Intelligent Tutoring System: Teaching Children to Write Alphabets

by

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Dissertation submitted in partial fulfillment of

the requirements for the

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CERTIFICATION OF APPROVAL

Intelligent Tutoring System: Teaching Children to Write Alphabets

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A project dissertation submitted to the
Information System Programme
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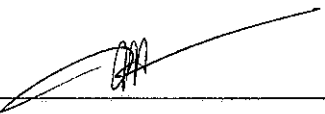BACHELOR OF TECHNOLOGY (Hons)
(BUSINESS INFORMATION SYSTEM)

Approved by,

_____

(En. Jale Bin Ahmad)

UNIVERSITI TEKNOLOGI PETRONAS
TRONOH, PERAK
JULY 2007

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 of persons.

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(MARDIANA MOHD BUSRO)

ABSTRACT

Teaching a children to write alphabets can be a hassle for parents and teachers especially at the kindergarten because of some factors such as time management, large class etc. The traditional way by using the alphabets book are proven to be effective but how to expose the early age children about computer as a first thing to learn? The paper begins with background discussion on problem statement of the project; scope of the study will be focusing on alphabets drawing and programming with Artificial Intelligence (AI). Following that, further explanation on the research project including features of product to be developed, tools required is being presented. For this project, there would be two main activities to take place in shape of research and prototyping for final product for this project. The questionnaire and observation studies are obtained in order to get the full ideas of the proposed system. Details on project works can be found in methodology section of this report. This report is wrapped up with a literature review to present the idea of the importance of AI in Intelligent Tutoring System (ITS).

ACKNOWLEDGEMENTS

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ABBREVIATIONS

AI

Artificial Intelligence

GUI

Graphic User Interface

HCI

Human Computer Interaction

ITS

Intelligent Tutoring System

UI

User Interface

VB.NET

Visual Basic.NET

VB Scripts

Visual Basic Scripts

CHAPTER 1

INTRODUCTION

1.1 Background of Study

One of the first steps in becoming a successful reader is to learn to recognize the letters of the alphabet. Recognition of the letters of the alphabet and knowing the sounds they make is one of the key predictors of reading success. The alphabet is an invented system of symbols. Alone, each letter of the alphabet has limited value, but combinations of letters create words, the essence of written communication. In order to read an alphabetic language like English, children must learn the alphabetic principle—that letter symbols represent sounds. This knowledge is a critical precursor to reading words, since words are merely a combination of the letters that can be used to represent a word's specific combination of sounds. Attaching sounds to these letters and learning to write them paves the way to successful reading and writing.

The objective of the study is to develop an intelligent tutoring system (ITS) for early age children to teach them to write alphabets and experience the self learning. The idea is to develop an application or software that can teach children age 3 to 8 how to write alphabet and guide them along the learning process. The application has a design platform so that the children can use the mouse to write the alphabet. The intelligent tutor will guide the children on how to start drawing the alphabet by using voice command.

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1.2. Problem Statement

1.2.1. Problem Identification

Learning to write numbers and letters are important tasks for children. It should be exciting and enjoyable activity through which children can experience success. In the kindergarten for an example, they are taught to write alphabets and reads ABC, but because of the large size of the class and only one teacher handling many kids during the learning times, they cannot give a full concentration on the learning process. Sometimes teaching children to write and read can be a problem for parents at home, they do not have much time to guide them and correct errors. Reading is also important. It will be exciting and rewarding for children to read from their own handwriting after they have completed their lessons.
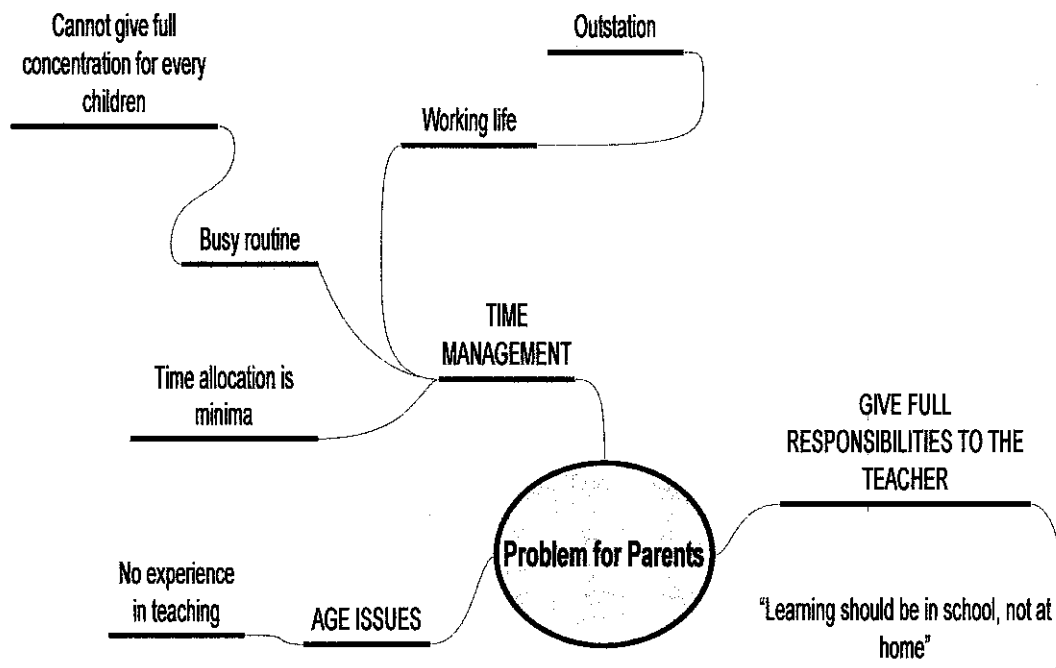
Figure 1-1: Problem Identification from Parents perspectives

Basically, on the internet there are many practice sheet template for teachers and parents to print and give for the children to try, but still it is not a best practical way for self learning as they still need some guidance by the elders to start writing the letters. If there is a software that can help the parents and learning centre like kindergarten to guide and teach them how to write alphabets and read along with them, the problem can be solved.

1.2.2. Significant of the Project

The Intelligent Tutoring System for teaching children in writing alphabet is a way to overcome this problem. The project development is intended to guide the early age children on how to write alphabet letters. The tutoring system will uses friendly GUI interface for the learning process with pattern recognition and neural networks to calculate the drawn image and compare it with the accurate template stored in the database. Some AI elements are implemented through voice command on the design area to guide the student for the next step and correcting errors.

The final product of this project will be able to assist children in indirect manner to organizing their time effectively in self learning. Besides that, the project will also work as an interactive practice in increasing the excitement of self learning. For education sector (basically, kindergarten) and parents will find this product as a useful tools of quick learning.

1.3. Objectives and Scopes of Study

1.3.1 Objectives

The objectives of this study are as follows:

- Teaching children how to write alphabets
- To research on an early age children (3 – 8 years old) behavior during self learning process on writing alphabets
- To develop a system that can teach children to write alphabets

1.3.2. Scopes of Study

To serve the objective, a questionnaire has been done for parents and teachers as a case study. The final product (prototype) development will include the intelligent tutoring system with required functionality.

- To guide the user in writing alphabet 'A',
- Detecting the user's drawing,
- Correcting errors according to user's drawing.

CHAPTER 2

LITERATURE REVIEW AND THEORY

2. OVERVIEW

A literature review is an account of what has been published on a topic by accredited scholars and researchers. These resources used to emphasize on the project topics and give a presentation on themes or identify trends, including relevant theory. To convey more understanding, this literature review will include important elements of the project; the definition of intelligent tutoring system, the intelligent tutoring system model, and the drawing techniques which include the coordinates system, handwriting algorithm and the use of Microsoft Agent in this study.

2.1. What is Intelligent Tutoring System?

An intelligent tutoring system is defined as any system which is capable of emulating an instructor's behavior in all aspects relating to supporting students as they acquire knowledge (C. Koutsojannis, J. Prentzas, I. Hatzilygeroudis). The teacher is not present and it is the system itself which guides the student as they learn different concepts.

One of the objectives of intelligent tutoring systems is to adapt hypermedia courses to each individual user by means of:
- Control of the learning level,
- Control of course navigation,
- Adaptation to available information, adaptation of the expert methodology, explanation of errors, answers to the student's questions, advice, etc.

In other words, the intelligent tutoring system is a model which enables a student to be evaluated and taught a subject and also for the education to be adapted to the student's performance.

For this project, some simulations and appropriate GUI can attract students mostly children to sit down and learn.

> "Many traditional instructional methods present learners with facts and concepts followed by test questions. These methods are effective in exposing people to large amounts of information and testing their recall. However, they often instill "inert knowledge" that learners can recall but may not apply correctly when needed. By contrast, ITS systems use simulations and other highly interactive learning environments that require people to apply their knowledge and skills. These active, situated learning environments help them retain and apply knowledge and skills more effectively in operational settings."
>
> (James Ong and Sowmya Ramachandran, 2003)

From the phrases above, it is best for the ITS systems to have simulations and GUI tools to create interactive learning environments for the children to apply the knowledge and their skills in writing the alphabet letters. The traditional instructional methods (in the kindergarten class) which is using the dot-to-dot book, follow teacher's handwriting on the blackboard then listen and speak the alphabet alone is not enough to apply the knowledge that they have learned. Thus, the ITS system for teaching children to write alphabet can create interactive learning environments for them to sit down and learn and apply the knowledge that they have learned.

In order to provide hints, guidance, and instructional feedback to learners (children), ITS systems typically rely on three types of knowledge, organized into separate software modules:

According to James Ong and Sowmya Ramachandran (2003)

- The "expert model" represents subject matter expertise and provides the ITS with knowledge of what it's teaching.

- The "student model" represents the student's knowledge, skills, and other attributes that affect how the student should be taught. This model lets the ITS know who it's teaching.

- The "instructor model" enables the ITS to know how to teach, by encoding instructional strategies used by the tutoring system.

Based on the argument, the project uses the three models plus with the GUI interface and Domain model. Simply put, the expert model will know who he is teaching, the student model will represent the student which is 3 or 8 years old, the tutor model will instruct the student based on the student model, the domain model which is the system itself that will give the knowledge for the tutor model how to teach the student. Finally the GUI interface will be the platform for the student to draw the alphabet and for the tutor model to teach the student. Further explanation about the project architecture using these models will be on the Chapter 5: Results and Discussion section.

2.2. Drawing Technique

The ITS system use coordinates system and direction method for the drawing technique of the alphabet. The system has the drawing canvas which the user can draw the alphabet by using the mouse.

