing on something. That is why the software must be interactive and exciting enough to capture their attention. Various methods can be used to make the software more interactive such as using nursery rhymes, cartoon characters or colourful animation. These methods need to be analyzed to choose which one suited the children best.

1.4.4 To study on the tools and mechanism used to develop the software

The main platform used to develop the software is Adobe Flash CS5 and GIMP. Adobe Flash CS5 is used to develop animation and interactive two-way interaction between Down Syndrome children and the software.

1.5 Feasibility Analysis

1.5.1 Technical Feasibility

- Tools: The proposed system can be developed using Adobe Flash CS5, GIMP, and other relevant software.
- Software Content: The content of the software will be based on the scope of study and interviews, as well as questionnaires surveys that will be distributed to Down Syndrome care centers.

1.5.2 Economic Feasibility

- The tools to develop the software are readily available and some are open source software. No extra cost needed to purchase the mentioned software.
- As for the benefit, there will be some intangible benefits once the software is implemented. Down Syndrome children that do not gain benefit from the 'early intervention principle' will eventually able to improve their quality of lives.

1.5.3 Operational Feasibility

- Once the software is finished, it is hoped that Down Syndrome care centers will take advantage of the system and implement it in their teaching programs.

1.5.4 Schedule Feasibility

- The development of the software will take place for two semesters.
- A Gantt chart is developed to ensure the tasks for the project is organized in a timely manner.

CHAPTER 2
LITERATURE REVIEW

2.0 LITERATURE REVIEW

"Learning and Education for Down Syndrome Children"

2.1 Introduction

According to MedicineNet.com (2011), Down Syndrome can be defined as

"A common chromosome disorder due to an extra chromosome number 21 (trisomy 21). Down syndrome causes mental retardation, a characteristic face, and multiple malformations. Down syndrome is a relatively common birth defect. The chromosome abnormality affects both the physical and intellectual development of the individual."

According to MedicalConsultations.org, Down syndrome causes mental retardation, a characteristic facial appearance, and multiple malformations. It is associated with a major risk for heart malformations and a minor but still significant risk of acute leukemia (Xavier & Taub, 2010).

Apart from that, Down Syndrome children suffers from physical disabilities as well as mental disabilities. According to Walker (2007), mental disabilities in this case mean the developmental delays and learning disabilities, mostly in terms of child's intelligence, language, speech, and social development.

Every child in the world is unique and develops according to his or her own pace. This statement is specifically true for children that suffer from Down Syndrome as the development rate is more variable. One example to prove this is although children with Down syndrome showed significant IQ declines before they are four years old, they demonstrated considerably fewer IQ declines between 4 and 11 years of age (Dykens, Hodapp, Evans, 2006; Christianson, 2009).

Based on various studies, it is proved that 'early intervention principle' can minimize learning disabilities among Down Syndrome children. 'Early intervention' refers to activities designed to enhance development of children at young age (Sharon, 1998). The purpose for 'early intervention' is to replace any sorts of therapy which may include physiotherapy, speech therapy, and occupational therapy. However, not all Down Syndrome children have the opportunity to undergo the 'early intervention' training program.

In Malaysia, older Down Syndrome children who have passed the age for 'early intervention' program will be enrolled to 'kelas pendidikan khas' in government school. However, according to PendidikanKhas.com, one of the entry requirements set by Ministry of Education Malaysia is the children must be able to do daily tasks independently without help from others.

2.2 Therapeutic Learning

As 'early intervention principle' caters for Down Syndrome children at young age, therapeutic learning caters for older Down Syndrome children. According to Wikipedia.org, therapeutic is derived from the word therapy, means the results of medical treatment that is beneficial and desirable. It

often relates to physiotherapy, occupational therapy, language therapy and speech therapy.

Although various studies proved that Down Syndrome children learning curve only improved during childhood, Chapman (2006) through his study proved it the other way around. The study stated that certain language skills continue to improve well beyond the teenage years, suggesting that adolescents with Down syndrome should continue learning although they are already in their teenage years.

2.2.1 Occupational Therapy

Occupational Therapy concerns with the skills of living. According to NovitaTech.com, living skills are skills used to complete tasks of a normal day, which include dressing, eating, toileting, bathing, and many more. Down Syndrome children unlike other normal children tend to rely on others in doing basic things such as grooming and eating. Occupational therapy helps Down Syndrome children to cater the problems of unable to do things by themselves.

2.2.2 Language Therapy

As stated by NovitaTech.com, Language Therapy on the other hand includes learning vocabulary, following instructions and expressing emotion in words. According to Buckley (2002), speech and language therapy is the most important part of intervention services for children with Down Syndrome if we wish to promote their mental and social development.

Language therapy is important as it is considered to be one of the learning disabilities related to Down Syndrome (Buckley, Bird, 2001; Stefano, 2006). According to Chapman (2006), the problems identified include speech intelligibility, syntax and grammatical morphology. As stated by Kumin (1998) in his research, certain linguistic areas, such as vocabulary, are usually easier compared to grammar and comprehension for Down Syndrome children. Only a few children achieve clear and fluent speech and only a few can express what they wish to communicate effectively because of delays in learning all the vocabulary and the grammar that they need (Buckley, 2007).

In addition to that, Buckley (2002) has stated in his research, the faster Down Syndrome children learns vocabulary, the faster they acquire knowledge about the world. Therefore vocabulary development is very important as the number of words that a child knows when he or she enters school at five years will have a very significant influence on progress. Secondly, language supports thinking and reasoning. The human brain has evolved a remarkable ability to learn spoken language with amazing ease and then to use that spoken language for mental activities.

According to Fidler (2005), older individuals with Down Syndrome show relative strengths in non-verbal communications. The expressive language and working memory deficits are more marked than comprehension skills, nonverbal visual problem solving skills, daily living, or social skills, and this continues as they get older (Dykens, Hodapp, Evans, 2006; Chapman,2006).

Down Syndrome children also able to learn mathematics (Brady, Clarke, Gervasoni, 2008; Buckley, Bird, 2001). This can be achieved through visual aids, such as calculating using cards and pictures (Buckley, 2008). This proved that memory training for Down Syndrome children is the key for other learning skills is true.

2.3 Software as a Teaching Tool

Game-based learning is becoming more popular these days. Computer games offered a programmable environment where people can play, experiment, and learn from mistake (Mayer, 2005). This environment allows the children to discover new rules and ideas rather than memorizing the material that others have presented. For example, simulation games offer possibilities to students to interact with the game by exploring and manipulating objects in order to test their hypotheses. Thus, while experiencing the game world, students become active participants in the learning processes by experiencing active learning, learning by experience, and discovery learning, which can be made possible through game-based learning (Killi K, 2005; Mayer, 2005).

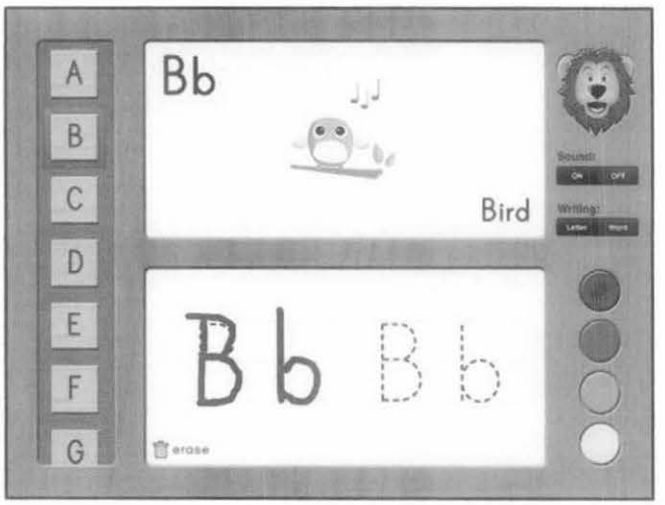

Figure 1: Learning alphabet with computer software

Computer software can be highly motivating, sustain a child's attention, and provide a highly organized environment which improves the learning process of a Down Syndrome children. According to Mayer (2005), one of the highest constraint in all formal learning is the ability to sustain the student's attention until the end of the lesson. This problem can be encountered by having a computer software as a tool.

