CHAPTER 4
EXPERIMENTAL METHOLOGY

This chapter focuses on the experimental methodology that is comprised of Introduction in experimental methodology, Data Gathering and Requirements Capture, Design and specification, Production and System Implementation.

4.1 Introduction

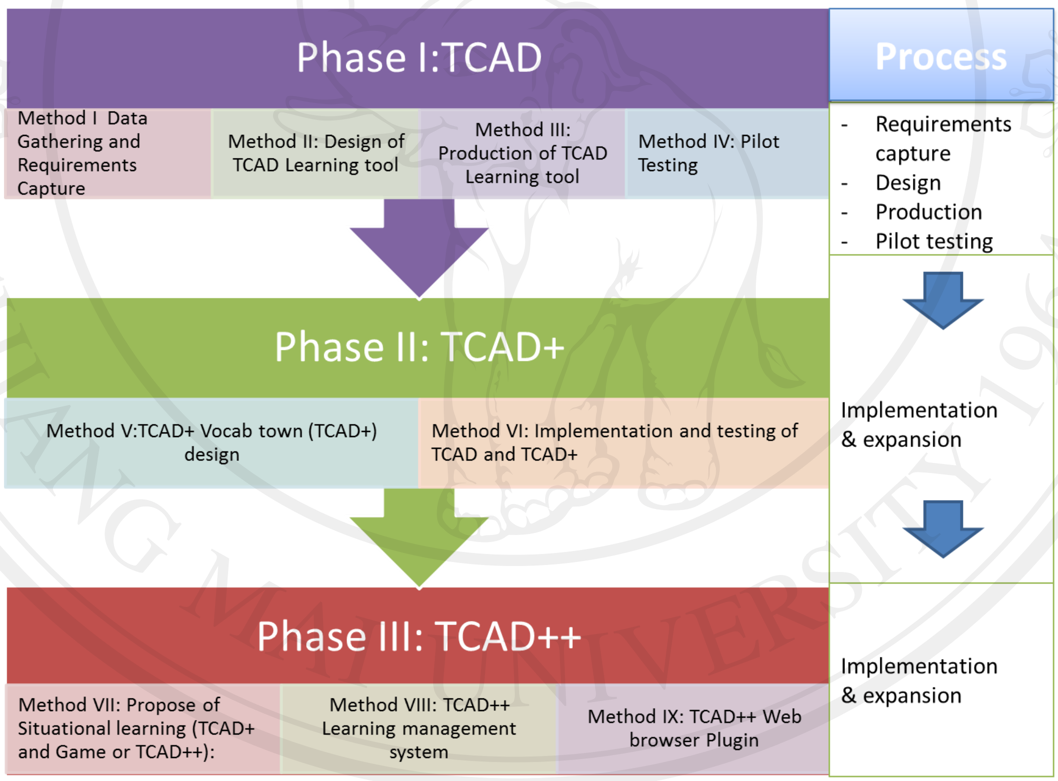


Figure 4.1 Methodology Framework

From Figure 4.1 this chapter describes this chapter describes the detail of the methodology framework that is focused with the TCAD development process which was adapted from a software development life cycle process (SDLC) comprising of use requirement capture, prototyping design, production, pilot testing, implementation and expansion. The framework is classified into three phase, the first is the TCAD phase that is focusing on developing the pilot learning system and being implemented in to the school for the deaf. It is then moved to collect the data, to be analyzed, and expanded to the second phase which is called TCAD+. In this phase, it is developed to the TCAD system that is bundled with the vocabulary group classification by places called “Vocab town”. It is then moved to the third phase of the SDLC to improve TCAD and TCAD+ system with the situational learning development called TCAD++. The third phase comprises of a situational game that is related with TCAD and TCAD+ vocabulary, learning management system and vocabulary translator via web browser plugin. The detail of each phase is shown as the conceptual framework in Figure 4.2

Conceptual Framework

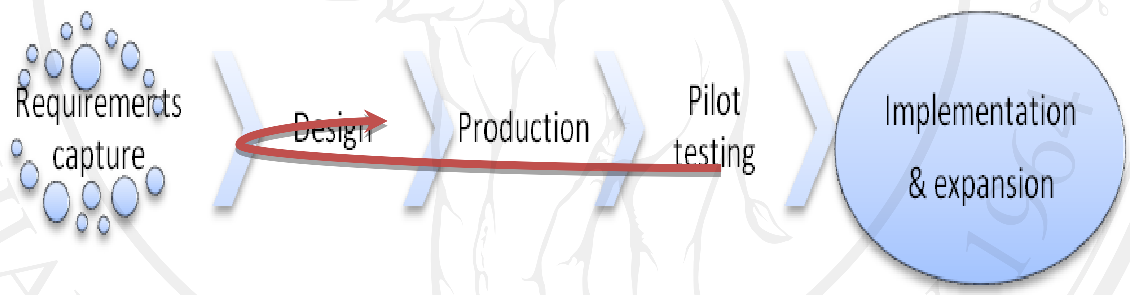


Figure 4.2 Conceptual framework diagram

From the conceptual framework diagram this research methodology begins by undertaking a requirements capture consisting of the user requirement analysis, design process from requirements results and move to production process, pilot testing and implementation and expansion of implementation.

4.2 Conceptual Framework Tools

Table 4.1 Illustrates the methodological process along with the tools used and rationale behind the process

Process	**Tools**	**Expected Result/Rationale**
Requirements capture	Interview (Teacher, Students) Curriculum analysis Class observation	Gap analysis results User requirements
Design	Screen design capture Prototyping	System Prototyping
Production	Motion capture (Evart) MAYA Motion builder Web engine and database Flash	Post production of Project
Pilot testing	Client - server Class supplementation (Learning tool) Pre-test Post-test (Limited Sample Size)	Initial Results
Implementation and Expansion	Expansion to whole school	Expansion Results

From table 4.1 the requirements capture process uses interviews class observation and curriculum analysis the tools to access the gap between correct learning systems and user requirements. The design process uses screen design capture and prototyping to obtain a system prototype. The production process uses motion capture, animation production tools for creating the animation sign language and other content (TCAD) and web-based engine to represent the animation. The pilot testing process uses the results from the production process as the learning tool for the hearing impaired students with the web-based contents and uses the pre-test and post-test to find initial results. The implementation and expansion process uses TCAD for implementation and expansion to the whole school to test on a larger sample population and expand results.

4.3 Data Gathering and Requirements Capture

This research starts with gathering the teaching and learning requirements of Anusarnsoontorn School for the Deaf, Chiang Mai, Thailand. The school currently has issues with its existing learning media and the school wishes to enhance support for students currently using a paper based system which has a short lifespan and needs to be reconstructed every year. The school requires instructional media with information technology that is easy to upload and maintain in the school database system. The school approached the academic reserve center of College of Arts Media and Technology (CAMT) with a research question which instigated this research project.(Chapter 1)

The first stage of this research began by capturing the user requirement within the school's curriculum, instructional media analysis, and via class observation. The majority of schools for the deaf in Thailand use the Total Communication System (TCS) in classroom teaching that is characterized by sign language, lip reading, finger spelling, picture captions, reading and writing which is conducted with the teacher and media at the front of the hearing impaired classroom. Teaching is separated according to class level with around 10 - 20 students per class which is the same teacher: student ratio in standard Thai school. Anusarnsoontorn School has approximately 330 students with 125 in primary level.

4.4 Feasibility Study

The first study began with the school director and interviews of teachers to analyze the feasibility of a new learning system and answering the research question of how to create and develop such a system. Subsequently, research reviewed the existing instructional media to obtain the right user requirements. The researcher found that the school is ready for Internet infrastructure implementation. They linked together the school network using the internet and an internet service provider (ISP). This means they have potential to upgrade those systems from paper based instructional media to using the Internet based as a supplementary tool in the classroom.

4.5 Requirements Analysis and Specification

Focusing on the teaching methods in Anusarnsoontorn School for the deaf in Thai and focusing on Thai sign language with a total communication approach is the main tool within this research. The ideas of Total Communication with an Animation Dictionary (TCAD) came from the user requirement; the researcher captures teachers and students requirements for adapted teaching method and integrates itinto the TCAD tool.

4.6 TCAD Design

4.6.1 Design and specification

After capturing any requirements from the school research team and constructing a mock-up of the TCAD tool to confirmation requirement and preliminary tests about the proof of concept how it will work and adapted it until it work.