2.2.1. Understanding Windows Coordinate Systems

The system uses the basic Windows coordinates systems in the .NET framework. The default coordinate system in Windows has the origin (0, 0) in the upper-left corner of the drawing surface. The x-axis extends to the right, while the y-axis extends downward. The pixel is the unit of measurement in the default coordinate system. For instance, a line can be defined by joining the pixels between a start and an end coordinate. (Lars Powers and Mike Snell, 2002)

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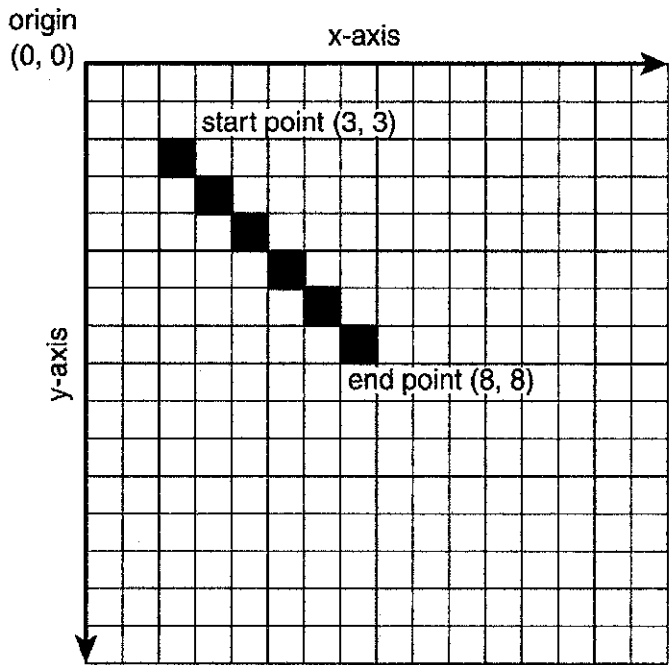
Figure 2-1: Windows Coordinates System

2.2.1.1. Pens

Graphics class and Pen class in .NET framework is used to make a drawing. The Pen class is used to define how the outlines of shapes are rendered to the surface. Similar to a real pen, the Pen class defines a width color that will be used to do the drawing. Lars Powers and Mike Snell demonstrate the various constructors that are available when creating new Pen instances (Table 2-1).

Constructor	Description
New Pen(Color, Single)	Creates a Pen object based on a color (Color structure) and a width (Single) in pixels.
New Pen(Color)	Creates a Pen object based on a color defined by the Color structure. Sets the pen's width to the default of 1 pixel.
New Pen(Brush,	Creates a Pen object using a valid class derived from the Brush

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Constructor	Description
Single)	base class. The pen's width (Single) is defined in pixels.
New Pen(Brush)	Creates a Pen object based on a valid Brush object. Sets the pen's width to the default of 1.0 pixel.

Table 2-1: Pen Constructors

2.2.1.2. Lines

Pen object is used to draw a line onto a drawing canvas. A line is a set of pixels linked by a start and end point. Line attributes are defined by the Pen object with which they are drawn. To draw a line, DrawLine method of the Graphics class is used. A Point structure stores the x and y coordinates of a point on a 2D plane.

The following code uses the DrawLine method and a Pen instance to draw a blue line onto a form. (Lars Powers and Mike Snell, 2002)

```
'draw the line on the form using the pen object
myGraphics.DrawLine(pen:=myPen, x1:=1, y1:=1, x2:=25, y2:=50)
```

The DrawLine method of the Graphics object is called to render the line onto the drawing canvas. The version of the DrawLine method used requires a Pen instance and a set of start and end coordinates. These coordinates are simply passed in order as two points defined as (x1, y1) and (x2, y2). The method connects the two coordinate points with the line's color based on the Pen object.

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2.2.1.3. Dashes and Caps

Table 2-2 shows the collections of line caps and arrow properties in the .NET framework that can be add at the end of the line. (Lars Powers and Mike Snell, 2002)

Property	Description
CustomStartCap	The CustomStartCap property is used to set or get a custom-defined line cap. The CustomStartCap property defines the cap at a line's start. The property is of type CustomLineCap.
CustomEndCap	The CustomEndCap property is used to set or get a custom-defined line cap. The CustomEndCap property defines the cap at a line's end. The property is of type CustomLineCap.
DashCap	The DashCap property is used to set or get the style used for the start or end caps of dashed lines.
DashOffset	The DashOffset property is used to set or get the distance between the start of a line and the start of the dash pattern.
DashPattern	The DashPattern property sets or gets an array of integers that indicates the distances between dashes in dash-patterned lines.
DashStyle	The DashStyle property sets or gets the style used for dashing a line. The property is of the type DashStyle enumeration. DashStyle enumeration members include the following: Dash, DashDot, DashDotDot, Dot, Solid.
EndCap	The EndCap property sets or gets the LineCap object used to define the end of the line. EndCap is of the type LineCap. The LineCap enumeration includes the following members: AnchorMask, ArrowAnchor, Custom, DiamondAnchor, Flat, NoAnchor, Round, RoundAnchor, Square, SquareAnchor, and Triangle.

Property	Description
StartCap	The StartCap property sets or gets the LineCap object used to define the start of the line. StartCap is of the type LineCap. The LineCap enumeration includes the following members: AnchorMask, ArrowAnchor, Custom, DiamondAnchor, Flat, NoAnchor, Round, RoundAnchor, Square, SquareAnchor, and Triangle.

Table 2-2: Pen Class Dash and Cap Properties

2.2.2. Handwriting Algorithm

According to Levent Yildiz, user draws lines in different directions while he's writing. First we have to note this direction and give them a value. For example, the letter "I"'s direction signature will be only 2. The user will draw a line to the south direction. We can achieve the direction signature by storing the X and Y information when the user moves the mouse on the drawing canvas while pressing the left mouse button.
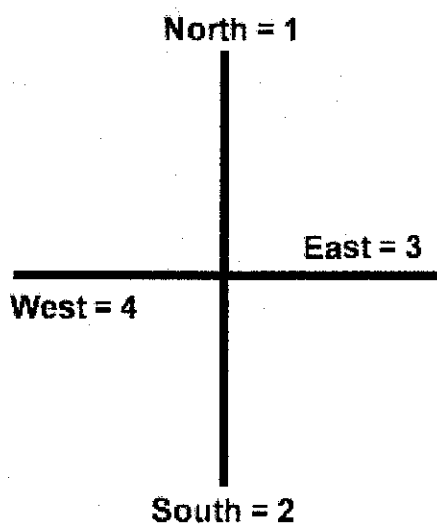
Figure 2-2: Direction Chart
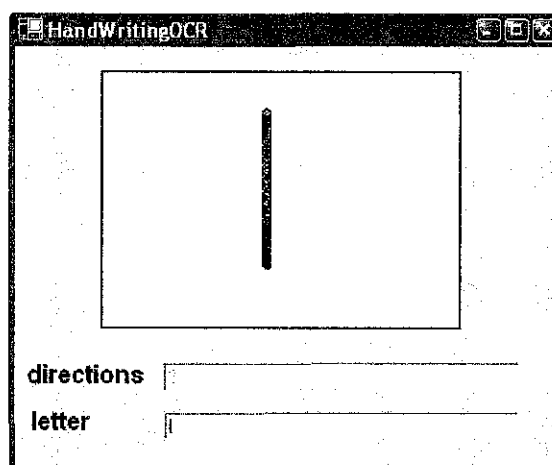
Figure 2-3: Letter "I" Example

To find out the direction changes, we have X and Y coordinates. So the direction changes will occur either on X and Y coordinates. If X direction has a value of 3 the direction will be east, 4 will be west. If Y direction has a value of 1 the direction will be north, 2 will be south. If both this coordinates has a value of 0 then we'll understand that the user did not draw anything.

Figure 2-4: Draw a letter "A"

In Figure 2-5 above, by referring to the direction chart in Figure 2-2;

Go to direction 4 for X and 2 for Y to draw line 1,

Go to direction 3 for X and 2 for Y to draw line 2,

Go to direction 3 for X and 0 for Y to draw line 3.

Thus, to describe the drawing as letter "A", the value used is 42323.

2.2.3. Microsoft Agent

The representation of animation character that used in the system that acts as the tutor. This application will guide the user using voice command.

> "Microsoft Agent is a software technology that enables an enriched form of user interaction that can make using and learning to use a computer, easier and more natural. With the Microsoft Agent set of software services, developers can easily enhance the user interface of their applications and Web pages with interactive personalities in the form of animated characters. These characters can move freely within the computer display, speak aloud (and by displaying text onscreen), and even listen for spoken voice commands."
>
> (Microsoft, 2003)

Peedy the Parrot   Merlin the Magician   Robby the Robot

Figure 2-5: Among the Animation Characters from Microsoft Agent

The software is easy to use, and it is available at no cost from Microsoft. Agent technology uses synthesized voices and a text-to-speech engine for translating speech into the spoken voice. That is, the system is created by writing a script, including directions for voice inflections and volume, and the text-to-speech engine then reads the script and directs the character to speak the words. The character's lips, by the way, are synchronized to move similarly to natural lip movements so that the character truly appears to be speaking. The script also provides directions as to where the character appears on the screen, and the gestures it makes. An Agent character can move around the screen, point to, and interact with the background materials on the screen. (Microsoft, 2003)

Another important advantage of Agent technology is that the text of a script is transcribed both as voice and as a written script inside a cartoon bubble. This is especially important if the student viewer is a non-native speaker or if he or she has a hearing impediment. Thus, the reason to choose Microsoft Agent as the voice and animation character companion is better than using the recorded human voice. The character has the functions to talk to the audience with animated move to make the system more attractable.

CHAPTER 3

METHODOLOGY/PROJECT WORK

3.1. PROCEDURE IDENTIFICATION

3.1.1. Research Methodology

A questionnaire for parents has been done through online and paper based. Age of parents, age of the children and some other question has been asked for further observation. The questionnaire results will be in Results and Discussion chapter. Most important research in this study is about the behavior of the children and their interaction with computer technology and tools on the application of the system. This is done by interviewing informally with one family to observe their children with computer technology and tools on the application system, and in what age did their children learn to write. The following is the formal interviews conducted at this stage:

a) Observation and interview in children

      1. Encik Kamaruzzaman Mohd Busro

         Working Parents

      2. Mohd Haziq Kamaruzzaman

         Kindergarten student, age 6

The information gathered was mainly to analyze how the children react with computer technology and tools on the application system. For the research methodology, the project is intended to increase student's learning time according to their age. For example, children at age 6 should have more learning time and more exercises than children at age 4.

Figure 3-1 shows an example on step by step process of writing/drawing alphabets. Take uppercase H for an example.
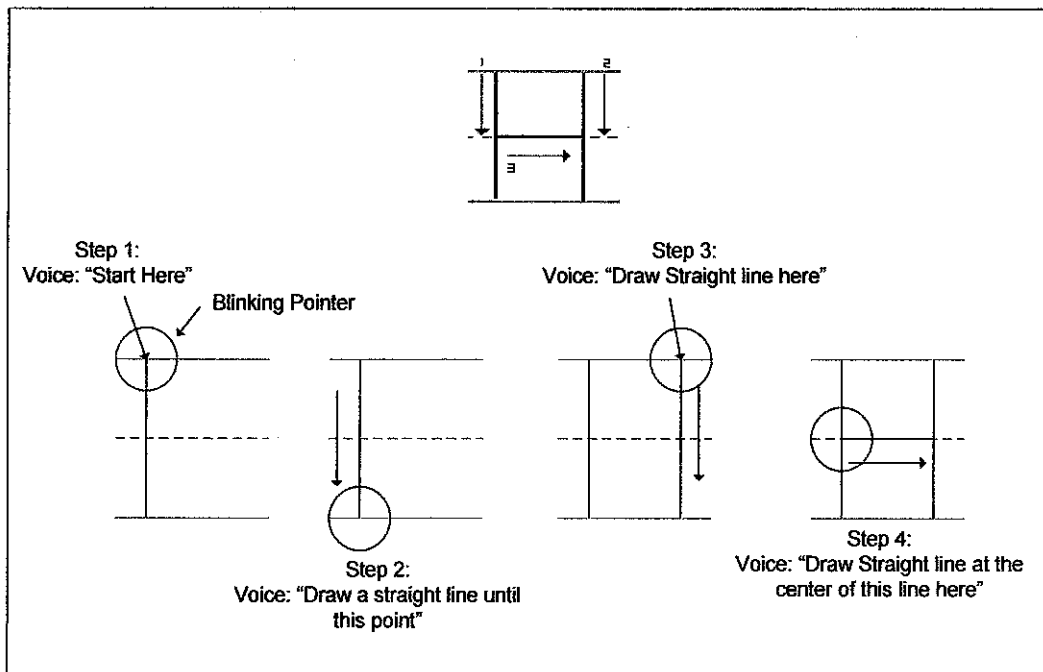
Figure 3-1: Step by step process drawing uppercase letter H

The steps above are extracts from the Handwriting Algorithm discussed earlier in Chapter 2: Literature review and theory. The steps above will show the basic guidelines on how the system teach the student step by step to write uppercase letter H using numbering, voices, and blinking pointer.