According to Black and Wood (2003), it is a fact that using computer software to assist in the learning process of Down Syndrome children is said to be effective, as software can be designed specifically with features that suited the learning process of these children.

As Down Syndrome children is easily distracted and difficult to pay attention to one thing at a time, one simple way to sustain the attention of Down Syndrome children is by using colourful animation and songs. According to Black (2010), game software using song and rhyme is very popular with children with Down syndrome and plenty of opportunities for these types of activity are available in Flash and other formats that can be played over the internet or installed on the computer.

The goals of education for Down Syndrome children is similar to normal children, which is to equip these children with the strength and knowledge to live independently in the community (Buckley & Bird, 2000).

CHAPTER 3
METHODOLOGY

3.0 METHODOLOGY

3.1 Data Gathering Methodology

Two major data gathering techniques were used during the analysis phase of the project:

- Interviews

The interview is the primary technique for information gathering during system analysis phase. Types of questions asked during the interviews would be open ended questions. An interview was conducted with the teachers and trainers at Kiwanis Down Syndrome Foundation, Ipoh, Perak. The purpose of the interview is to capture data which cannot be captured through questionnaires. The main purpose of conducting the interview is to learn how the teachings are conducted by trainers and teachers at Down Syndrome centre. An informal interview was also conducted with a teacher of 'kelas pendidikan khas' at SMK Tengku Kudin, Raub, Pahang to ask about the condition of students at the class.

- Questionnaires

Questionnaires are used to gather information from a large scale of respondents. By developing questionnaires, statistical information that cannot be gained from interviews is recorded and analyzed. Sets of

questionnaire had been distributed to two places, which are Kiwanis Down Syndrome Centre and Yayasan Sultan Idris Shah Ipoh.

- Research

Literature review is being done from time to time, in order to obtain information and view from experts around the world.

3.2 System Development Methodology

After analyzing the pros and cons of a few types of development methodology, prototyping methodology is chosen as it suited the software the most. The main reason of using prototyping methodology is because prototype can be delivered although the system is not fully completed. One of the advantage of using prototype is user's opinion and comments can be captured easily after they saw the prototype.

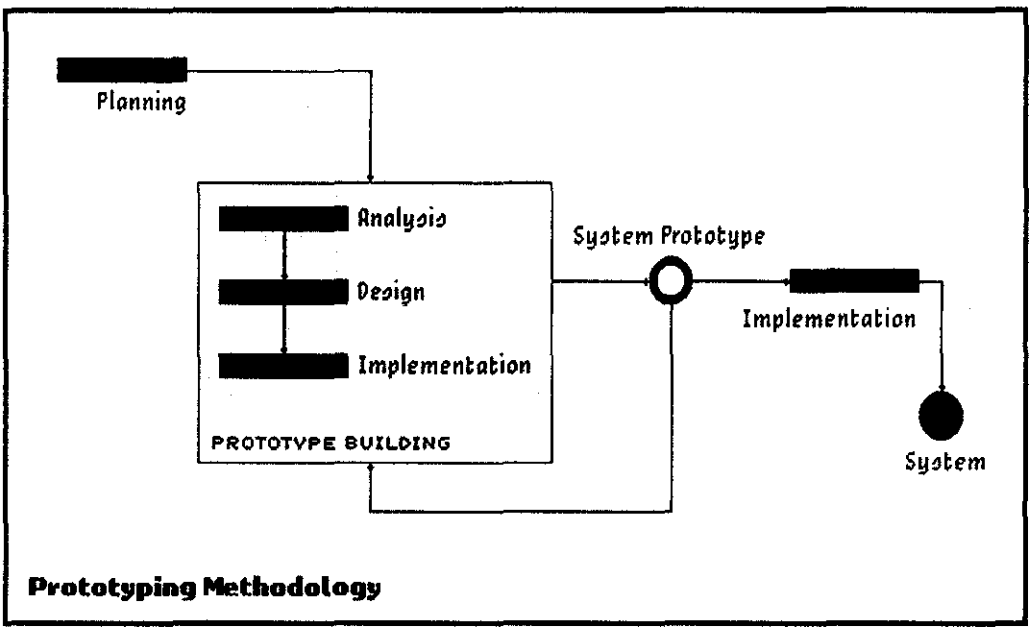

Figure 2: Prototyping Methodology

Up until now, the project is currently in Development Phase. Below are a few descriptions on what have been done and planning of what to be done in the next phase.

- Planning

Planning phase is where the fundamental process of understanding why an information system should be built and determining how the project team will go about building it. Feasibility analysis and scope identification is conducted during this phase.

- Analysis

Analysis phase is when all requirements are gathered. During this phase, interviews being done and surveys were being distributed to gather system requirements.

- Design

The design phase include designing the functions of the software, which include the screen layouts (storyboard), and process flow diagrams.

- Development

During this phase, the animation and game module is developed. Sounds are also incorporated into the software to make it more interesting.

- Implementation

After the system is complete, it will be distributed to Down Syndrome care centers in the form of a CD.

3.3 Tools

3.3.1 Software

- Adobe Flash CS5

Adobe Flash in a platform to develop multimedia application such as animation and interactivity on web pages. Flash contains an object-oriented-language called ActionScript. Adobe Flash CS5 contains inverse kinematics features which enable bone animation.

Figure 3: Adobe Flash CS5 screenshot

- GIMP

A graphic and image editing tools used to design static image. It is similar to Adobe Photoshop in many ways, including the function, and unlike Adobe Photoshop, it is a freeware.

3.3.2 Hardware

- Personal Computer

A main hardware is used in developing the software. Other hardware may include speaker and microphone.

3.4 Gantt Chart

No	Activities	Months									
		Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
1	**Planning**										
	Choose topic										
	Preliminary research on topic										
	Specify scope										
	Feasibility analysis										
2	**Analysis**										
	Requirements gathering										
3	**Design**										
	Design interface										
	Design storyboard										
4	**Development**										
	Animation										
	Coding										
5	**Testing**										
6	**Implementation**										

Figure 4: Project Gantt Chart

CHAPTER 4
RESULTS AND DISCUSSION

4.0 FINDINGS

4.1 Interview

An informal interview had been conducted to gain clear understanding on the learning process and learning method of the Down Syndrome children. The interview session involved Mr Chris, a teacher at Kiwanis Down Syndrome Ipoh Centre. He had been teaching and training Down Syndrome children for seven years, and he specializes in speech therapy.

From the interview, it is understood that most Down Syndrome care centers only focuses on early intervention program. Early intervention program is well known to be effective when conducted to children below 6 years old. However, at the centre, because no specific program to cater for older children, these children will also join the early intervention program.