4.6.2 Prototyping

When the proof of concept model of TCAD is confirmed with the user, research will develop the full system of TCAD to produce the part of TCAD that each word or vocabulary is composed of; the 3D sign language from motion capture technique, the picture, the finger spelling, the lip reading video, the meaning word in Thai and English, the phonetic spelling and the situational vocabulary learning system. The TCAD has around 250 vocabulary and the researcher will then attempt to test the system in the school again.

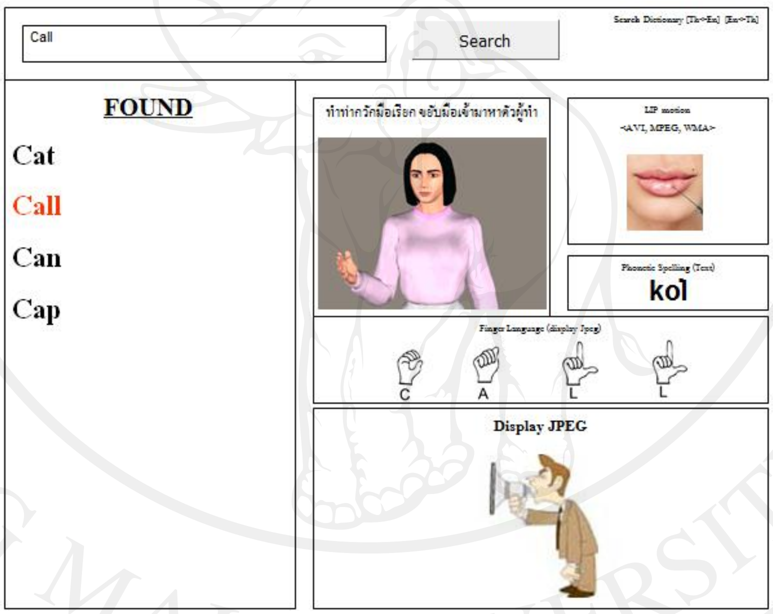


Figure 4.3 The first prototype of TCAD

From this figure, the prototype is designed from the user requirements. This prototype uses the user requirements confirmation that comprises the screen of vocabulary, sign language animation, lip reading, phonetic, finger spelling and picture caption. After proposing the first prototype to the user, the researcher went back to redesign a prototype with user requirements and proposed a prototype to an expert and user again to confirm of its practical use.

4.6.3 Character design

The character design is the animation design process using the model for bundle with motion capture technique. This process is comprised of a 2D character design and 3D character design.

2D design

2D character design starts from character sketching to create the models for primary school students. It is comprised of a boy and girl model: shown in Figure 4.7

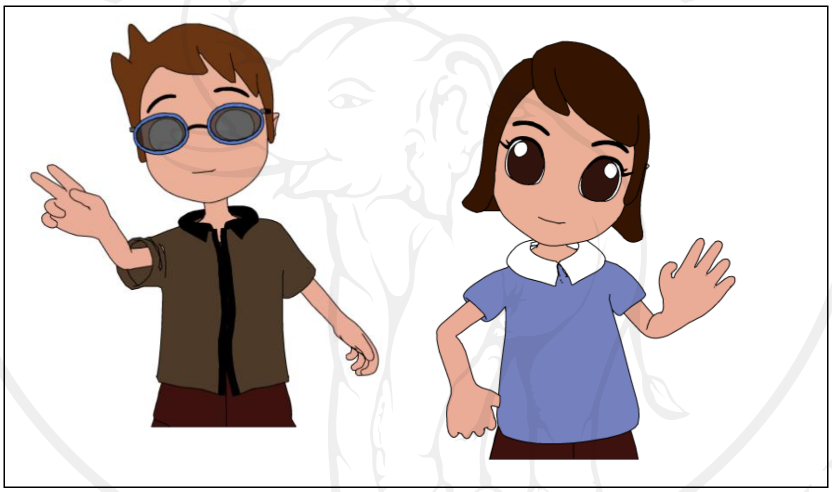


Figure 4.4 2D model designs

3D design

After creating the 2D character, the researcher moved to create the 3D model with MAYA program for creating the skin, texture, and bone that supports the movement from the motion capture technique; which is shown in Figure 4.5

Figure 4.5 3D model designs

4.7 TCAD Production

4.7.1 Motion capture

Motion capture is a technique for recording movement and is used in this research to record detailed body movements associated with sign language. This tool can be used to subsequently implement movement into a digital model along with 2D or 3D animation. The objectives of using the motion capture technique are the large number of vocabulary (500 words) used for teaching students that would be time consuming, and difficult to replicate subtle detail of sign languageusing which has solely traditional animation techniques. Motion capture supports animation of vocabulary in a quick, efficient and accurate way by using a real sign language teacher to perform the vocabulary while every nuance of movement is captured and stored by a computer in preparation to be combined with appropriate 2D and 3D character animation. This research used the CAMT motion capture laboratory which is shown in Figure 4.6

Figure 4.6 motion capture camera

Model for Sign language capturing

Figure 4.7 The motion capture suit, body and glove marker setting in the sign language model (Sign language model)

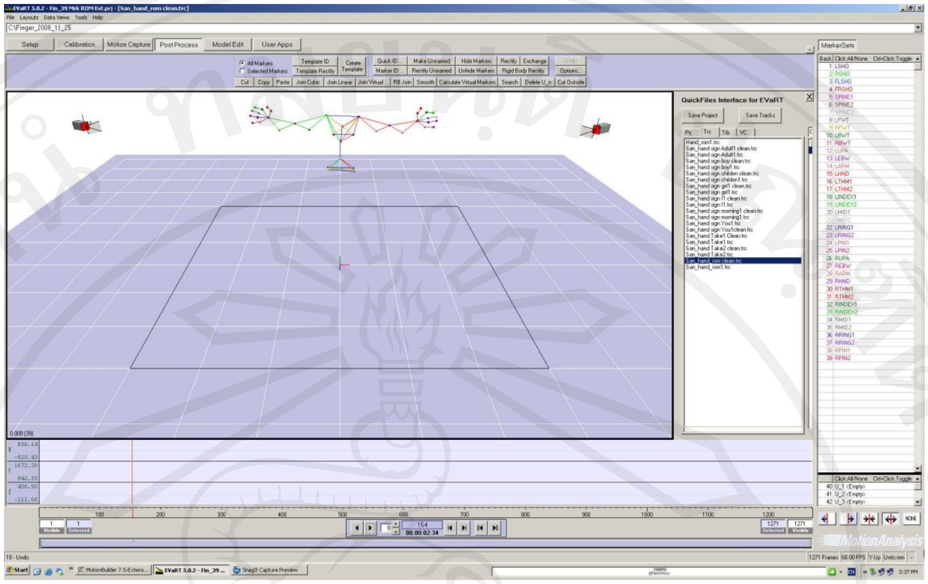


Figure 4.8 The motion capture in the Evart model view

Figure 4.9 The motion capture in the Motion builder model view

The sign language movement model used in this work is a teacher from the Anusarnsoontorn school for the deaf. The translation process starts with sign language movement word by word using the motion capture technique to record the movements associated with each word from the selected vocabulary.