3.1.2. Design Methodology

For the methodology of the ITS, the system followed the James Ong and Sowmya Ramachandran ITS models method. The project has the expert model, student model, tutor model and the GUI interface in order to create interactive environment for children to use the system.

For the ITS models; student model, expert model, instructor model and GUI (tutoring system UI and simulation) are used. Further explanation about the ITS architecture on Chapter 5: Result and discussion.

- The **expert model**, the system will use and follow the templates of the alphabets in the database to be match the drawn image on the design platform. Thus the pattern recognition and calculation will involve.

- The **student model** evaluates each learner's performance to determine his or her knowledge, perceptual abilities, and reasoning skills.
- Then, for the **instructor model**, voice command and simulation such as blinking pointer on the correct point will appear to guide the learners according to the student model. Every model will interact with each other on the **tutoring system UI and simulation**.

Use Case Diagram in Figure 3-2 will help in clarifying the steps in the whole system process. The actor which is student will enter the system using their name and they can start drawing the selected alphabet letter in the system menu. They have the options to continue with the previous progress or start with a new alphabet letter.

The Tutor System Model which will described in the architecture of the system in Chapter 5: Result and discussion will evaluate student's drawing and give the grading predictions based on the progress of the student. During the learning process, the tutor model will guide the student in direct manner using the GUI tools mentioned before such as voice command.
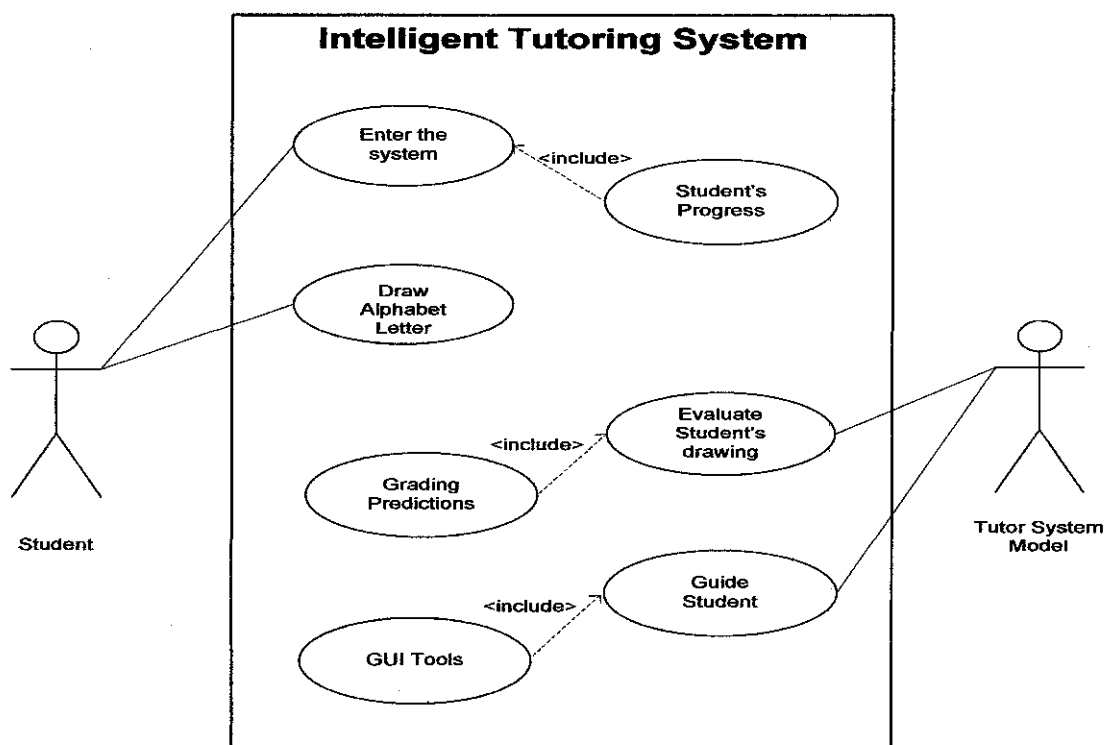
Figure 3-2: Use Case Diagram

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After drawing a certain unit (alphabet letters), the intelligent tutor differentiates the drawn image (pattern recognition involved).

- If the student passes (with accurate calculation) on the first draft, they go on to the next phase; otherwise, they are provided with a remedial phase by repeating the same letter until it match/closely match with the template image in the database.

- If the student fails, the process continues until all the remedial units have been failed, at which point the student will repeat the process from the initial remedial phase.

- If the student passes the remedial phase, they will return to the lesson where they committed the original error to repeat the drawing they failed. At the end of the lesson, the students are examined on all the learning units so that they can be graded by the system.

Figure 3-3 shows how to teach a children how to write by using the ITS system.

Consider children at age 4 in writing alphabet letter, the system will try to detect the handwriting of the children without knowing that the user is at age 4 or not. But the system is 'train' to recognize the drawing based on the prediction from the calculation being made from the system with the template drawing in the database. This is where the pattern recognition takes place. The input is the student's drawing and the system calculates the drawn image from the template in the database with the user's input. The processing output would be the voice command and the blinking pointer.
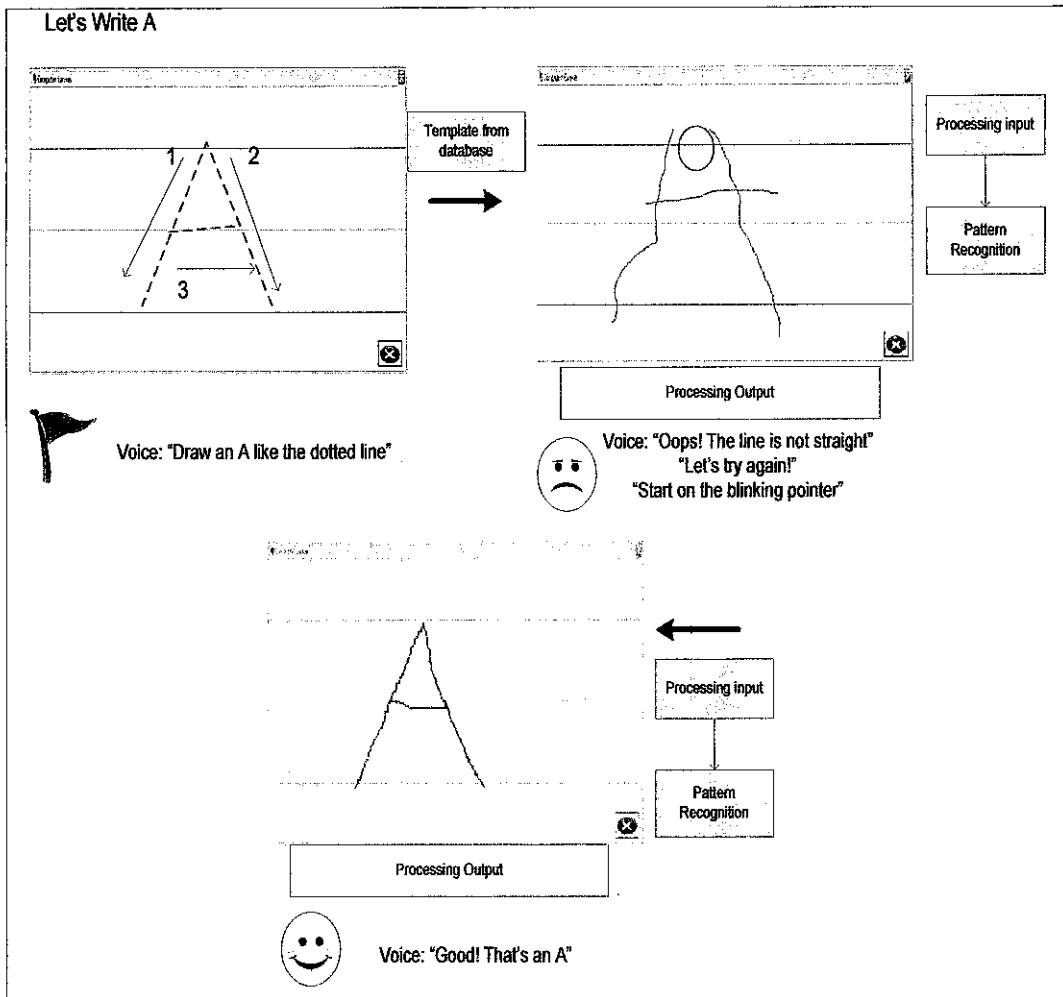
Figure 3-3: Example of children at age 4 writing letter 'A'

3.2. Tools and Equipments

In order to accomplish the project, the tools used for the development are divided into three categories such as followings:

a)   Project Management

1. Microsoft Word

    - This software is mainly used for report writing purposes.

2. Microsoft Visio

    - This software is used to design the Data Flow Diagram (DFD) and figures.

3. Microsoft Power Point

    - This software is used to prepare slides presentation.

4. Microsoft Excel

    - This software is used for scheduling purposes and data information gathering for the questionnaires.

b)   Development Tools

1. Microsoft Visual Basic.NET
2. Microsoft Access
3. Microsoft Agent version 2.0

c)   Additional Hardware

1. Speaker

CHAPTER 4

RESULTS AND DISCUSSION

As stated earlier in this report, the objective of this project is to develop an intelligent tutoring system for early age children to teach them to write alphabets and experience the self learning. Details on the application system are as follow.

4.1. System Overview and Architecture

This section will describe the educational behavior of the intelligent tutoring system, its architecture, its resolution with intelligent agent systems (AI), its implementation, and other of its functions. The application system for this project would be the development of AI system and implement it on the Drawing canvas (drawing platform for kids to draw) of the intelligent tutoring system.

The developed intelligent tutoring system comprises the following modules (see Figure 4-1):
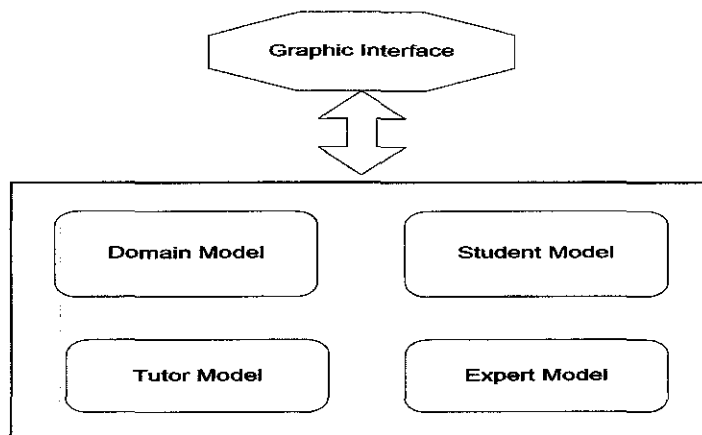
Figure 4-1: Architecture of the intelligent tutoring system

The architecture of the system is described in details in Table 4-1 below.