According to Mr Chris, there is no specific learning method for Down Syndrome children. The only well-known principle to cater for Down Syndrome children is only the early intervention principle. Therapeutic learning, on the other hand, is one type of learning method that can be applied to older Down Syndrome children.

For the learning process, there are two important parts, which are speech therapy and occupational therapy. According to Mr Chris, speech therapy includes spelling, pronunciation, articulation and eye contact. On the other hand, occupational therapy involves teaching the children on how to get dress, grooming and toileting.

As of now, the method of teaching the children is all done manually, which is either using whiteboard, flashcard or CDs. Thus, from the interview, it can be concluded that the need of a computer-aided tool or software to help in teaching these children is very crucial.

Apart from that, a phone interview with Mr Rashid, a teacher at SMK Tengku Kudin was also conducted. He had been a teacher at 'kelas pendidikan khas' for almost 10 years. He explained the condition of his students when they first enter the class. Most of his students aged between 15-20 years old, and they entered the school at such later age because many of them were unable to do daily tasks independently when they were younger. Among the things taught in the class are language skills, such as vocabulary, grammar, and composition of sentences.

4.2 Questionnaire Survey

A survey was also conducted to gain extra information on the current situation at the centre and to obtain inputs and requirements in developing the software. A total of 11 respondents which all of them are teachers and trainers for Down Syndrome children were given a set of questionnaires to get their feedback on the development of Therapeutic Learning Software for Down Syndrome. The questionnaires involve three main sections which are background, current situation and system features.

4.2.1 Survey Results

There are a total of three sections and 17 questions for overall questionnaires. Questions that are being highlighted are believed to be the most crucial and govern the design of the software later on.

Question 4: What is the average age of children at Down Syndrome centre?

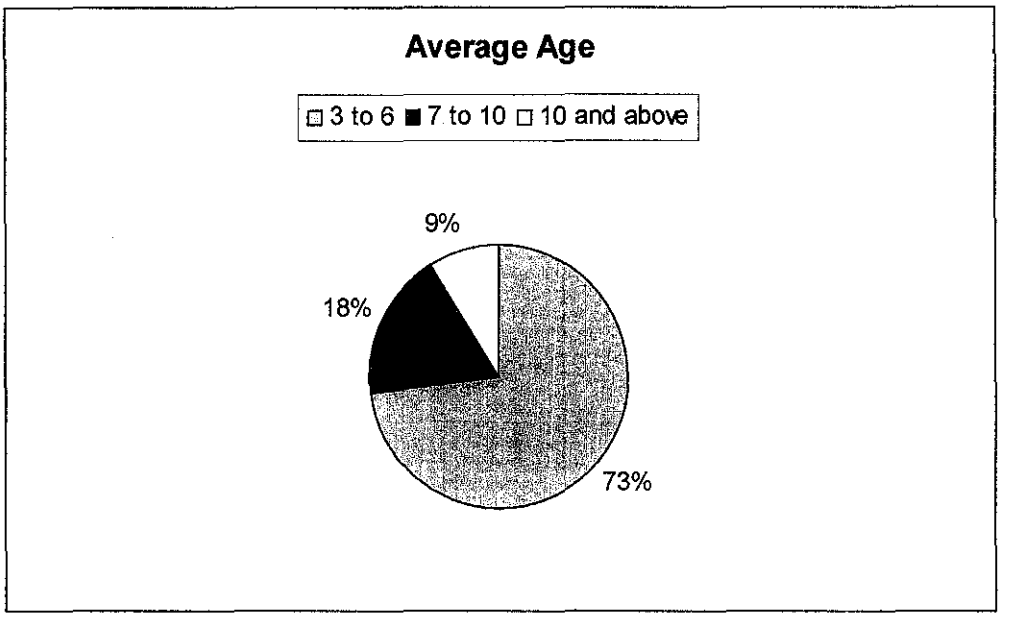

Figure 5: Average age of children at Down Syndrome centre

Result:

The pie chart shows the average age of Down Syndrome children at care centers. The survey shows that 73% of the children are from three to six years old, 18% are from seven to ten years old, and only 9% are ten years and above.

Discussion:

Based on the chart, it shows that most the centers prefer to take children aged six and below, as they do not have specific learning method for older children. This also shows how crucial and critical the center needs to have therapeutic learning being implemented to cater for the needs of older children.

Question 11: In your opinion, can a computer aided tool or software helps in teaching Down Syndrome children?

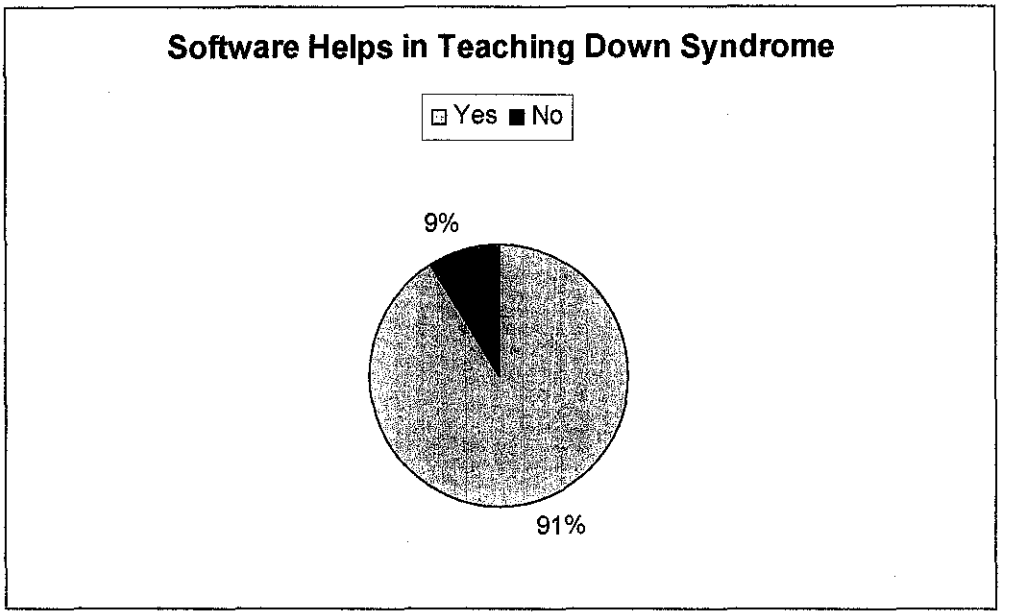

Figure 6: Can software helps in teaching Down Syndrome children

Result:

The pie chart shows whether a computer aided tools or software can help in teaching Down Syndrome children. The result is 91% responded "Yes", which agrees that the use of software can help the children, while only 9% responded "No".

Discussion:

Based on the chart, it shows many trainers and teachers agree to have a software as a tool to help them in teaching the children.

Question 12: If a software is to be developed, what areas of learning or module should the software focuses on?