4.7.2 Motion Capture Process

The seven processes of animation production using the motion capture technique are show in Figure 4.10

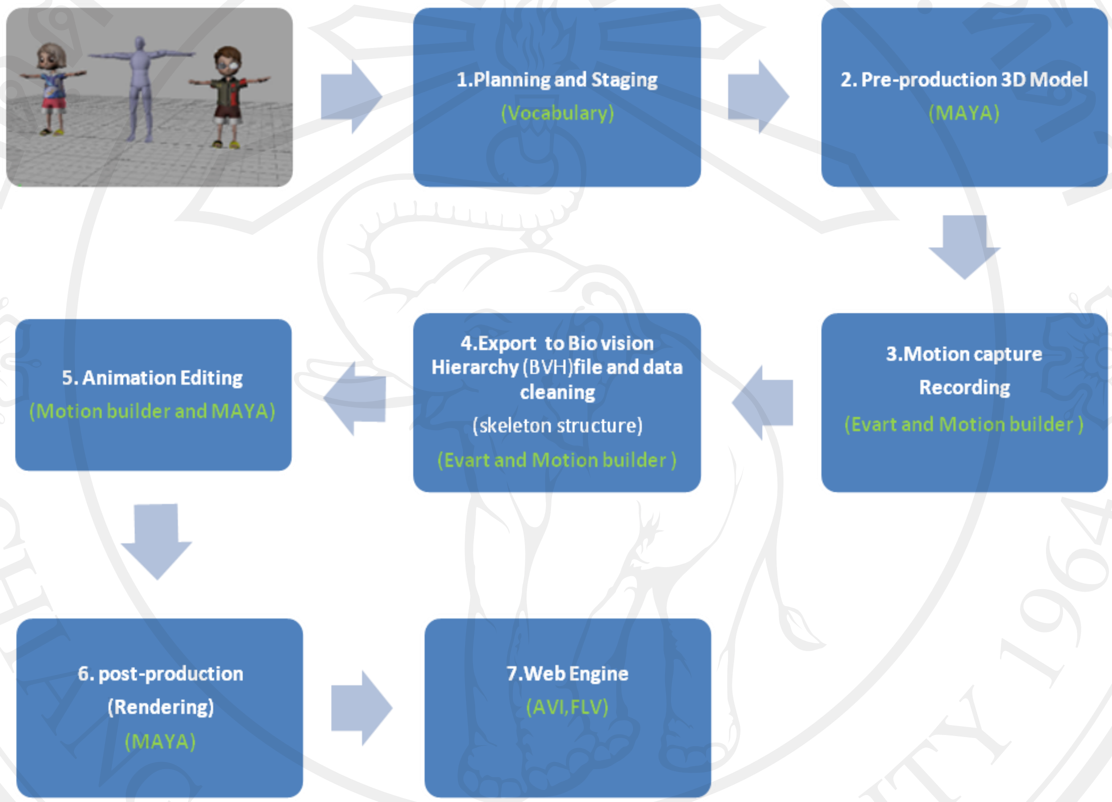


Figure 4.10 The motion capture process

Figure 4.10 shows the production process starting from the first stage, planning and staging process which focuses on vocabulary preparation using a vocabulary list from the Ministry of Education English curriculum that is comprised of around 500 key vocabulary from daily life that covers primary students from levels one to six. Before starting the motion capturing, the staging of sign language perform will be set with the setting of model for motion capture suit and marker; the setting is with the body shape that is around 42 marker and using a hand glove for finger movements capture (see as Figure 4.7). After vocabulary planning and staging, the processes in second stage are pre-production with a 3D model, which are 3 D models created in the Maya program to produce the models to support the motion capture, such as the skin texturing and skeleton setting of characters show in Figure 4.11

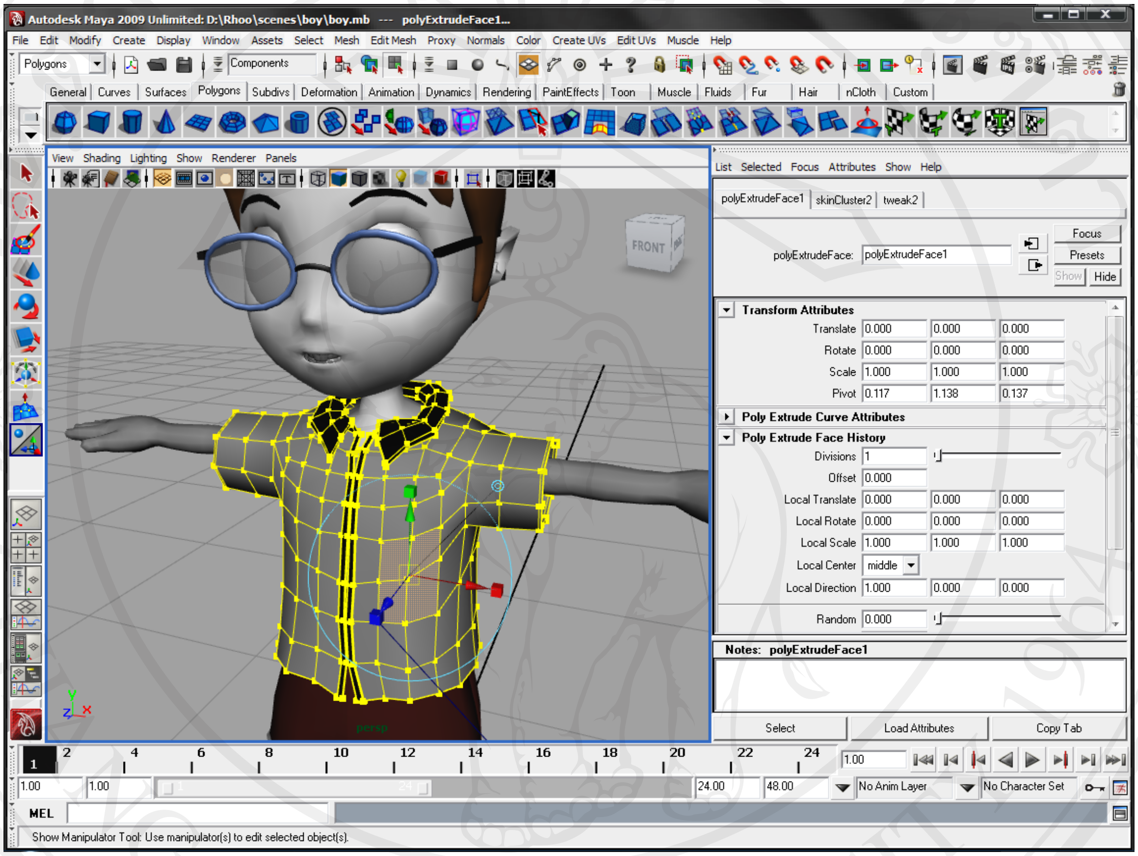


Figure 4.11 3 D model from Maya (Polygon Editing)

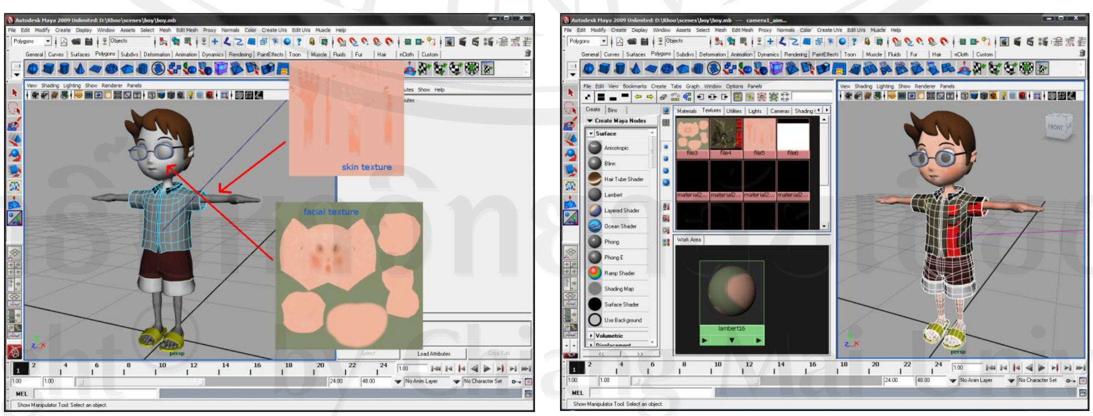


Figure 4.12 Skin and texturing

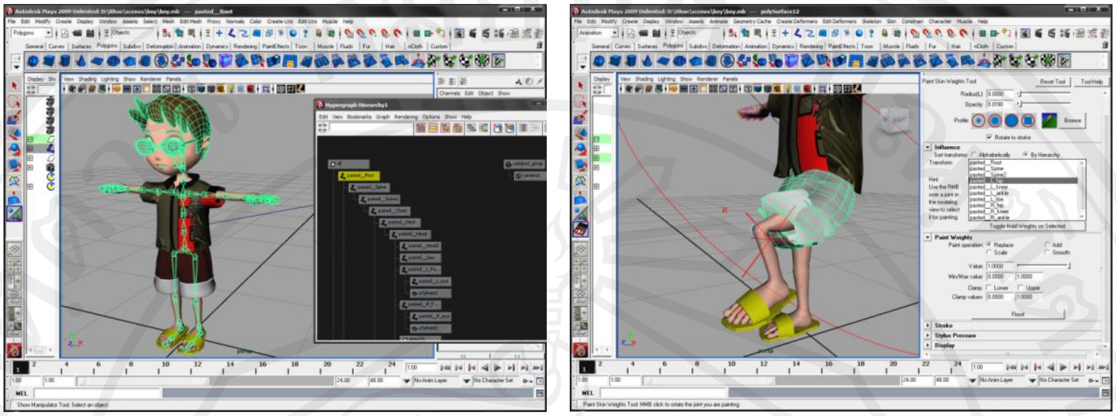


Figure 4.13 Skeleton setting

The third stage, after model setting, the model is exported from Maya into FBXfile format that require and used by Auto desk software for being imported to the Motion builder program where the motion recording uses both the Evart program and Motion builder program - shown in Figure 4.14- 4.15. The output of this step is the .fbx file model that is used in the sign language performing record with the motion capture laboratory.