Model	Description
Domain Model	• Provides the knowledge that the student will be taught, and consists of declarative knowledge (lessons, repeat task, grading etc.)
Student Model	• Records the information about the student (name, learning progress)
Tutor Model	• This tutor model will guide the student according to the student learning process parameter. • During the learning process, voice command will be the companion and the 'teacher' to guide the student for the next step and correcting errors.
Expert Model	• Defines the students' learning cycle. • For this, it adjusts the presentation of the material to each student's knowledge according to the information contained in the student model. • The expert model comprises seven modules: evaluation model, problem generation model, problem solving model, model for analyzing students' answers, model for generating plan of revision phase, model for predicting students' grades, and the syllabus generation model (see Figure 4-2). • Voice companion is under the direction of these seven modules. This is where the Agent technology takes place.
Graphic Interface (GUI)	• This is responsible for user interaction with the intelligent tutoring system.

Table 4-1: Description for Intelligent Tutoring System Architecture
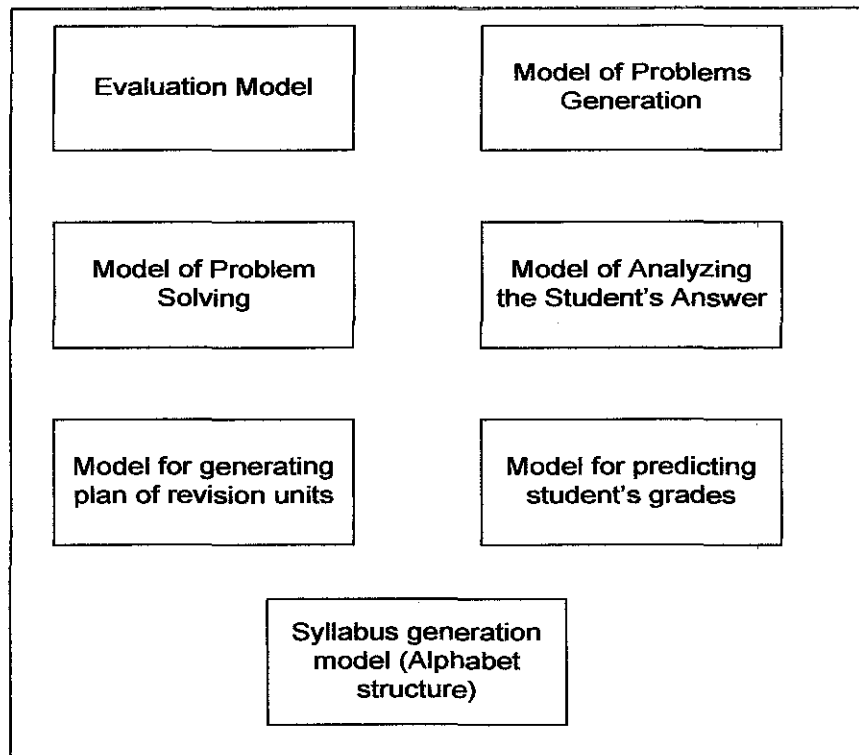
Figure 4-2: Expert Model Structure

4.2. System Development

4.2.1 Intelligent Agents

The intelligent tutoring system has been resolved by means of multi-agent systems (AI) between the student model and expert model. The functionality of these agents is to emulate the behavior of an instructor based in particular on the expert model which includes: evaluating the student's behavior while drawing the alphabet letters such as the times it took to finish it and the accuracy between the drawn image with the match pattern in the database, drawing up a plan of units to revise, predicting the student's grade, and designing the syllabus according to the evaluation obtained by the students.

In this study, Microsoft Agent software technology has been used as the tutor model. The text of scripts is transcribed both as voice and as a written script inside a cartoon bubble. "Peedy the Parrot" is used as the selected animation character. The reasons

behind this selection of character are because of its "friendly" animated actions and the voice of Peedy, make the kids attract to this character.
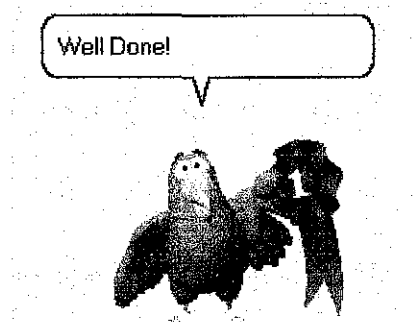
Figure 4-3: Attractive animation shown by Peedy

4.2.2 Functionality of the ITS

The intelligent tutoring system has the following additional functions. This functions will be based on the AI and interaction with the ITS Architecture Model. Table 4-2 shows the description of the additional functions of the intelligent tutoring system.

Functionality of ITS	Descriptions
Grade Prediction	• It can predict the grade (pass or fail) that a student registered on a course will receive so that teachers can assess how well students are coping with their courses.
Revision Plan	• It can design a revision lesson plan for the students based on the alphabet lessons which have been studied. • This include the revision if the student fail or did not get a good grade on the previous drawing.

Table 4-2: Functionality of the ITS

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4.3. System Design

4.3.1. Interface Design

For this section, the system design or graphic interface of the ITS system would be explain in the Table 4-3 below.

Graphic Tools	Descriptions
Drawing Canvas (drawing platform)	• The main platform for drawing image (alphabet)
Voice Command (Microsoft Agent – Peedy)	• Voice companion/sound makes to instruct the student to draw the image. • Eg. "Draw a straight line here", "This is not correct, try again"

Table 4-3: Graphic Tools

The system is developed using stand-alone program Visual Basic.NET for the main part of the system. The rationale behind the selection of a stand-alone approach is because the system will be more useful if it is develop as software so that users (teacher and parents) can have the experience of self learning of their children on their own desktop computer without any distraction. For database of the system, Microsoft Access is used. The reason behind selection of MS Access database is that it is easy to be integrating with VB scripts; the main programming language for this project.

Figure 4-4 and Figure 4-5 is the prototype of the GUI interface using VB script. On this draft, it contains the Alphabet Options, Toolbox for drawing and the Drawing canvas/platform for student to draw the alphabet letter.
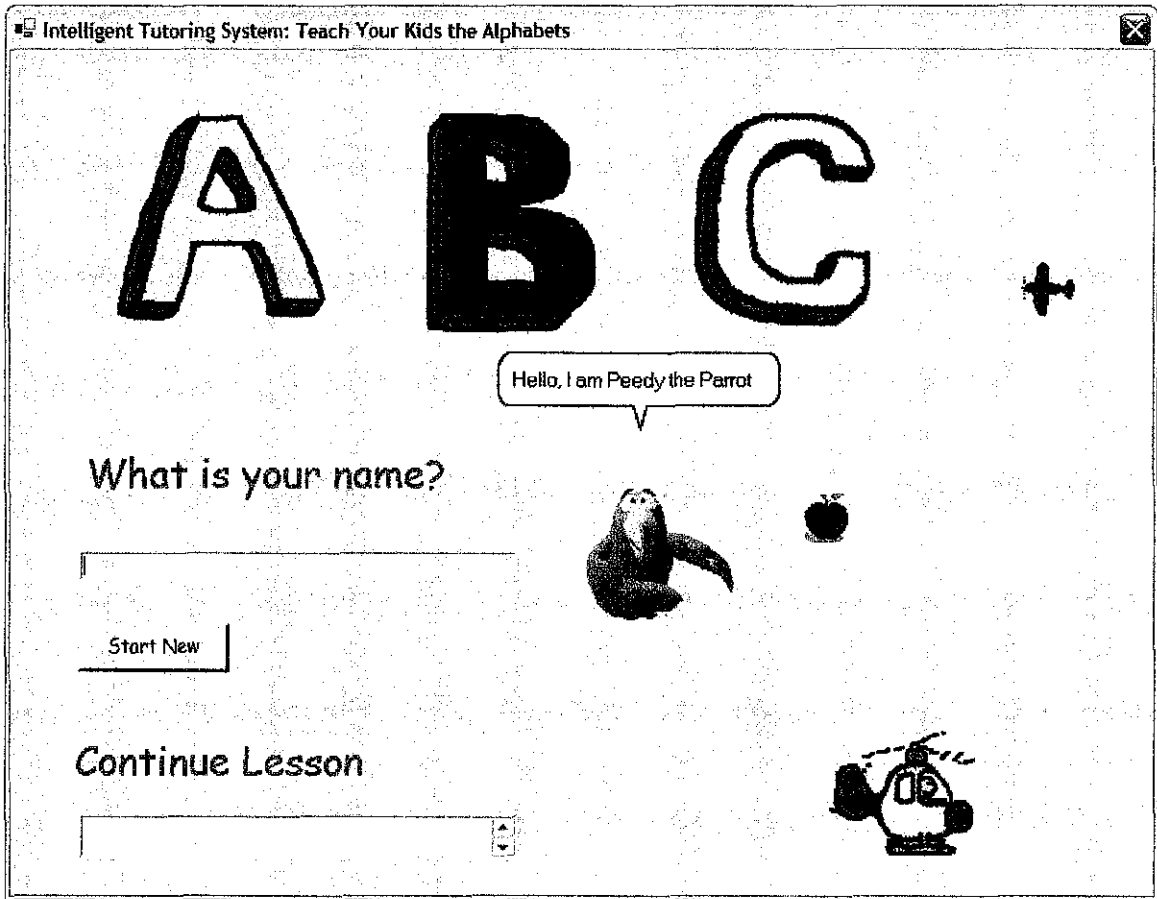
Figure 4-4: Intelligent Tutoring System GUI Interface
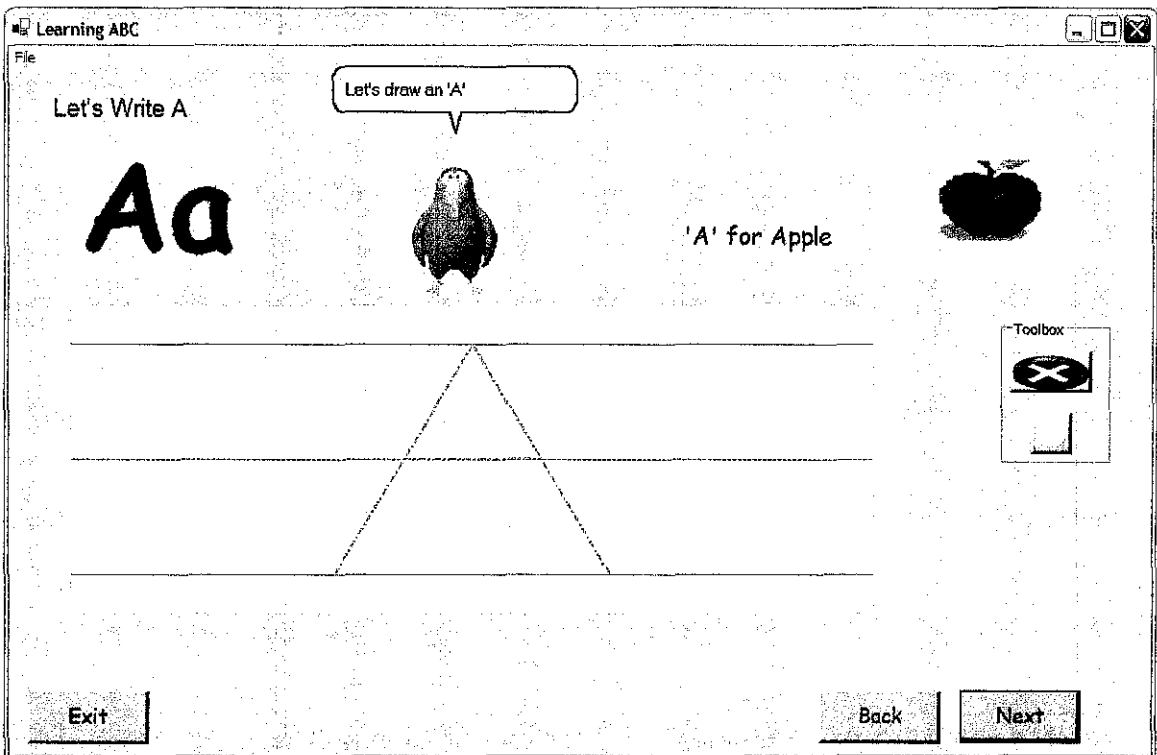
Figure 4-5: Intelligent Tutoring System GUI Interface: Drawing Canvas

4.3.2. Drawing Technique

Graphics, Pen and Line class are used to do the drawing. Drawing canvas made up of PictureBox tool with a specified pixels size of 640 widths and 240 heights (640 x 240). The coordinate's location is specified to (x=50, y=180). The system has specified the specific length and range from the drawing canvas to limit the drawing region to draw the alphabet 'A'. To draw the 'A' alphabet, the region limit is 320x240 pixels in the drawing canvas.