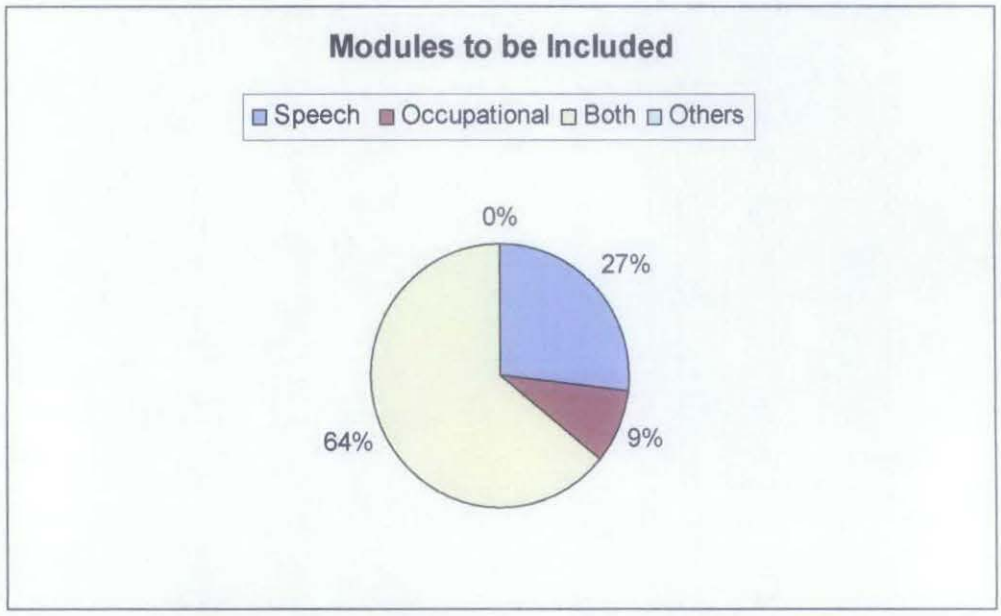

Figure 7: Modules to be included in the system

Result:

The pie chart shows what modules or areas of learning that should be included in the software. 64% says that both speech therapy and occupational therapy should be included in the system, 27% says only speech therapy is important, and only 9% says that occupational therapy is important.

Discussion:

Based on the chart, it shows that both speech therapy and occupational therapy is crucial and important to the children. The children need to be able to communicate correctly and at the same time increase their quality of life by learning basic living skills. However, since speech and articulation been taught extensively during 'early intervention' program,

the software will focus more on occupational therapy and language learning as the extension for the program.

Question 14: What features should be used in speech therapy and language learning?

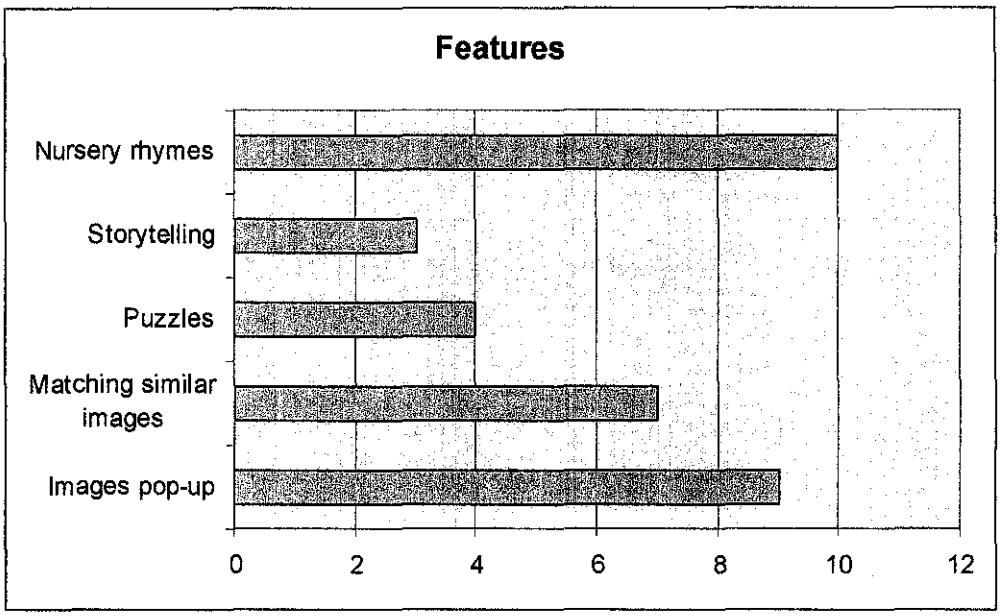

Figure 8: Features for speech therapy and language learning module

Result:

The bar chart shows the features of the software preferred by the trainers and teachers. Most of the respondents agree to have nursery rhymes images pop up and matching similar images in the software.

Discussion:

Based on the chart, it shows that the features preferred by the trainers are the most important features that should be included in the software. It also prove that music, pictures and animation plays an important role in the learning process of the Down Syndrome children.