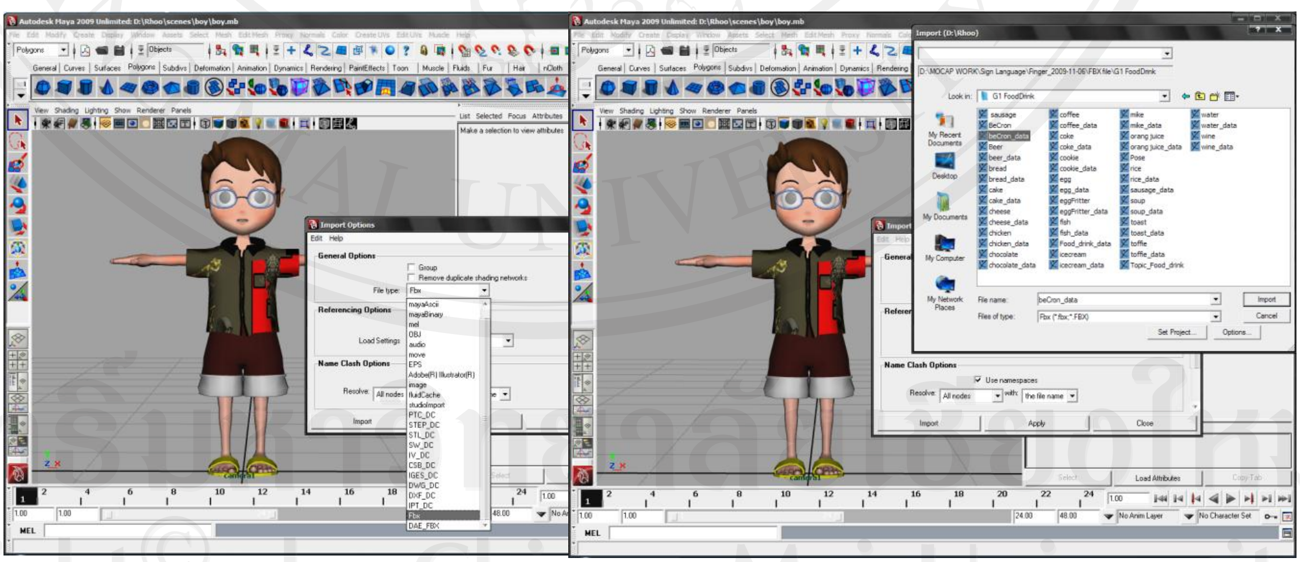


Figure 4.14 Import toFBX file

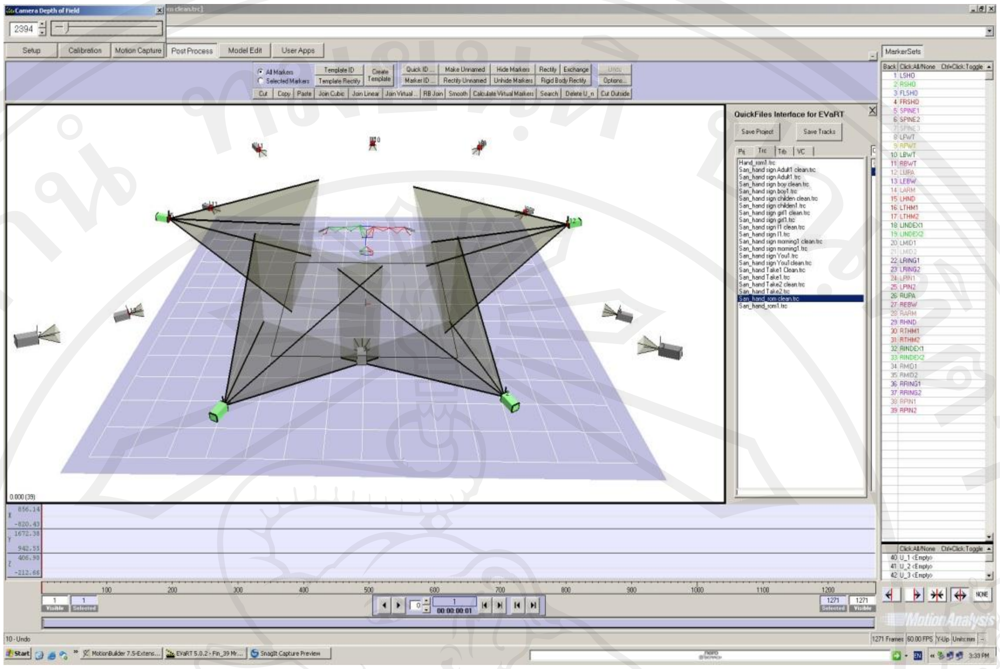


Figure 4.15 Motion recording from Evart program

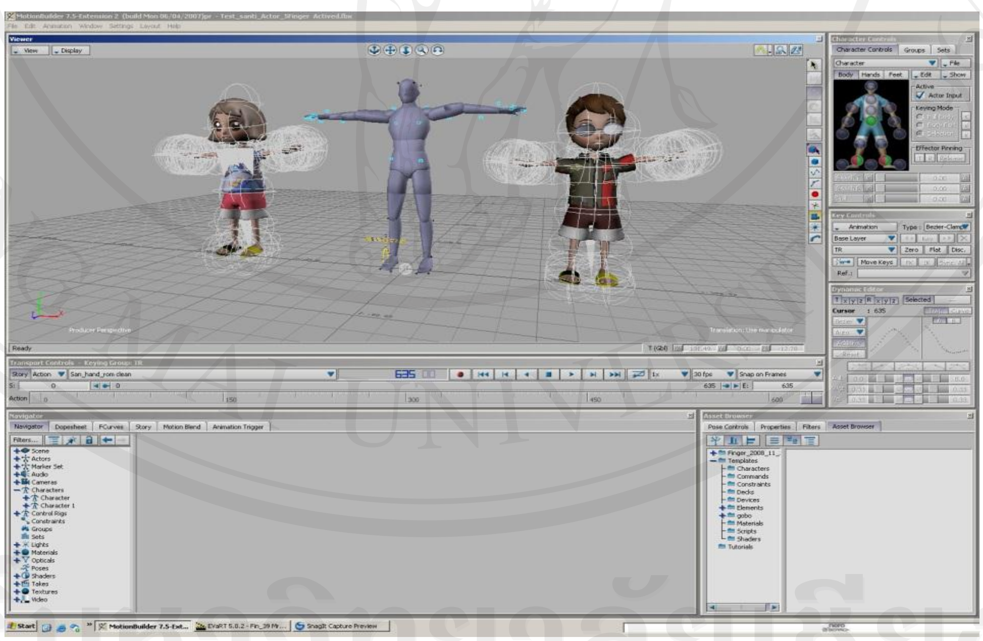


Figure 4.16 Motion recording from Motion builder program

- Stage 4 involves exporting file toa Bio vision Hierarchy (BVH) file and cleaning the data to create a skeleton structure by Evart and Motion builder program. The skeleton structure from this step will be used for mapping with the model from the third stage. Before the mapping of the model and skeleton movements, this process require the skeleton data cleaning: this is a process that is fully comprised with a coordinate linking in which vocabulary movement, or checking the coordinate data missing and replaced with Evart program for cleaning the coordinate data. The data from motion capture technique store in the coordinate X, Y, and Z with the marker is set on human body or the sign language model perform.