DrawLine method of Graphics object is called to render the line onto the PictureBox. The version of the DrawLine method used requires a Pen instance and a set of start and end coordinates. These coordinates are simply passed in order as two points defined as (x1, y1) and (x2, y2). In addition to defining color and width, the Pen class is used to create dashed lines and to attach start and end line caps.

The following code demonstrates setting the styles and cap properties of a Pen object. The code first creates a Pen object of the color blue or red. It then sets the EndCap property to an arrow using the LineCap enumeration. Last, it indicates the line's DashStyle to be a dash followed by a dot (DashDot).

```
Line1.StartCap = Drawing.Drawing2D.LineCap.NoAnchor


Line1.DashStyle = Drawing.Drawing2D.DashStyle.DashDot
myGraphics.DrawLine(Line1, 320, 30, 210, 210)
Line2.DashStyle = Drawing.Drawing2D.DashStyle.DashDot
myGraphics.DrawLine(Line2, 320, 30, 430, 210)
Line3.DashStyle = Drawing.Drawing2D.DashStyle.DashDot
myGraphics.DrawLine(Line3, 265, 120, 375, 120)
```

MouseMove and MouseDown events in .NET framework are used to detect the moving and drawing made by the user. When the user press the left mouse button the MouseDown event will trace the (x1, y1) and (x2, y2) coordinates of the drawn lines. Figure 4-6 shows the example of a drawing with the MouseMove and MouseDown being traced.
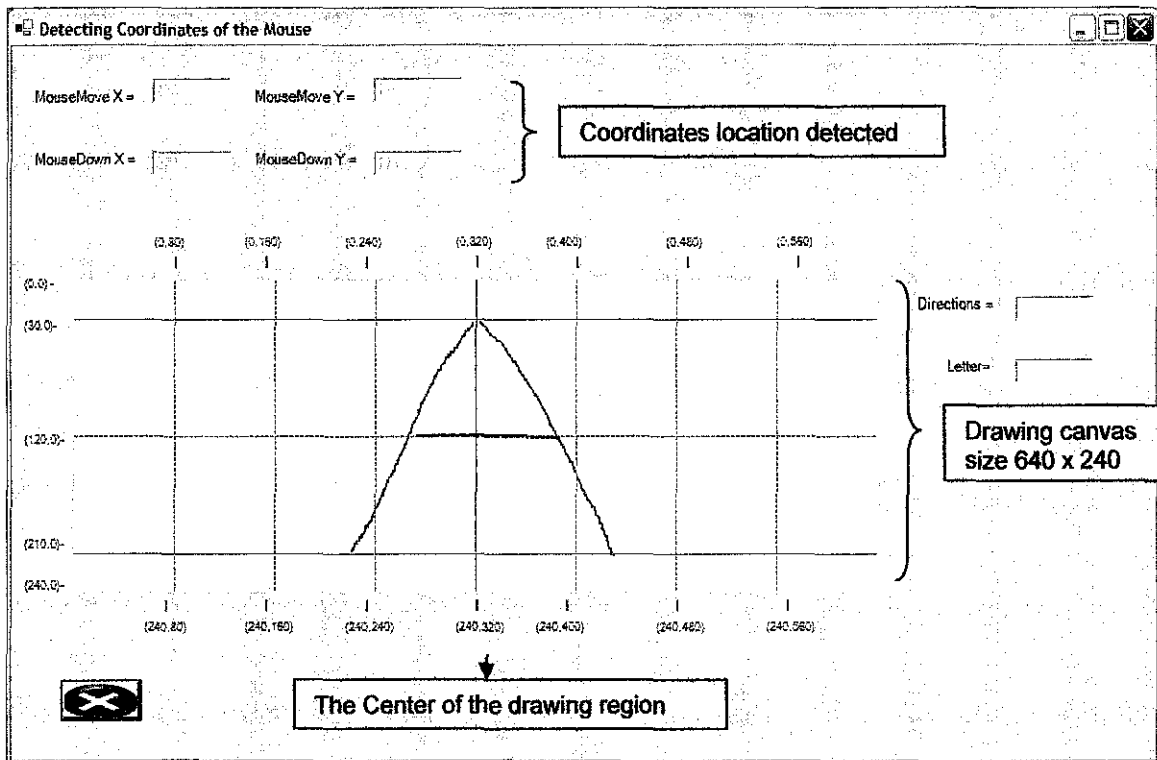
Figure 4-6: Detecting Coordinates of the Mouse

The following codes demonstrate the MouseDown event to draw a line when the user clicks the left button of the mouse.

```
If e.Button = MouseButtons.Left Then
          g.DrawLine(p, XPrev, YPrev, e.X, e.Y)
          g.DrawEllipse(p, e.X - CInt(0.5 * PenWidth), e.Y -
CInt(0.5 * PenWidth), PenWidth, PenWidth)
          XPrev = e.X
          YPrev = e.Y
      End If
```

From the codes {g.DrawLine(p, XPrev, YPrev, e.X, e.Y} ;

XPrev and YPrev is the first coordinates of (x1, y1) while the e.X and e.Y is the second coordinates of (x2, y2). The system will trace the drawing according to the coordinates of the MouseDown events with the region of letter 'A' which is 320x240 pixels. If the user draws the line outside the region, the tutor model which is Peedy will show the error message in the bubble balloon.

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4.4. Research on Problem Identification

4.4.1. Initial Research

28 parents from various backgrounds have been selected to fill in the questionnaire through online and paper based. This group of people has been selected as sample for the project. The selection of people has been done randomly and not being bias. Therefore, it can be assumed that this sample can represent parents and their children in overall view. The questionnaires have been divided into 4 sections. This is the initial finding and the objective or scope of this finding is to determine whether the parents really have the problem identified and to determine the behavior of their children about computer technology and educational software.

The sections are:

- Section 1: Respondents information
- Section 2: Problem Identification
- Section 3: Children behavior
- Section 4: Respondent Opinion

Section 1: Respondent Information

With total respondents of 28 from working parents, 92.9% has children age 3 to 8. Parents with age 30 to 35 are the highest respondents with 42.8% to 50%. Second highest is parents with age range 26 to 30 with 35.7% to 42.8%. All the respondents own a computer at home.

Section 2: Problem Identification

Working parents with children age 3 to 8, 71.4% does not have enough time to teach and guide their children writing alphabets. 50% of them said they had minimum time allocation to teach their children in writing, 28.6% of them said they don't have time because of the working life, sometimes they has to go outstation, and 21.4% of them said they had a busy routine, and cannot give full concentration for every children. Age issues also lead to the problem in teaching children, 21.4% of them said they had an age issues because of no experience in teaching.

Section 3: Children behavior

All of the respondents possessed a computer at home and 78.6% of their children know what a computer is and how to use it. But 78.6% of their children also need help or guidance when using the computer alone. 40.1% of the children do not know how to use any application (Windows) or software, 25.9% of them find difficulties to use the mouse and 18.8% of them find difficulties on how to use a keyboard. But only 15.2% of the children find difficulties on how to switch on the computer. For this level of acceptance and difficulties of the children on handling a computer, the data show that most of the children knows what a computer but still need help and guidance from their parents to teach them how to use it.

Section 4: Respondent Opinion

42.8% of respondents agree that computer can replace the use of book as a teaching method for early age children to write alphabets. While, 28.6% both agree that book is better than computer and some of them said it is not necessary at all to use computer as a teaching method. Most of the parents agree that with the help of intelligent tutor can reduces some of their problem about time management and age issues of working parents. 29% of the respondents strongly agree of the proposed system, 14% of them have a doubt about the proposed system and 7% of them disagree. From all the data collected, most of the working parents agree with the proposed system but most of their children still had some difficulties of how to use the computer.