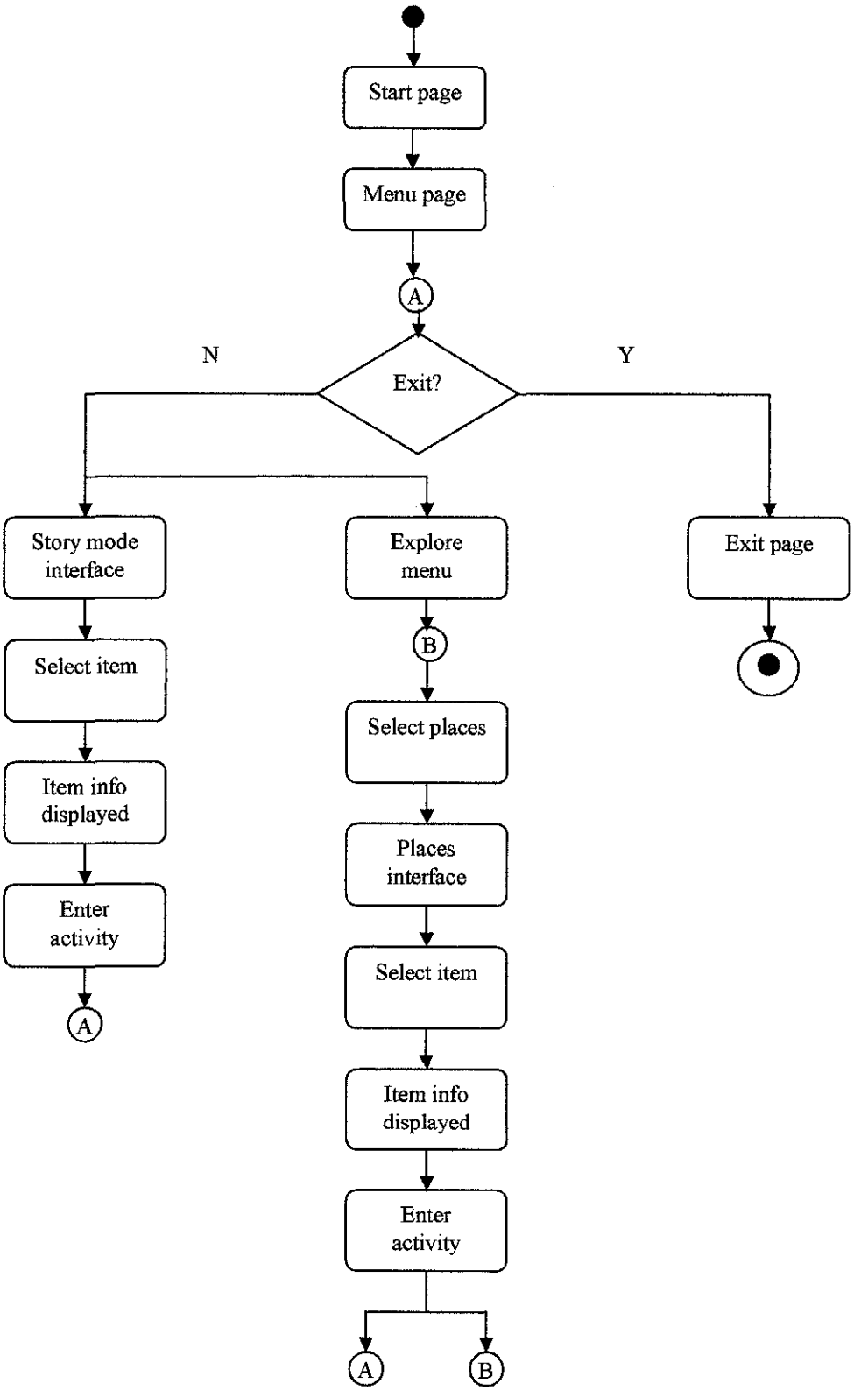

Figure 9: Activity Diagram of the System

4.3.2 Use Case Diagram

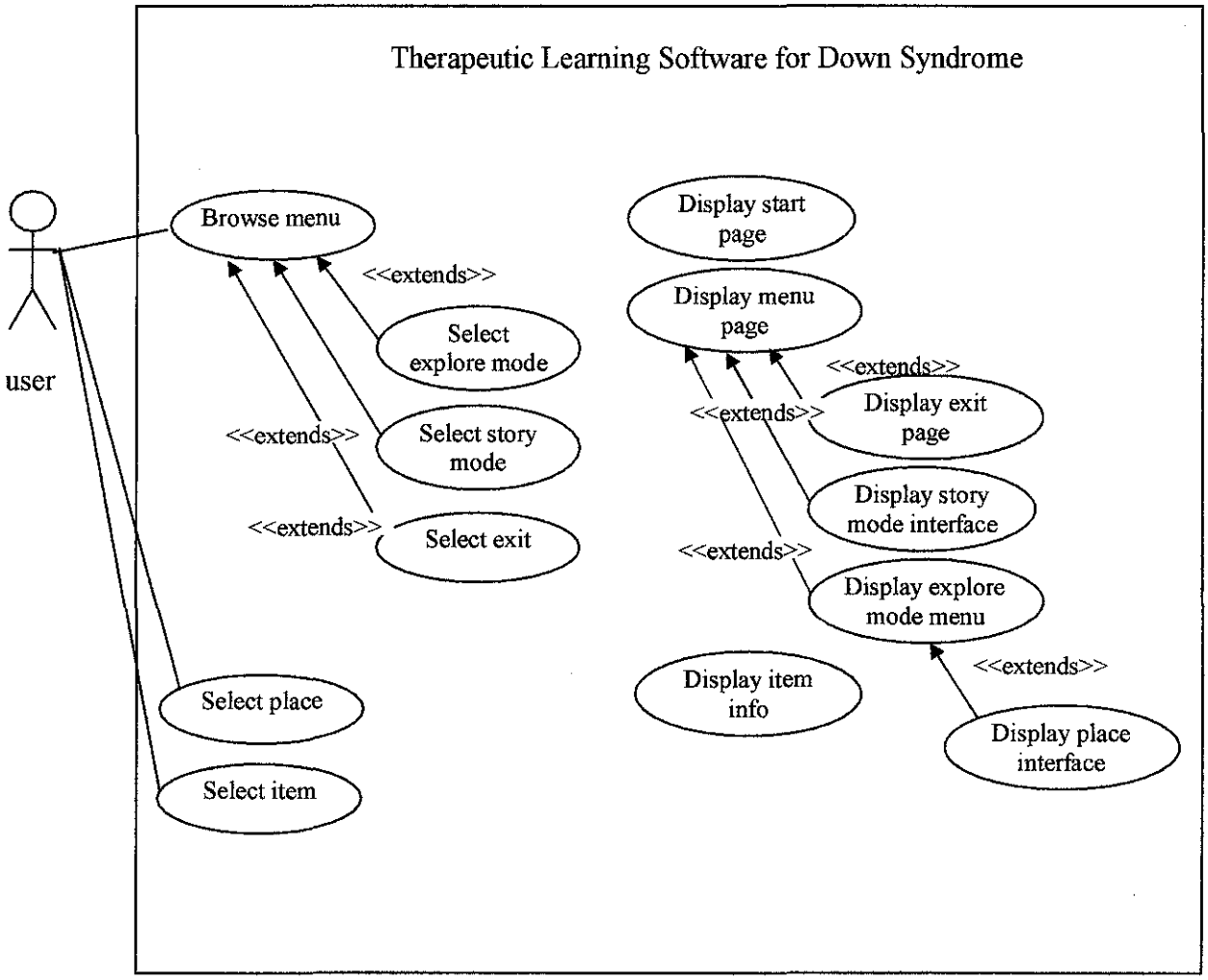

Figure 10: Use Case Diagram of the System

4.3.3 Storyboard

A storyboard is a low fidelity prototype consisting of a series of screen sketches. The purpose of developing storyboard is to illustrate and organize ideas and obtain feedback. A storyboard for the software had been developed and presented during Final Year Project 1 Oral Presentation. Refer attachment for the full storyboard.

4.4 Interfaces

The interface design follows the basic principles of Human Computer Interaction, which are minimizing user effort, consistency, and reduce user's memory load. The interface design is made to suit the requirements for Down Syndrome children. The game is made interactive, an animated character is designed to demonstrate the input by user and instructions will be given for each game. For each activity in the game, an encouragement message is displayed before user starts the activities. This is to give moral support and encourage user try completing the and not quitting in the middle of the activities. Apart from that, every page is accompanied by soothing sounds and cheerful music to retain the attention of the user so that they will not easily distracted or bored.

The game follows a standard storyline of normal everyday life of a children. The on-screen instruction as well as audio instruction will accompany user throughout the entire game.

4.4.1 Start page

The start page is the first page the user will see apart from the splash screen. The page contains colourful graphics and START as well as EXIT button. Both START button and EXIT button will change colour when the user hover cursor above it so that user knows where to click. The page will look like Figure 11(a) before user hover the cursor or mouse, and the changes to Figure 11(b) when user hover the cursor onto a clickable button or image. This feature is adapting the Human Computer Interaction principle, which is reducing user effort and memory load.