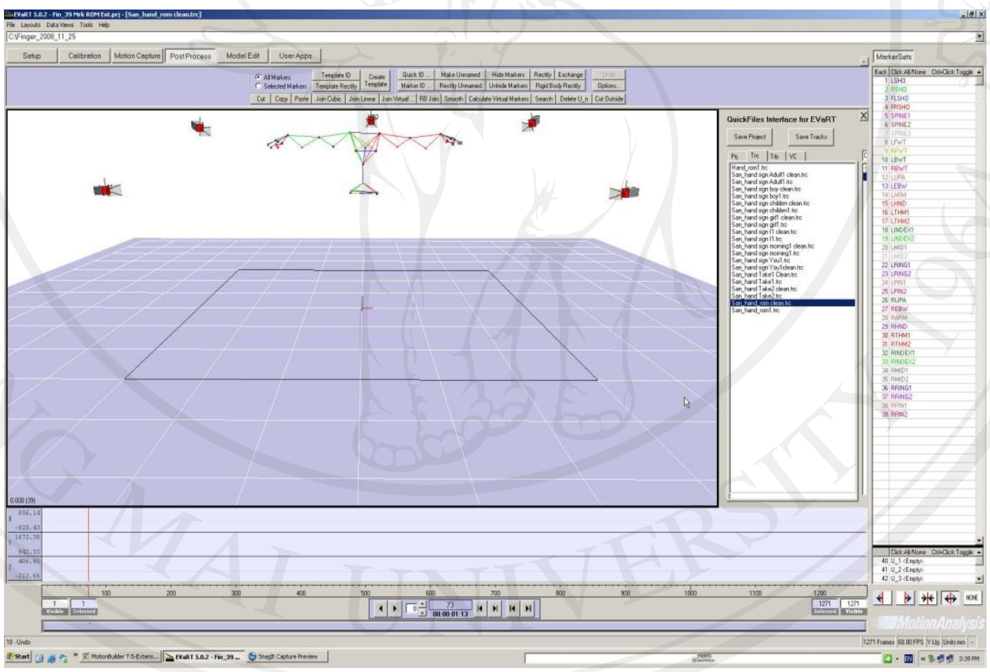


Figure 4.17 Data cleaning from Evart program

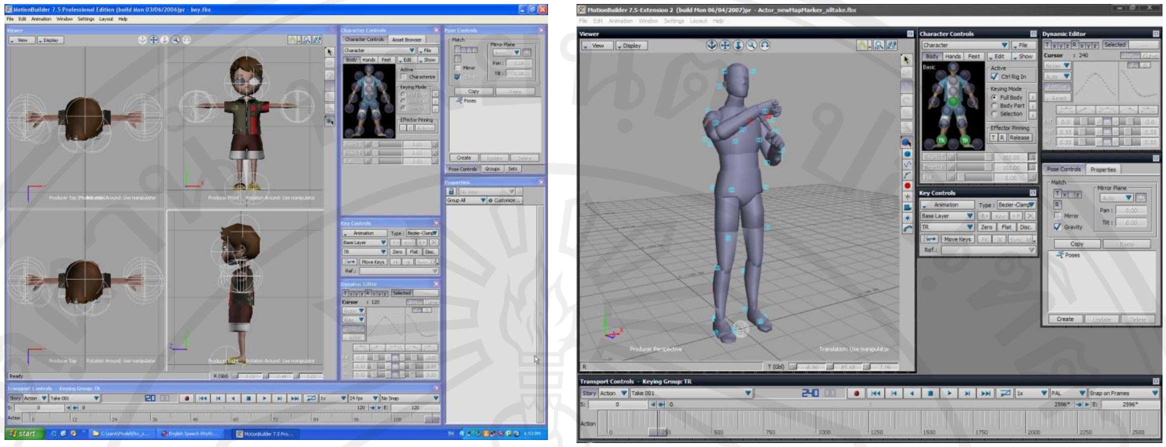


Figure 4.18 Data cleaning from Motion builder program (source marker data)

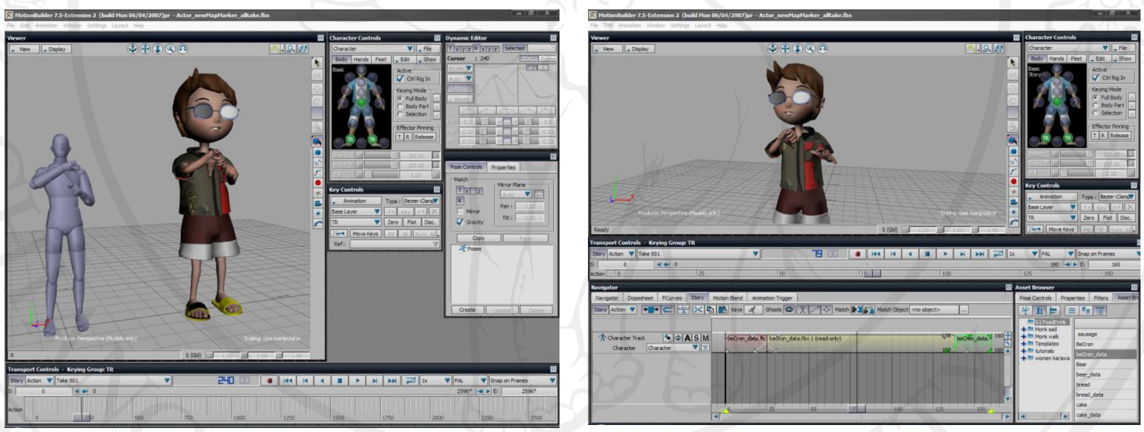


Figure 4.19 Data cleaning from Motion builder program (take data from actor to model skeleton and Split DATA to each clip of vocab)

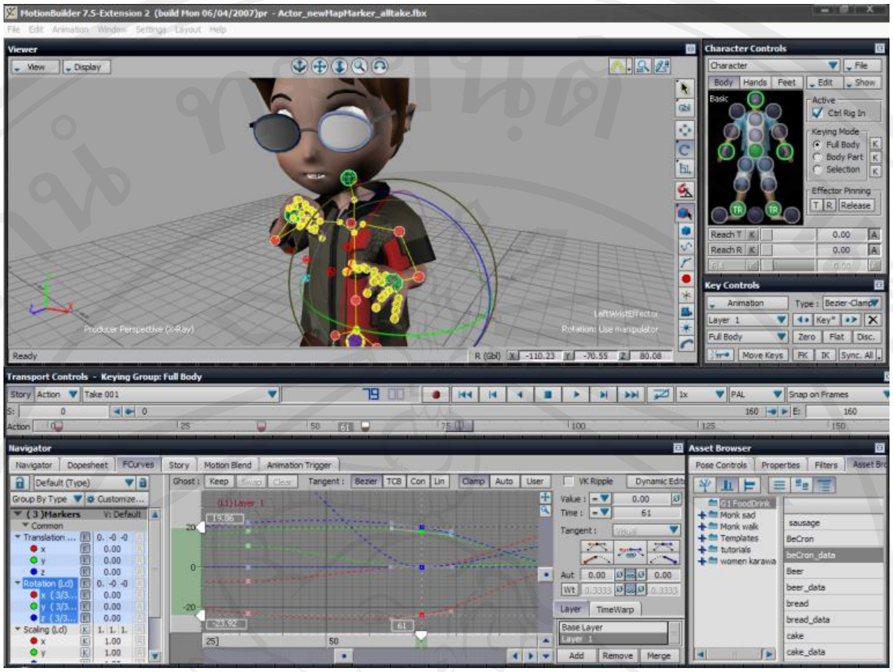


Figure 4.20 Data cleaning from Motion builder program

(cleanand edit data for each vocabulary)