4.4.1.1. Finding

Section 1: Respondent Information
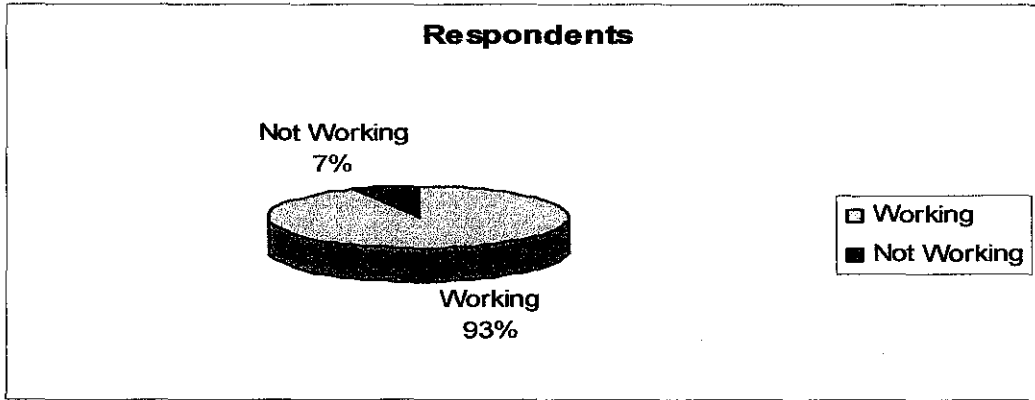
Figure 4-7: Chart of working parents
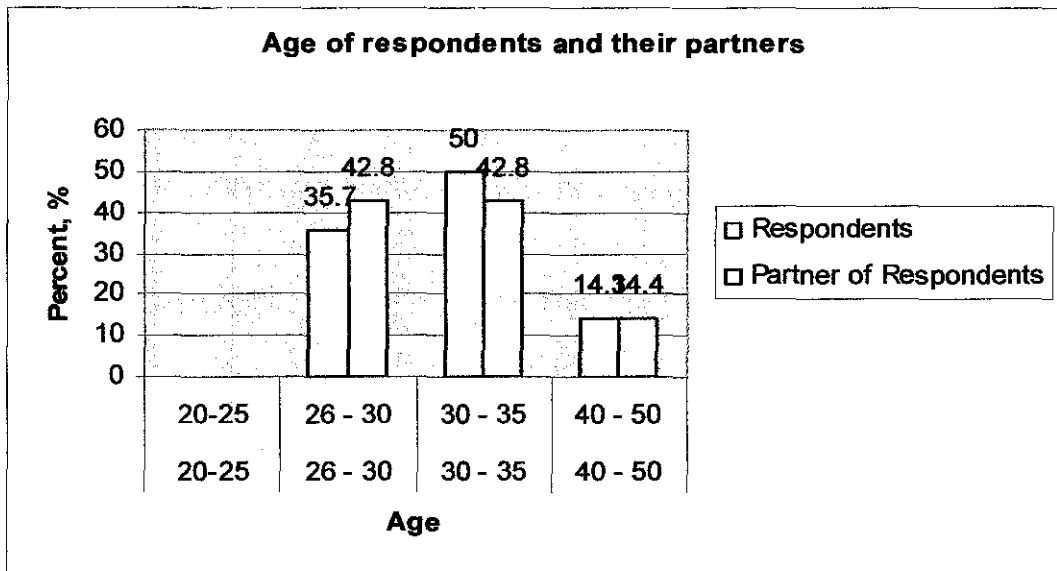
Figure 4-8: Age of respondents and their partners
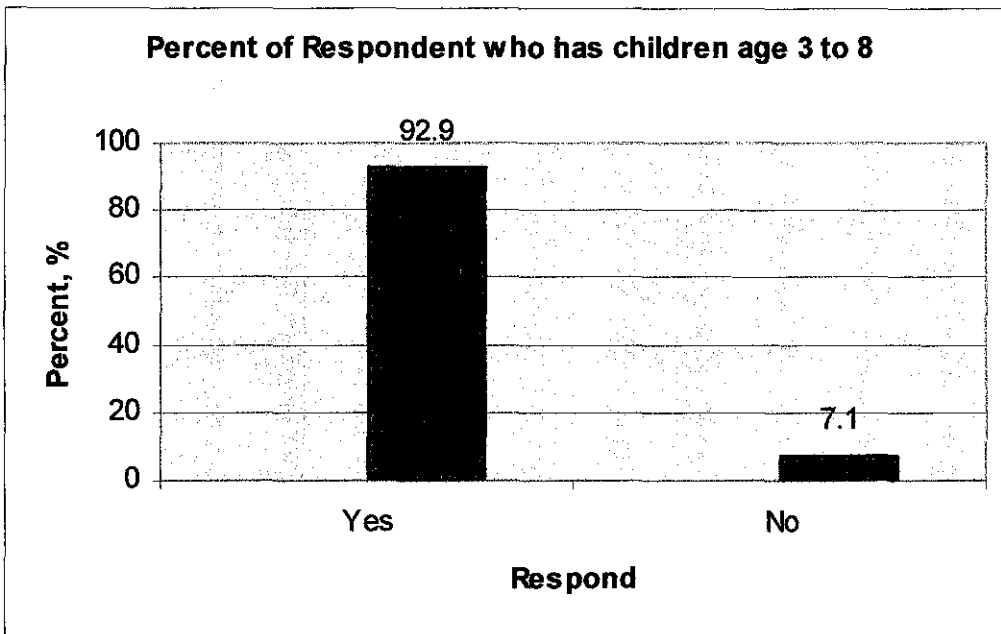
Figure 4-9: Respondents who has children age 3 to 8
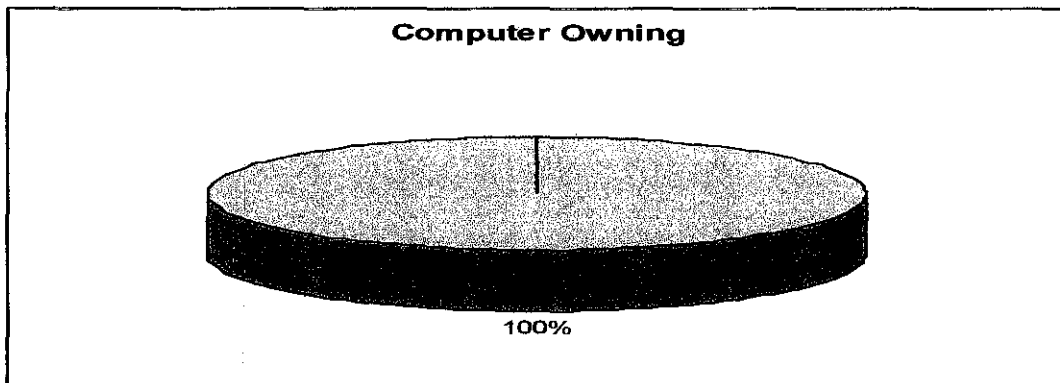
Figure 4-10: Chart of computer owning among respondents

Section 2: Problem Identification

Do you have enough time to teach and guide your children writing alphabets?

Percentage

80	
70	71.4
60	
50	
40	
30	28.6
20	
10	
0	

Yes   No

Responds
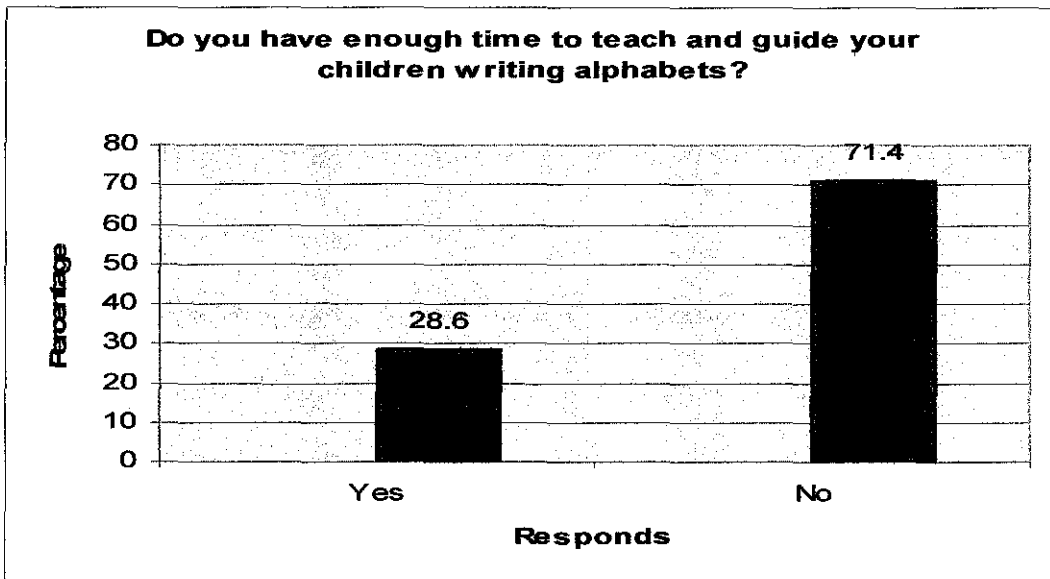
Figure 4-11: Time allocation to teach in writing alphabets

Does time management is your problem in teaching your children to write?

Percentage

60	
50	50
40	
30	28.6
20	21.4
10	
0	

Time allocation is minimum   Busy routine, cannot give full concentration for every children   Working life, sometimes has to go outstation
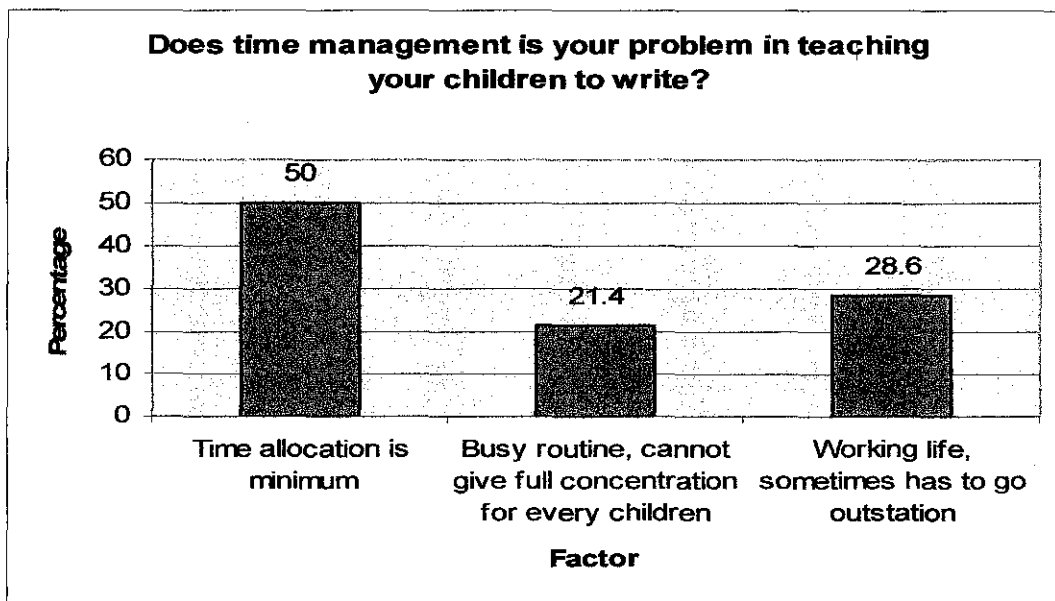
Factor

Figure 4-12: Time management factors

32
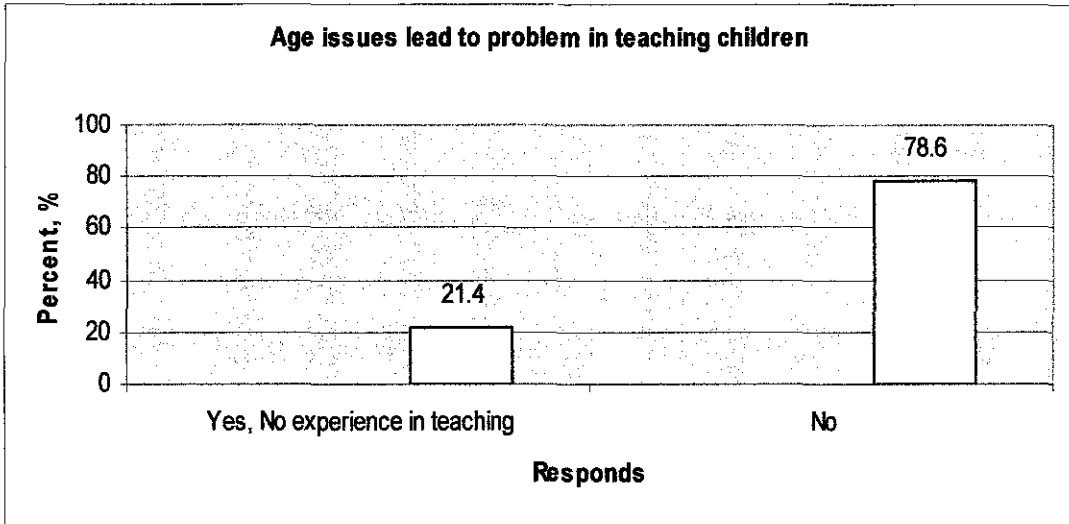
Figure 4-13: Age issues for parents to teach their children in writing alphabets.