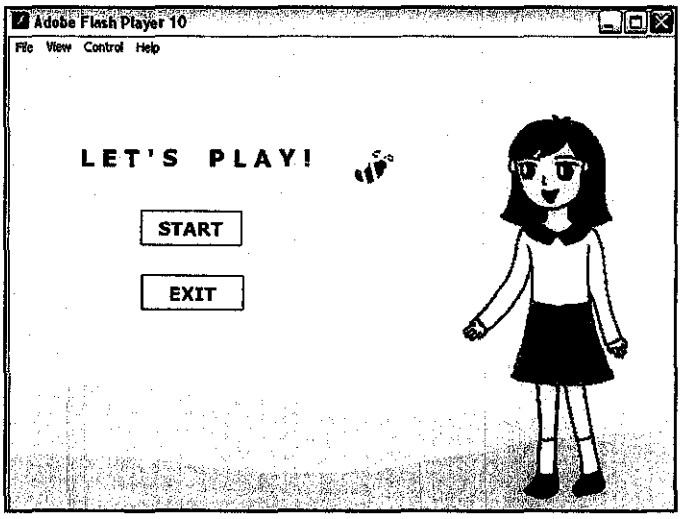

Figure 11 (a): Before hovering cursor

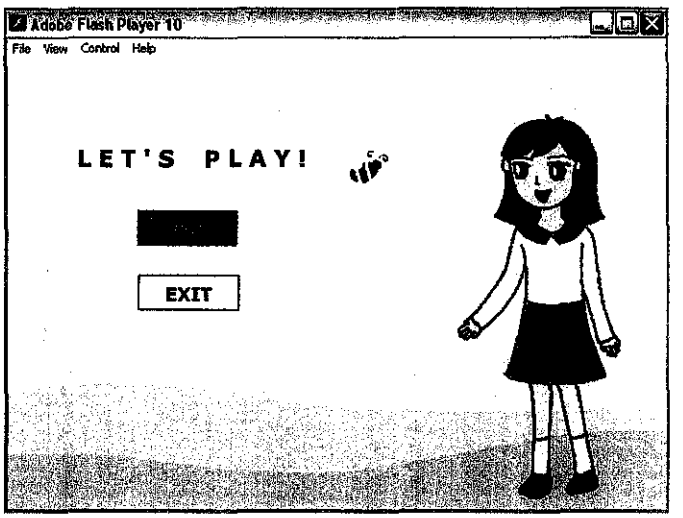

Figure 11 (b): After hovering cursor

4.4.2 Menu page

After user click on the START button, the menu page is loaded, as shown in Figure 12. User then needs to choose between story mode or explore mode. If user choose story mode, the game start where the user will follow the storyline and complete all task and instructions in order to continue the game. This is how the occupational therapy is embedded into the system. User will have to do the task, which comprises of bathing, getting dress, and other basic living skills which are part of the occupational therapy module in the system.

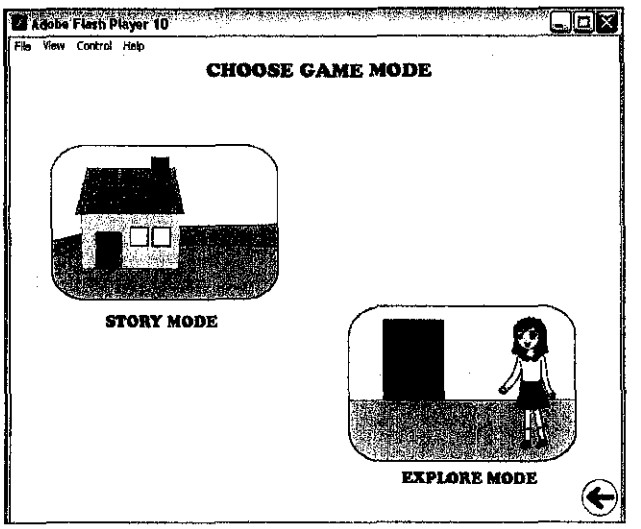

Figure 12: Menu page

4.4.3 Story mode

If user select story mode, the game start where the user will follow the storyline and complete all task and instructions in order to continue the game. This is how the occupational therapy is embedded into the system. User will have to do the task, which comprises of bathing, getting dress, and other basic living skills which are part of the occupational therapy module in the system. For example, the game will start in a bedroom, such as shown in Figure 13, where instructions given are for the user to fold the blanket. User has to complete the task in order to the room. As for following instructions, it is a part of language therapy embedded in the system.

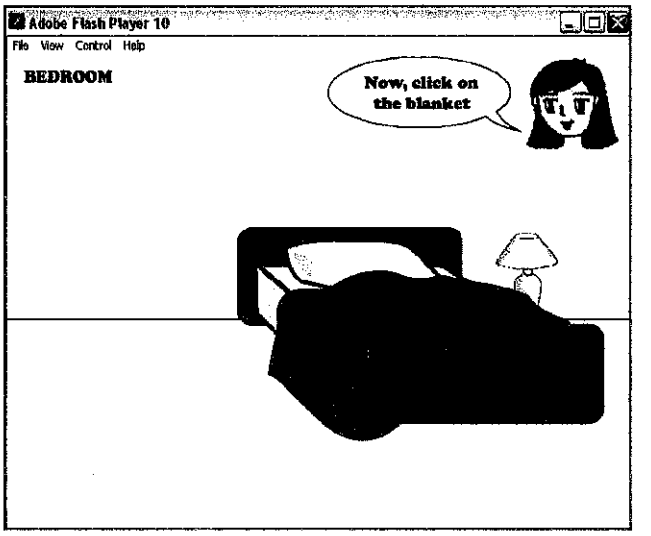

Figure 13: Story mode

4.4.4 Drag and drop game

Apart from that, there are also activities for user to play. For example, a drag and drop game on how to get dress such as shown in Figure 14. User has to drag the clothes and drop them onto the right body parts. For example, a hat must be situated on a head. If user drop it onto the wrong body parts, for example, the hand, the hat will automatically return to its original place.

Figure 14: Drag and drop dress up game

4.4.5 Explore mode

If user selects explore mode, the page such shown in Figure 15 will prompt user to choose the place in the house that the user wish to explore. For example, if user select living room, the game will move to living room interface, such as in Figure 16. User can hover the cursor on the items in the living room to learn new words, or vocabulary. This is also a part of the language therapy in the system.

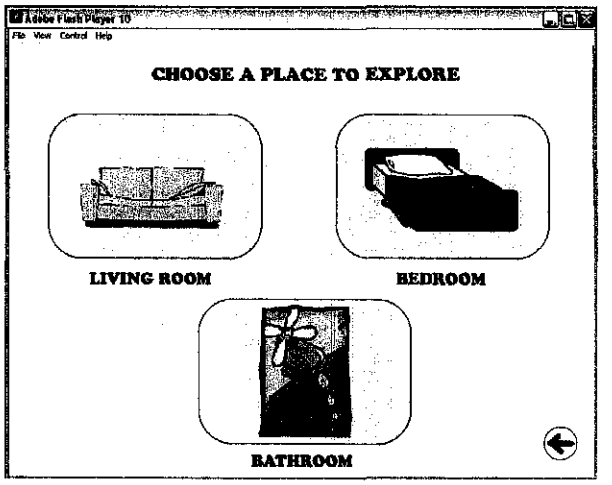

Figure 15: Choose place interface

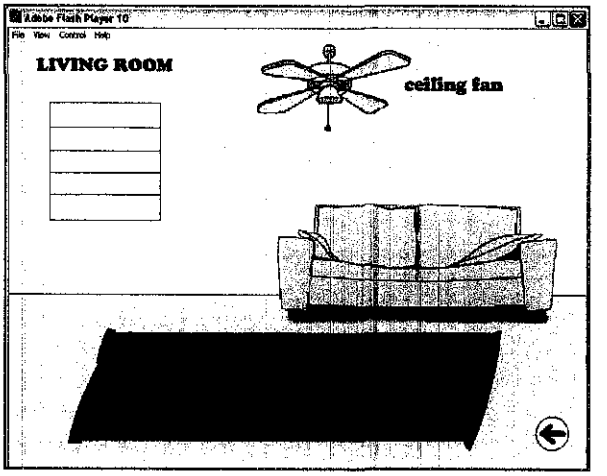

Figure 16: Living room

CHAPTER 5
CONCLUSIONS AND RECOMMENDATIONS

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

'Therapeutic Learning Software' care to address the learning process and the mental development of older children with Down Syndrome, particularly children who have passed the age to enter 'early intervention' program and at the same time will enroll in 'kelas pendidikan khas' at government school later.

The software mainly focuses on occupational therapy and language therapy. Occupational therapy teach the Down Syndrome children on how to do daily task independently through the game storyline which revolves around the activities they may encounter in daily life. Language therapy on the other hand, helps them in terms of enhancing vocabulary and following instructions.