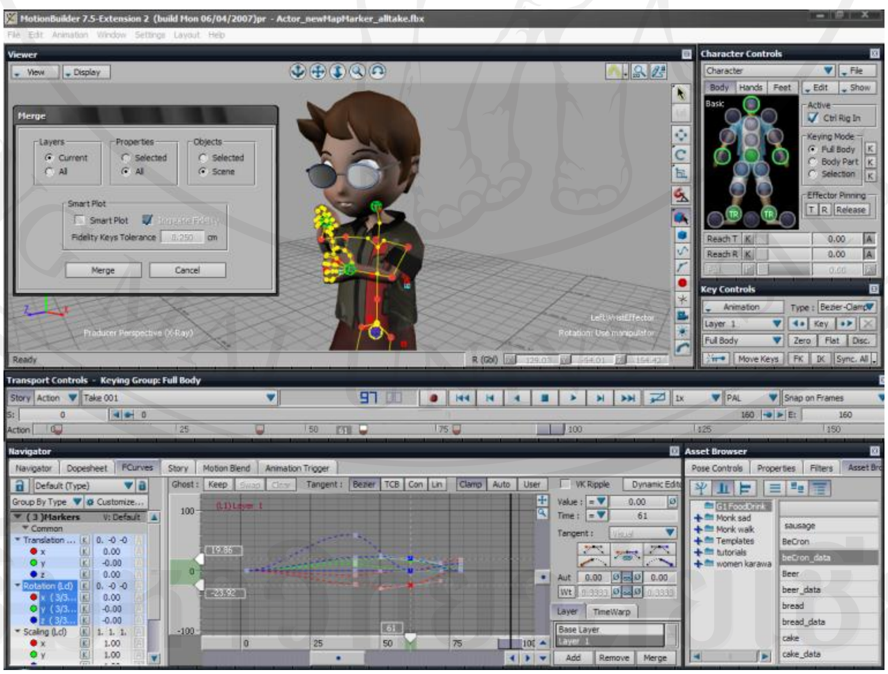


Figure 4.21 Data cleaning from Motion builder program

(put cleaned data to skeleton)

Stage 5 is Animation editing (Motion builder and MAYA), which focuses on editing the data from the animation or motion movements in stage 4 that are comprised of the animation editing in motion builder compared with the model movement that records from the Video camera file for checking vocabulary consistency. The model was recorded and edited with the complete of model via Motion builder program.

The sixth stage is Post-production (Rendering) within the MAYA program. This stage involves exporting a working file from the Motion builder software into MAYA to render the animation vocabulary file to represent in the video file output. The video file output can then be used in the sign language part of the TCAD.