Section 3: Children Behavior
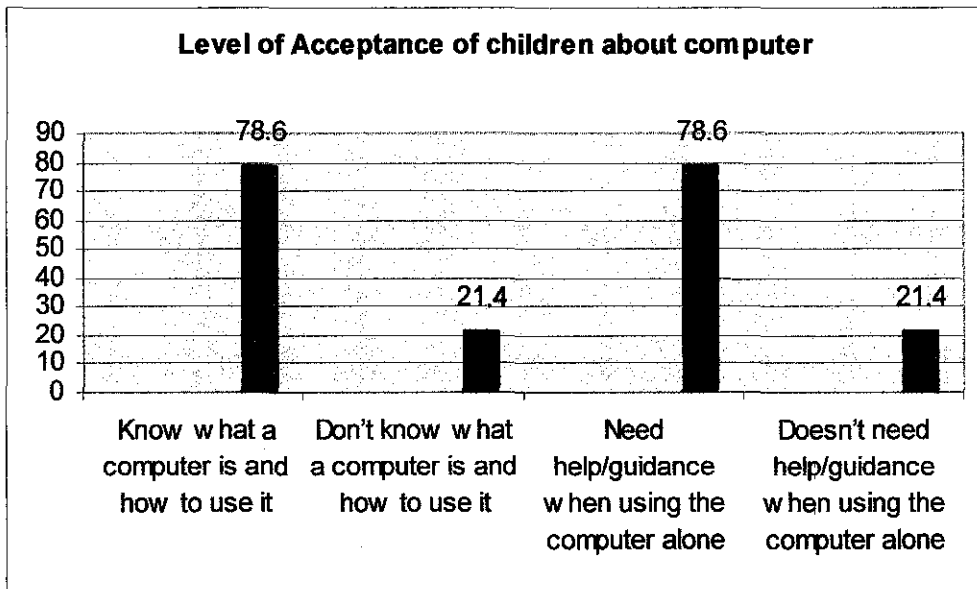
Figure 4-14: Level of Acceptance of children about computer.
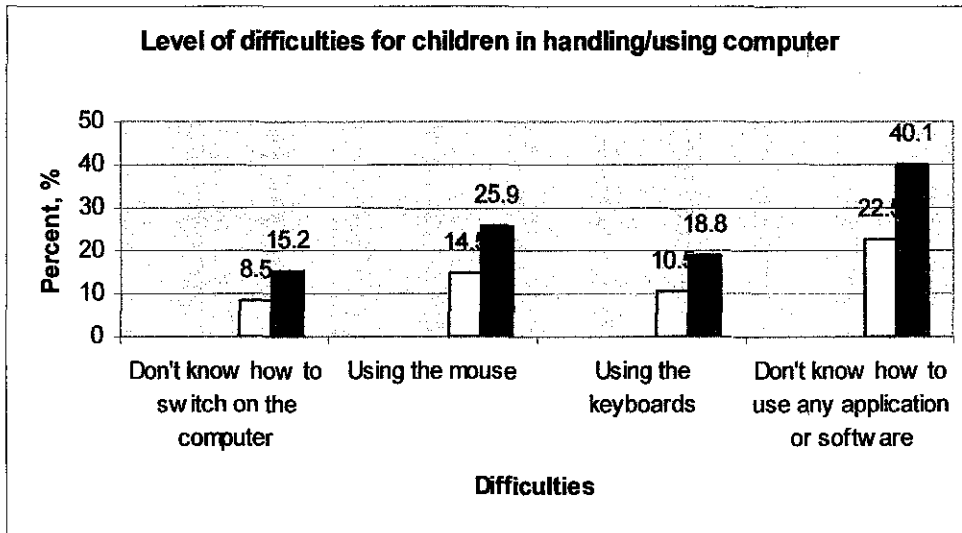
Figure 4-15: Level of difficulties of children on handling/using a computer

Section 4: Respondent Opinion
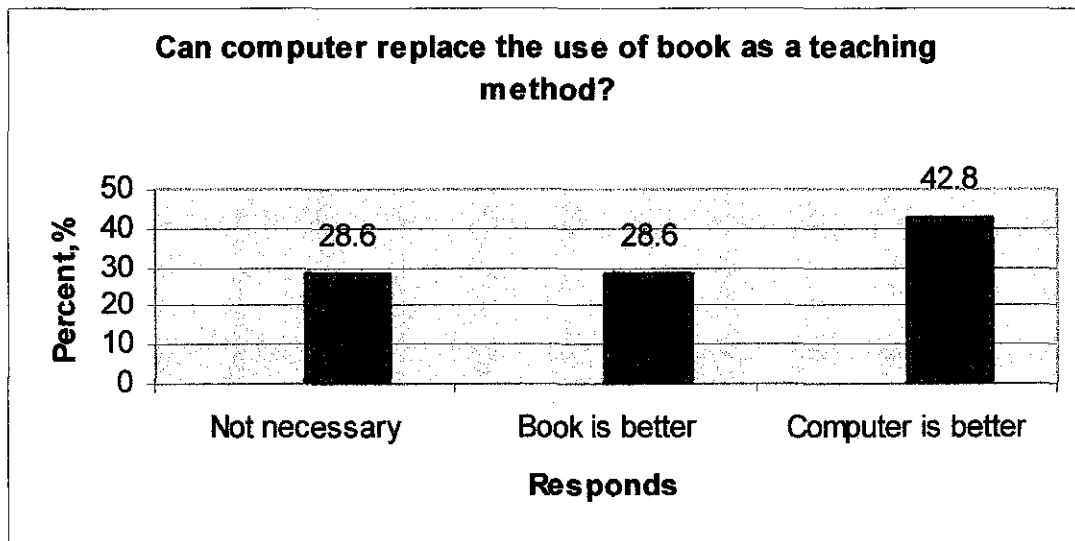
Figure 4-16: Respondents opinion about computer as a teaching method

Level of Acceptance of Proposed Intelligent Tutoring System for Children

Disagree
7%

Strongly agree
29%

Maybe
14%

Agree
50%

☐ Strongly agree
■ Agree
☐ Maybe
☐ Disagree
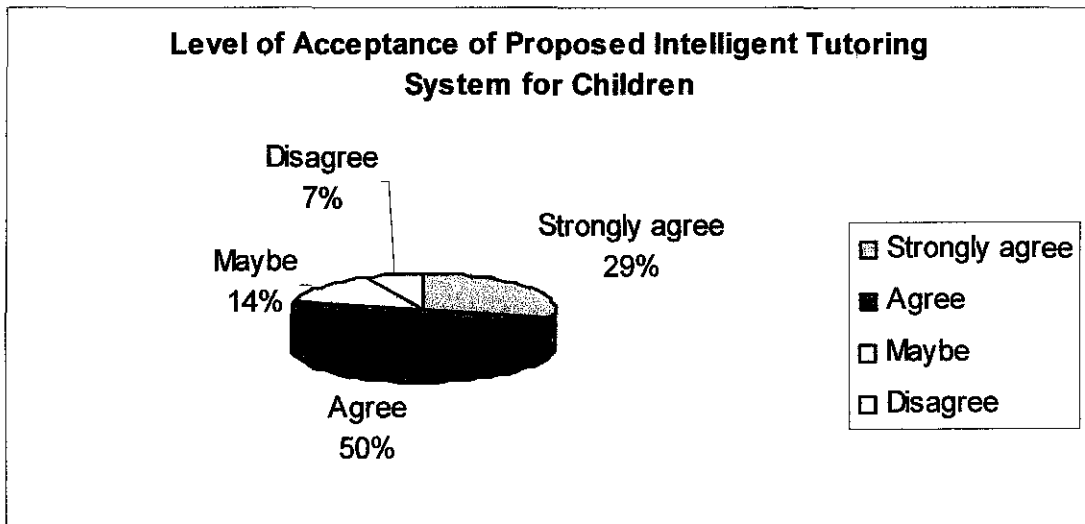
Figure 4-17: Perception towards the computer and proposed Intelligent Tutoring
System for children

4.4.1.2. Discussion on Finding

From the result taken from the questionnaire, the problem identifications for the parents and the behavior of the children are determined.

Because the time and age factors, these will determined in the needs of a tutor in teaching their children to write. They can send their children to school or kindergarten (for early age children) and also they can use the computer at home or learning purposes. So this is where the need of ITS software among the working parents to use it for their children whiles their not at home.

The development of the system will have a user friendly voice and animation for kids. Mouse is used to do the drawing of alphabet. Parents guidance is needed when comes to open the application system and key-in details such as name in the textbox. During the learning process, the system can guide the children without the help and guide from the parents.

4.4.2 Observation and Interview

From the research performed related to the observation and interview session with one working family and their children in Kuala Lumpur. According to Encik Kamaruzzaman, Mohd Haziq age 6, currently a student at one kindergarten able to write alphabets starts at age 4. Mohd Haziq also able to use the computer starting at age 4, but he only know how to open the computer and using any application or software with the help from their parents.

Level of Knowledge about Computer and their tools			
	High	Moderate	Low
CPU (Power on/off)			
Monitor/Screen (Power on/off)			
Keyboard (Alphanumeric and usefulness)			
Mouse (Pointer)			
Using Computer software/application			

Table 4-4: Observation of Level of Knowledge about Computer and their tools

Comparison of Interest between Book and Computer							
	Level			Average Time Consumed			
	High	Moderate	Low	More than 5 hours per week	3 - 4 hours per week	1 - 2 hours per week	Less than 1 hour per week
Doing homework/study with books							
Play the computer for education purposes (using children's education software)							

Table 4-5: Comparison of Interest between Book and Computer

From the observation, children at age 6 are able to use computer with some basic knowledge about the computer and its tools. Children at age 6 know what the usage of keyboard and computer mouse is, but has a lower knowledge on how to use the computer software/application or operating system application. On the other hand, in the comparison of interest between book and computer, the child preferred computer instead of books for education learning. This is shown by the average time consumed for using the computer per week (more than 5 hours per week) compared with the usage of books for homework or study (3-4 hours per week).

Meanwhile, the parents also encouraged the exposure of computer for early age children for education purposes at home or at school. This shown that there is a need in education software especially for kids at home to learn and experience self learning using the computer.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 CONCLUSION

Learning to write numbers and letters are important tasks for children. It should be exciting and enjoyable activity through which children can experience success. Teaching children to write and read can be a problem for parents at home, they do not have much time to guide them and correct errors. This paper has described the research and development of intelligent tutoring system on how to teach an early age children to write.

Through the research methodology that has been used, the Intelligent Tutoring System is essential in increasing the learning time for children to write using a computer instead of alphabets book. The implementation of the Intelligent Tutoring System in real world environment may reduce the burden of working parents on how to teach their children to write. Instead of repeating the same alphabets and buying more books, the proposed system can actually be use for generations. Deleting and saving student's progress are best to show and rates children's progression in writing.

In conclusion, the result of the project has significantly provided thorough understanding on the real implementation of a computerized software system and also the perception of the society on using computer for the early age children. Overall, the project has successfully met the objectives. However, further study on the implementation of the project need to be taken into considerations. This is to allow for further analysis can be carried out and to ensure the success of future work.

5.2 RECOMMENDATIONS

There are several recommendation and suggestions that can be done such as the followings:

a) Web based and mobile based application

The Intelligent Tutoring System is a stand-alone application. The working progress from the student to the system requires the system to be installed in the personal computer and all the progress and data are saved in that computer. The parents and teachers can only views the children progress and reporting using that computer only. It would be more practical if this application can submit the results and reporting to the parents or teachers through internet or in their mobile phone. With web-based or mobile application, working parents or teachers can easily check the children's progression records online.

b) Tablet (digital pen, digital pad)

To enhance the learning process for children on learning to write, the system can use the digital pen and digital pad instead of using the mouse. This can increase the effectiveness in learning using the normal pencil or pen on a paper.

c) Complete out the other alphabets

From the study of drawing alphabet uppercase letter 'A', the remaining number of alphabet can be complete out such as from uppercase and lowercase letter of 'A' to 'Z'.