The use of animations and sounds are essential to make learning process more interactive and effective. With the presence of encouragement messages, clapping sounds, rhymes and songs, the therapeutic element in the software is complete.

Upon the completion of this project, it is hoped that the project is able to benefit and inspire people, especially teachers, parents, and Down Syndrome children themselves.

5.2 Recommendations

The system can be further improved in the future by adding extra features to it. One of it is by adding speech therapy module into the system. Speech therapy teaches the Down Syndrome children how to pronounce sounds and words correctly, which involves phonetics and articulation. Having a speech therapy module means having a speech recognition software into the system, which enable the system to be highly interactive. By adding the speech therapy module, almost all elements in the therapeutic learning is complete and the software could cater for a larger age group of Down Syndrome children.

Other than that, the instructions for the game and activities should be made in both written and verbal. This is important as the Down Syndrome children might not be able to read the instructions carefully, or they can have the tendency to forget the instructions given to them earlier. The instructions also should be visible until the game or activities ended so that the user can always glance at the instruction in case they have forgotten.

Apart from that, it is recommended that the character for the game is made for both boy and girl. As of now, the only character for the game is a girl. It is important to design two characters so that user can choose which character, either a boy, or a girl, to represent them in the game and activities.

Another feature that can be added to the software is that to have a module to learn alphabet and numbers. By adding this feature, the software can also cater for younger age group of Down Syndrome children. As mention in earlier chapter of this document, the 'early intervention principle' cater for younger Down Syndrome children, and mainly focus on teaching alphabets and numbers. Thus, if the software also implements this module, the therapeutic element can be used to both younger and older Down Syndrome children.

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Therapeutic Learning Software for Down Syndrome

Survey

Prepared by:

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Information and Communication Technology

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Therapeutic Learning Software for Down Syndrome is to be developed specifically for older Down Syndrome children. The software adopts the concept of therapeutic learning and focuses on two major areas, which are speech therapy and occupational therapy. The objective of this survey is to gather information about the learning method and learning process of Down Syndrome children.

Section A: Trainer's / Teacher's Background

1. Gender

   ☐ Male
   ☐ Female

2. Age:

   ☐ 20-25 years old
   ☐ 26-30 years old
   ☐ 31-35 years old
   ☐ 36-40 years old
   ☐ 40 years and older

3. Experience (in teaching Down Syndrome children):

   ☐ 2 years and below
   ☐ 2 – 5 years
   ☐ 5 – 10 years
   ☐ More than 10 years

Section B: Current Situation at Down Syndrome centers

4. What is the average age of children at Down Syndrome center?

   ☐ 3-6 years old
   ☐ 7-10 years old
   ☐ 10 years and older

5. How does teaching in Down Syndrome center being conducted?

   ☐ Manually
   ☐ Using computer-aided tool/software
   ☐ Others (please specify): .....

6. Teaching in Down Syndrome centers focuses more on?

   ☐ Speech / communication
   ☐ Occupational / living skills
   ☐ Others (please specify): .....

7. Do older Down Syndrome children have more difficulties in learning compared to younger ones?

   ☐ Yes
   ☐ No

8. Have you heard of the early intervention principle?

   ☐ Yes
   ☐ No

9. Does early intervention principle being practiced in most Down Syndrome centers?

   ☐ Yes
   ☐ No

10. Have you heard of the term therapeutic learning?

- [ ] Yes
- [ ] No

11. In your opinion, can a computer aided tools / software helps in teaching Down Syndrome children?

- [ ] Yes
- [ ] No

If the answer for this question is Yes, proceed to Section C.

Section C: System Features

12. If a software is to be developed for older Down Syndrome children, what areas of learning / module should the software focuses on?

- [ ] Speech therapy
- [ ] Occupational therapy
- [ ] Both
- [ ] Others (please specify): .....

13. For speech therapy and language learning, what important element that the software must have?

- [ ] Learning alphabet
- [ ] Learning vocabulary
- [ ] Learning to construct sentence
- [ ] All of the above

14. What method should be used in learning speech and language? Please rate according to preference, from [1] best to [5] poor.

- [ ] Images pop-up (similar to flashcard)
- [ ] Matching similar images / letters / etc
- [ ] Puzzle
- [ ] Storytelling
- [ ] Nursery rhymes

15. For occupational therapy, what areas should the software focuses on?

- [ ] Living skills (eg. How to get dressed etc)
- [ ] Others (please specify): .....

16. In your opinion, does pictures, music and animation helps in improving the learning process of Down Syndrome children?