The rendering process from MAYA

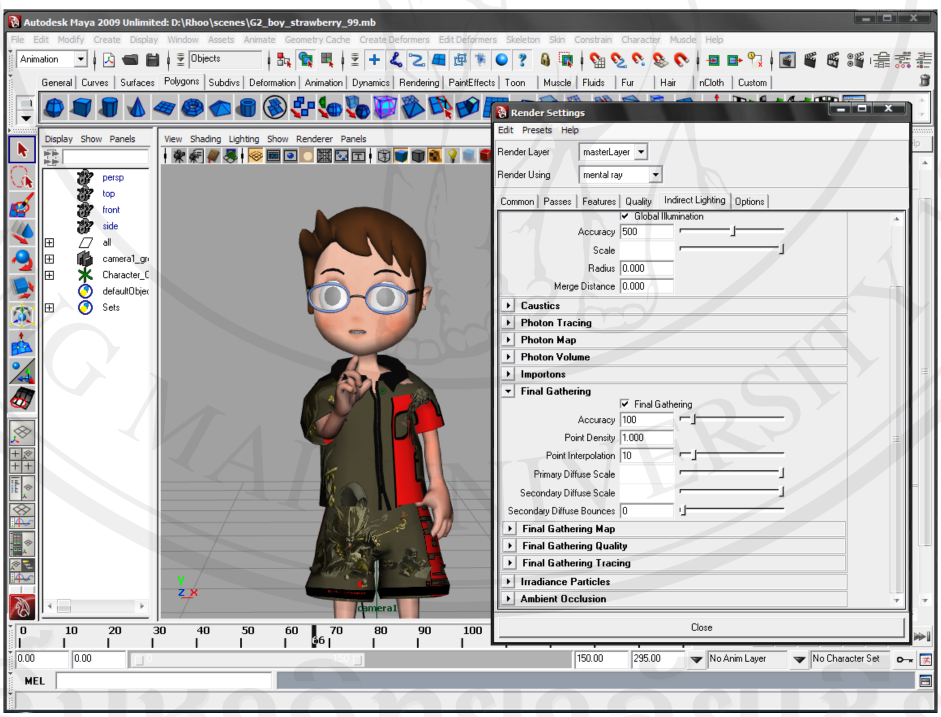


Figure 4.22 Render setting

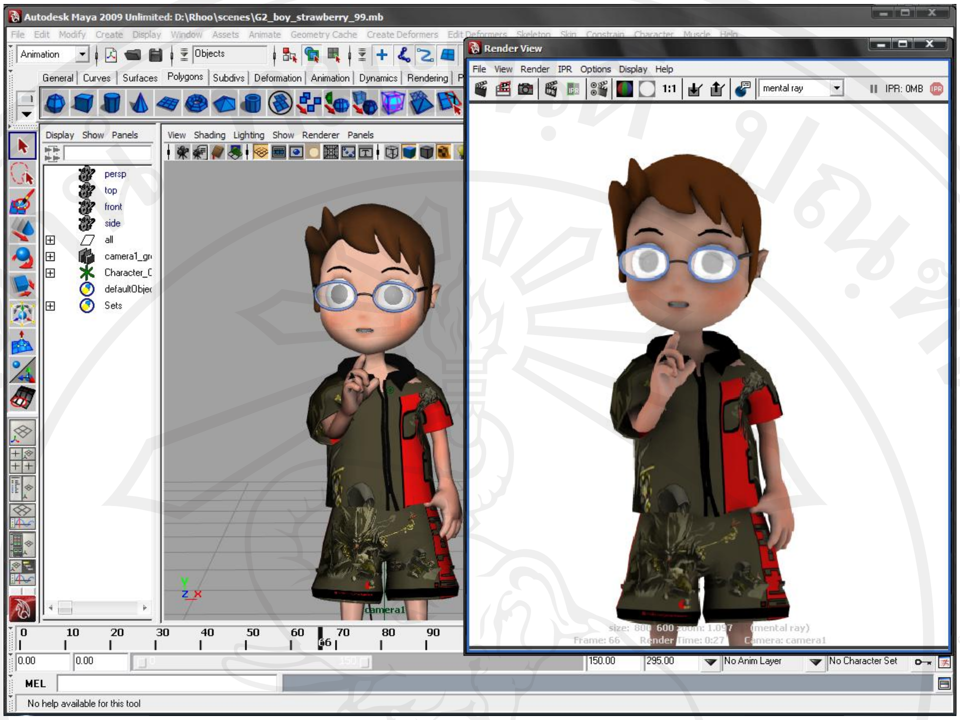


Figure 4.23 Render testing

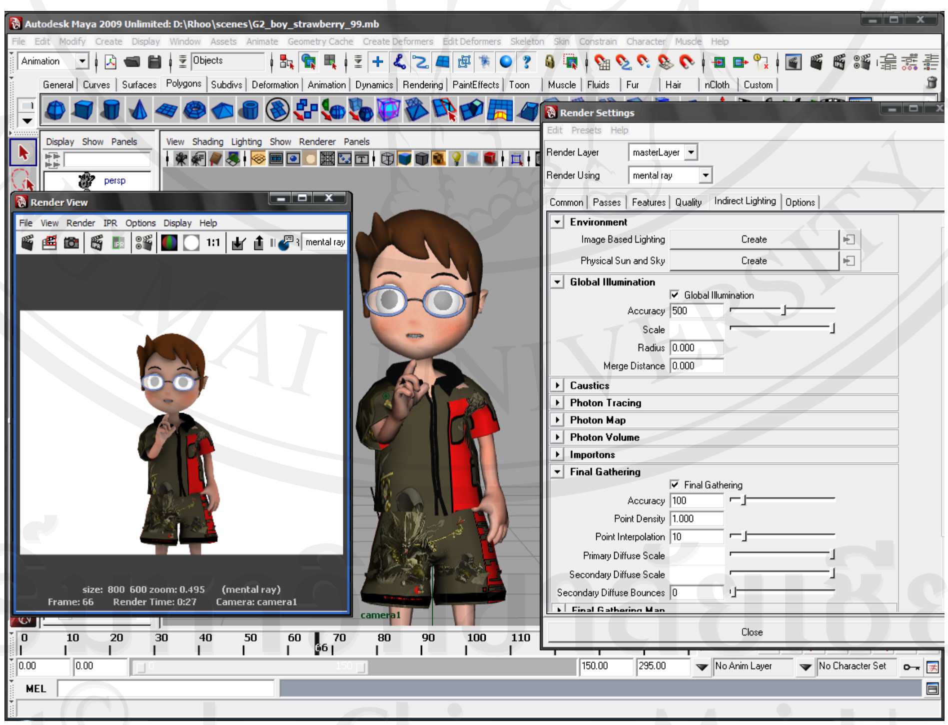


Figure 4.24 Rendering

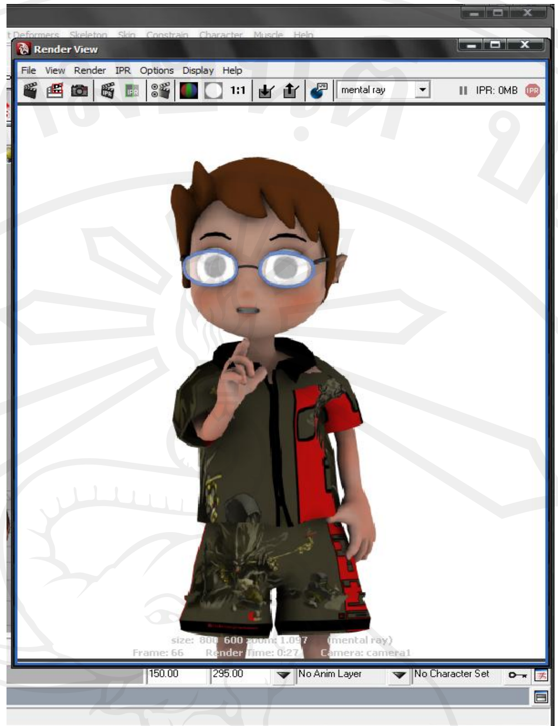


Figure 4.25 Post product from rendering

Stage 7 shows results of the video file in the web-based engine.This stage collects the video output from stage 6 and converts the file from AVI into FLV topresentation in a web -based engine (e.g. Firefox, Chrome, Internet Explorer, Opera and Safari). The animations are results from the motion capture laboratory process and are shown in Figure4.29

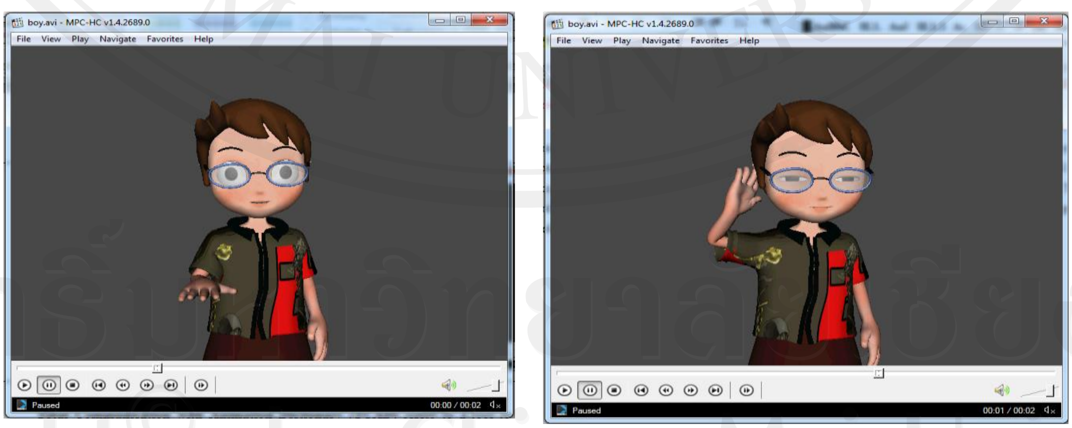


Figure 4.26 Post product of the animation sign language

4.8 System Implementation

After the production process, this research implemented the animation sign language output by representing those contents on web based application that were stored, updated and manipulated by the web database system. The design of TCAD system is comprised of a data flow diagram (DFD) and the entity relationship diagram (ER) to describe how the system works - shown in Figure 4.27 – 4.29

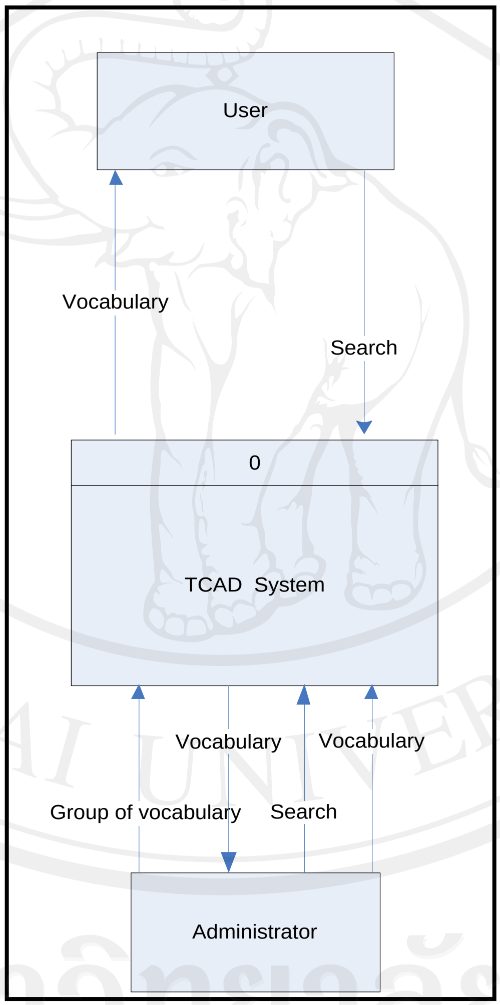


Figure 4.27 TCAD DFD, Context Diagram

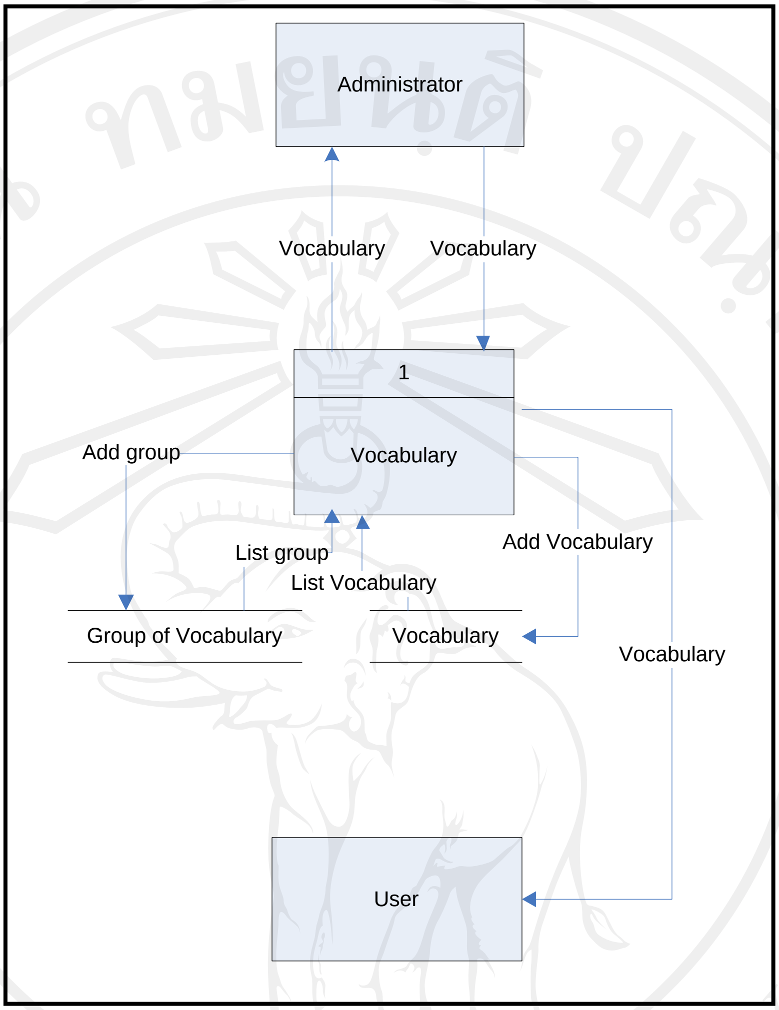


Figure 4.28 TCAD DFD level 1

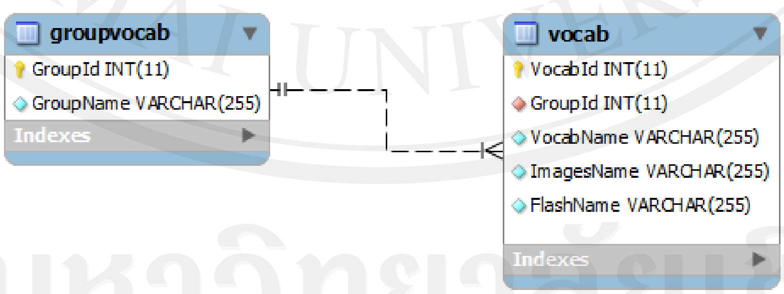


Figure 4.29 TCAD ER diagram

4.8.1 TCAD Screen design

After working on the database design, this research developed the screen to represent the TCAD system output that layouts the TCAD contents comprising of areas to search the TCAD vocabulary, areas to show animation sign language, Picture, Vocabulary meaning, The international phonetic, Finger spelling, Lip reading, and areas to link with the situational learning – this is presented in Figure 4.30 and Figure 4.31.