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Microsoft Agent
    <http://www.microsoft.com/msagent/>

Gantt chart: FYP 1

Project Progress
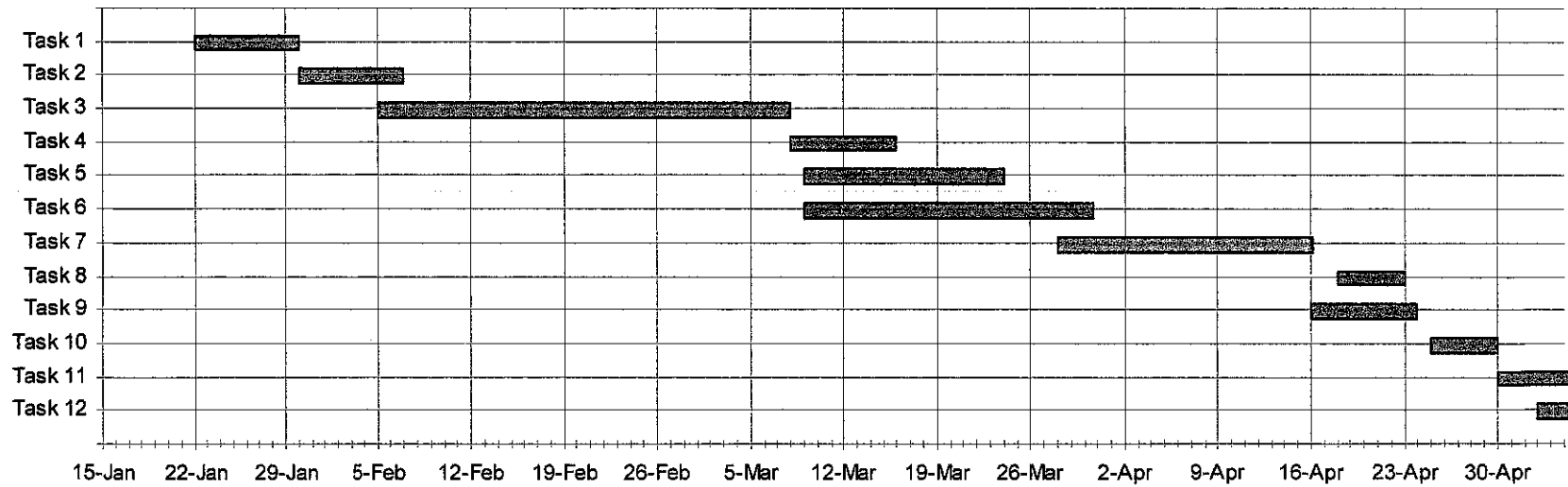
Task ID	Task Description	Start Date	Duration	Progress
Task 1	Proposal Preparation	22-Jan-07	8	100%
Task 2	Proposal Approval	30-Jan-07	8	100%
Task 3	Background Studies	5-Feb-07	31	100%
Task 4	Preliminary Report Preparation & Submission	8-Mar-07	8	100%
Task 5	Development Environment Setup	9-Mar-07	15	100%
Task 6	VB Study & Design	9-Mar-07	21	100%
Task 7	GUI Analysis and Research	28-Mar-07	19	70%
Task 8	Seminar 1 Preparation & Presentation	18-Apr-07	5	100%
Task 9	Progress Report Preparation & Submission	16-Apr-07	8	100%
Task 10	Seminar 2 Preparation & Presentation	25-Apr-07	5	90%
Task 11	Interim Report Preparation & Submission	30-Apr-07	8	100%
Task 12	Preparation for final presentation	3-May-07	7	0%

Gantt chart Description

Gantt chart: FYP II

Task No.	Detail/ Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Project Development: Phase 1	▒	▒	▒											
2	Progress Report 1: preparation		▒	▒											
	• Submission of Progress Report 1			●											
3	Project Development: Phase 2				▒	▒	▒	▒	▒						
4	Progress Report 2: preparation							▒	▒						
	• Submission of Progress Report 2								●						
5	Seminar preparation									▒					
6	Seminar presentation									●					
7	Project Development: Phase 3									▒	▒				
8	PreEDX Exhibition										●				
9	Submission of Final Report										●				
10	Project Development: Final Phase										▒	▒	▒		
11	Oral Presentation: Final Reporting														●
12	Dissertation: submission														▒

● Milestone   ▢ Process

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Legend:

1. Project Development: Phase 1

    a. Research studies: Develop Questionnaire and collecting data.

    b. Continue developing prototype.

2. Project Development: Phase 2

    a. Research studies: Interview and observation

    b. Coding functionality of the system.

3. Project Development: Phase 3

    a. Inserting the voice outcome of the project.

4. Project Development: Final Reporting

    a. Increasing the user effectiveness of the system.

    b. Finalise coding.

APPENDIX 2: QUESTIONNAIRE

The Computer and Children...

Building an Intelligent Tutoring System: Teaching Children How to Write Alphabets

Questionnaire for Parents / *Soal selidik untuk Ibu Bapa*

All information is given ANONYMOUSLY. You or your child cannot be identified from this questionnaire. Thank you for helping with this survey!

Semua maklumat diberi kepada mereka yang TIDAK DIKENALI. Anda atau anak anda tidak akan dikenalpasti daripada soal selidik ini. Terima kasih kerana membantu pantauan ini!

Q1. How old are you and your partner? / *Berapakah umur anda dan pasangan anda?*

You / *Anda*   Your Partner / *Pasangan anda*

- 20 - 25   - 20 - 25

- 26 - 30   - 26 - 30

- 30 - 35   - 30 - 35

- 40 - 50   - 40 - 50

Q2. Do you have a child age 3 to 8? / *Adakah anda mempunyai anak berumur antara 3 hingga 8 tahun?*

- Yes / *Ya*   - No / *Tidak*

(If you answer "Yes" please proceed to Q3. / Jika anda berkata "Ya" sila mara ke Q3.)

(If you answer "No" please proceed to Q6. / Jika anda berkata "Tidak" sila mara ke Q6.)

Q3. Is this child a girl or boy? / *Adakah anak ini seorang perempuan atau lelaki?*

- Boy / *Lelaki*   - Girl / *Perempuan*

Q4. Does your child go to kindergarten/child development centre? / *Adakah anak anda ini memasuki tadika/pusat pembangunan kanak-kanak?*

○ Yes / *Ya*　　○ No / *Tidak*

Q5. Does this kindergarten/child development centre is helpful in teaching alphabets writing (ABC writing)? / *Adakah tadika/pusat pembangunan kanak-kanak ini membantu dalam pembelajaran menulis huruf (menulis ABC)?*

○ Excellent/*Cemerlang*

○ Good/*Bagus*

○ Average/*Sederhana*

○ Not Really/*Tidak Juga*

Q6. Are you working? / *Adakah anda bekerja?*

○ Yes/*Ya*　　○ No/*Tidak*

　　(If you answer "Yes", please proceed to Q7. / Jika anda berkata "Ya", sila mara ke Q7)

Q7. Do you have enough time to teach and guide your children writing alphabets (ABC)? / *Adakah anda mempunyai cukup masa untuk mengajar dan membimbing anak anda semasa menulis huruf (ABC)?*

○ Yes/*Ya*　　○ No/*Tidak*

Q8. Does time management is your problem in teaching your children to write? Which is the most? / *Adakah pengurusan masa adalah masalah anda untuk mengajar anak anda menulis? Yang manakah paling banyak?*

○ Time allocation is minimum / *Peruntukan waktu yang minima*

○ Busy routine, cannot give full concentration for every children / *Kesibukan harian, tidak boleh memberi konsentrasi penuh terhadap setiap anak*

○ Working life, sometimes has to go outstation / *Gaya hidup bekerja, kadangkala terpaksa ke luar daerah*

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Q9. Do age issues lead to your problem in teaching your children? / *Adakah isu umur menyumbang kepada masalah anda untuk mengajar anak anda?*

○ Yes, No experience in teaching / *Ya, Tiada pengalaman mengajar*

○ No/*Tidak*

Q10. Do you agree with this sentence? "Learning should be in school, not at home" / *Adakah anda setuju dengan ayat ini? "Pembelajaran sepatutnya di sekolah, bukan di rumah"*

○ Yes/*Ya*   ○ No/*Tidak*

Q11. Does your child know how to write? / *Adakah anak anda tahu menulis?*

○ Yes/*Ya*   ○ No/*Tidak*

(If you answer "Yes", please proceed to Q12. / Jika anda berkata "Ya", sila mara ke Q12)

Q12. At what age? / *Pada umur berapa?*

○ 3   ○ 4   ○ 5   ○ 6   ○ 7   ○ 8

Q13. Do you possess a computer at home? / *Adakah anda memiliki komputer dirumah?*

○ Yes/*Ya*   ○ No/*Tidak*

Q14. Does your child know what a computer is and how to use it? (Referring to children age 3 to 8) / *Adakah anak anda tahu apakah komputer dan bagaimana menggunakannya? (Merujuk kepada anak berumur 3 hingga 8 tahun)*

○ Yes/*Ya*   ○ No/*Tidak*

Q15. How often do you use computer together with your child? (For education purposes) / *Berapa kerap anda menggunakan komputer bersama-sama anak anda? (Untuk kegunaan pendidikan)*

○ All of the time / *Sepanjang masa*

○ Most of the time / *Kebanyakan masa*

○ About half of the time / *Separuh masa*

○ Less than half the time / *Kurang daripada separuh masa*

○ Never / *Tidak pernah*

Q16. Do you think a computer can replace the use of book as a teaching method for early age children to learn how to write alphabets (ABC)? / *Adakah anda rasa komputer dapat menggantikan penggunaan buku sebagai cara pengajaran untuk kanak-kanak awal umur belajar menulis huruf (ABC)?*

○ Not necessary / *Tidak semestinya*

○ Book is better / *Buku lebih baik*

○ Computer is better / *Komputer lebih baik*

Q17. How many hours does your children use computer at home for education purposes (reading, using other education software)? (Refer to children age 3 to 8) / *Berapa jam anak anda menggunakan komputer dirumah untuk kegunaan pendidikan (seperti pembacaan, menggunakan perisian pendidikan lain)? (Merujuk kepada anak berumur 3 hingga 8 tahun)*

○ More than 5 hours per week / *Lebih daripada 5 jam seminggu*

○ 3 - 4 hours per week / *3 hingga 4 jam seminggu*

○ 1 - 2 hours per week / *1 hingga 2 jam seminggu*

○ Less than 1 hour per week / *Kurang daripada 1 jam seminggu*

○ Never / *Tidak pernah*

Q18. Does your child need help/guide when he or she uses the computer alone? / *Adakah anak anda memerlukan pertolongan/bimbingan semasa dia menggunakan komputer berseorangan?*

○ Yes/*Ya*   ○ No/*Tidak*

(If you answer "Yes", please answer Q19 / *Jika anda berkata "Ya", sila jawab Q19*)

Q19. What are his or her difficulties during the process of using it? You can tick more than one. / *Apakah kesulitan anak anda semasa proses menggunakannya? Anda boleh memilih lebih daripada satu*

☐ Don't know how to switch on the computer / *Tidak tahu bagaimana hendak menghidupkan komputer*

☐ Using the mouse / *Menggunakan tetikus*

☐ Using the keyboards / *Menggunakan papan kunci*

☐ Don't know how to use any application or software / *Tidak tahu menggunakan aplikasi atau perisian*

Q20 Do you think with the help of "intelligent tutor" in a computer can reduces all your problem in Q5 until Q8? / Adakah anda fikir dengan pertolongan "pengajar cerdik" pada komputer dapat mengurangkan semua masalah anda didalam Q7 hingga Q10

○ I strongly agree / *Saya sangat bersetuju*

○ I agree / *Saya bersetuju*

○ Maybe / *Mungkin juga*

○ I disagree / *Saya tidak bersetuju*