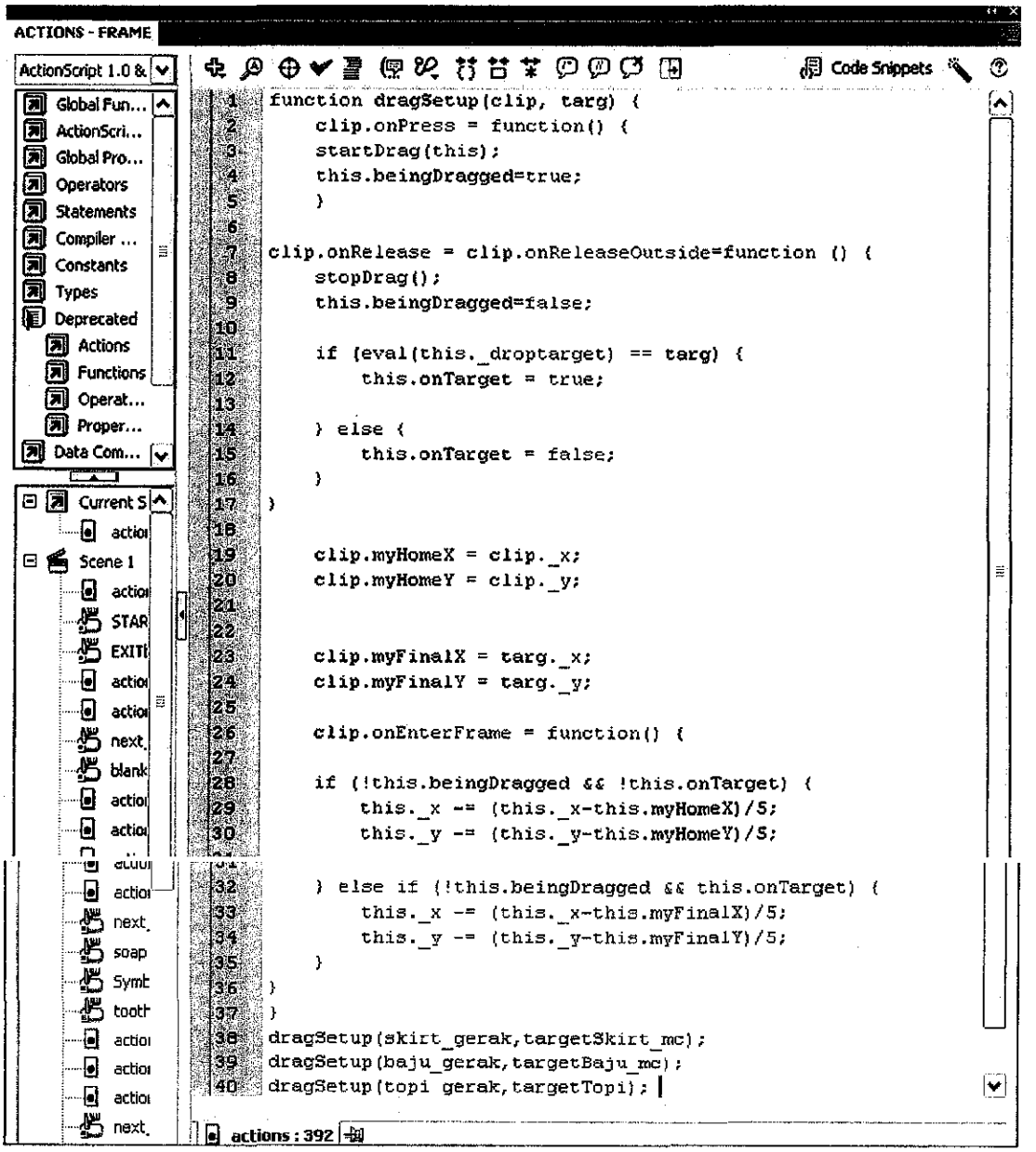
- [ ] Yes
- [ ] No

17. In your opinion, should learning Mathematics be included in the system?

- [ ] Yes
- [ ] No

Thank you so much for your cooperation in completing the survey. ☺

Attachment 2: Code snippet for drag and drop function




```
function dragSetup(clip, targ) {
    clip.onPress = function() {
    startDrag(this);
    this.beingDragged=true;
    }

clip.onRelease = clip.onReleaseOutside=function () {
    stopDrag();
    this.beingDragged=false;

    if (eval(this._droptarget) == targ) {
        this.onTarget = true;

    } else {
        this.onTarget = false;
    }
}

    clip.myHomeX = clip._x;
    clip.myHomeY = clip._y;


    clip.myFinalX = targ._x;
    clip.myFinalY = targ._y;

    clip.onEnterFrame = function() {

    if (!this.beingDragged && !this.onTarget) {
        this._x -= (this._x-this.myHomeX)/5;
        this._y -= (this._y-this.myHomeY)/5;

    } else if (!this.beingDragged && this.onTarget) {
        this._x -= (this._x-this.myFinalX)/5;
        this._y -= (this._y-this.myFinalY)/5;
    }
}
}
dragSetup(skirt_gerak,targetSkirt_mc);
dragSetup(baju_gerak,targetBaju_mc);
dragSetup(topi_gerak,targetTopi);
```

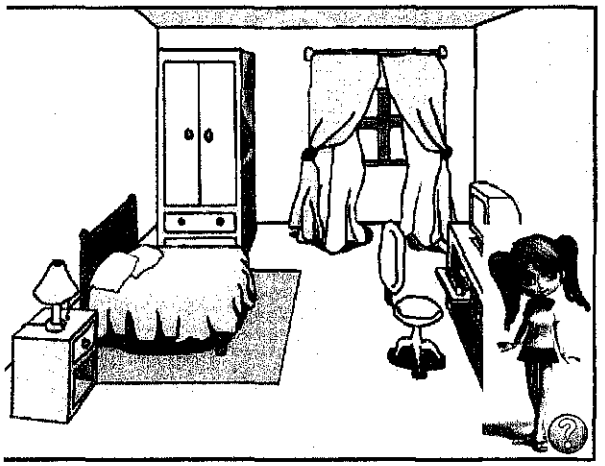
PLAY!

<picture>

Story Mode

<picture>

Explore Mode



Let's get dress!

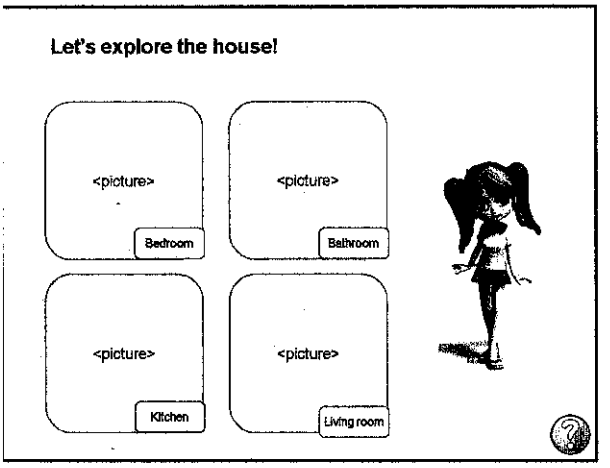
Click on the attire to get dress.

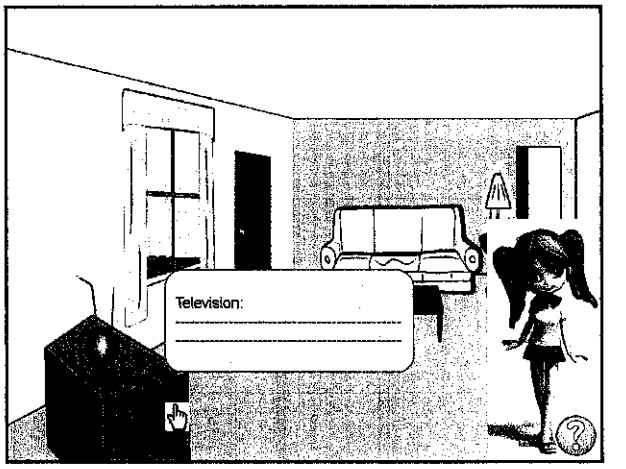
Menu

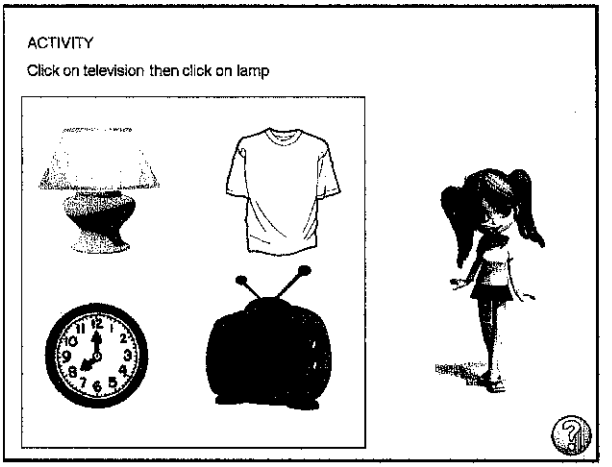
You are all dressed up!

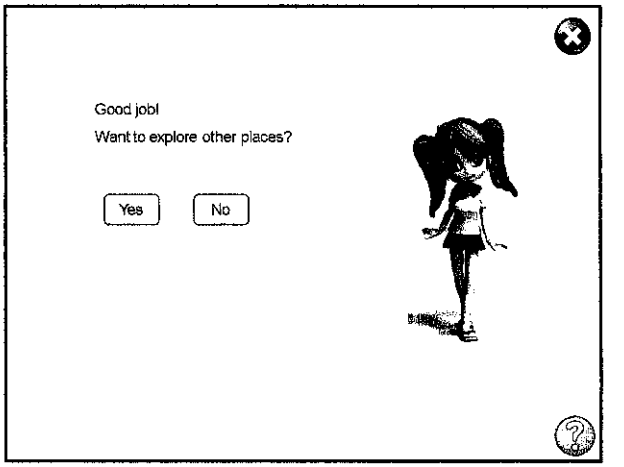
Now let us explore the house.

Let's explore!


Let's explore the house!
<picture>
Bedroom
<picture>
Bathroom
<picture>
Kitchen
<picture>
Living room


Television:


ACTIVITY
Click on television then click on lamp


Good job!
Want to explore other places?
Yes
No