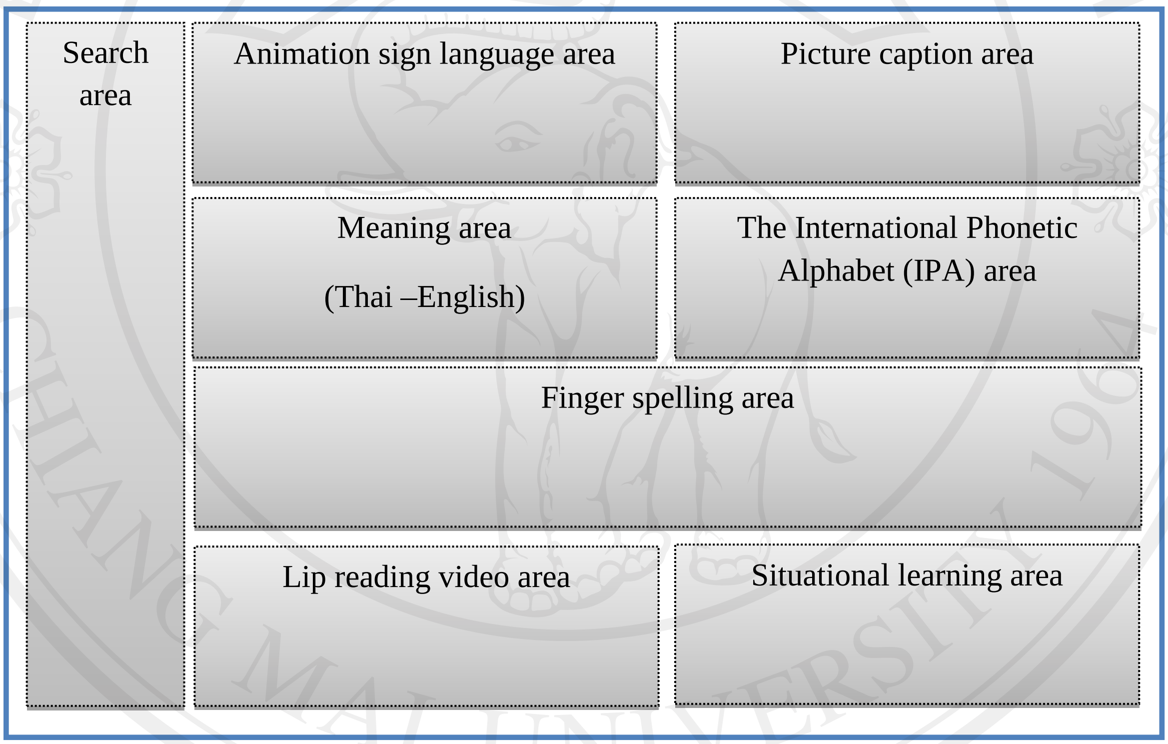


Figure 4.30 TCAD screen design

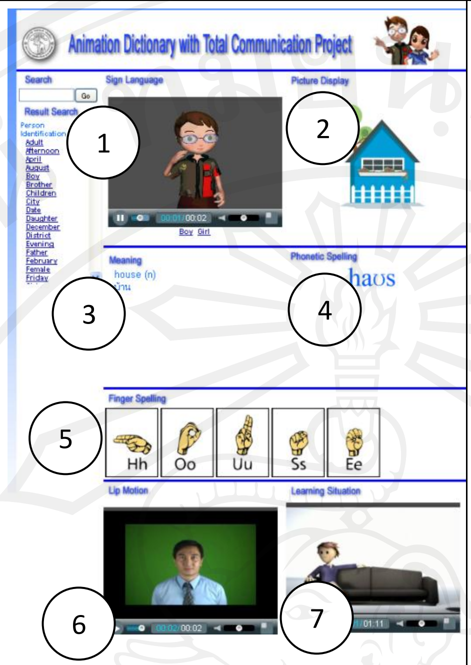
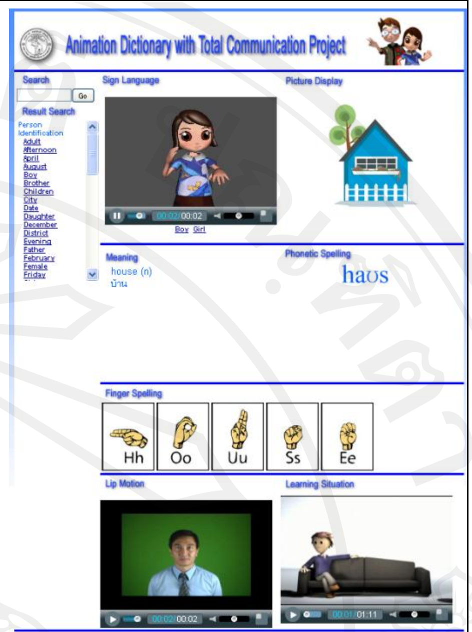
Key		
1= Animation Thai sign language 2= Picture caption 3= Meaning with Thai and English 4= International phonetic 5= Finger spelling 6= Lip reading video 7= Situational learning		

Figure 4.31 TCAD Screen (with boy and girl character)

Figure 4.31 demonstrates the total communication with animation dictionary (TCAD) screen comprised of seven parts of communication. The methods are sign language animation that shows in number 1, picture caption (number 2), meaning (number 3), phonetic(number 4), finger spelling (number 5), lip reading (number 6) and situational learning(number 7).

4.9 TCAD Pilot Testing

4.9.1 Animation dictionary refers to the English vocabulary program that is shown with a 3D animation model and Situational learning using 3D movie and Lip reading that supports the total communication. An Animation Dictionary cloud be asupplementary educational tool accessible wherever and whenever the learner requires it.

4.9.2 Total Communication with Animation Dictionary (TCAD) refers to a tool to be utilized in the English vocabulary program. Activities are based on encouraging hearing impaired students to their learning vocabulary. The English vocabulary program is a language class using animation as an applied tool for creating an intellectual learning environment, improving English language skills and enhancing vocabulary memory that consists of total communication.A supplementary educational technology tool, known as 'Total Communication with Animation Dictionary' (TCAD) is proposed in this study and refers to a tool to be utilized in the English vocabulary program. TCAD is a new tool for teaching English vocabulary to Thai primary school students with a hearing impairment. TCAD is a tool that has been adapted from the total communication method, the way of communication that usedwithin the school for the deaf Thailand that is composed of 8 ways of communicating which are sign language, lip reading, finger spelling, picture captioning, auditory, reading and writing. Since the TCAD had already been implemented in the experimental group it was found that the tool supported vocabulary in particular long-term memory retention. With the study extended to a large population and the number of vocabularies increased for these students. The results confirmed that the TCAD is an active supplementary vocabulary learning technique and a comprehensive instruction tool for the hearing impaired.

4.9.3 TCAD with the vocabulary relational knowledge with group of vocabulary (TCAD+)

From the user review in the first phase of study, the TCAD program extends to bundle the new situational learning part with a situational sign language application for classifying the vocabulary by placing or calling in the word place or known as TCAD with the vocabulary relational knowledge to improve vocabulary comprehension with group of vocabulary or TCAD+ which developing using a flash animation tool and is shown in figure 4.32- 4.33

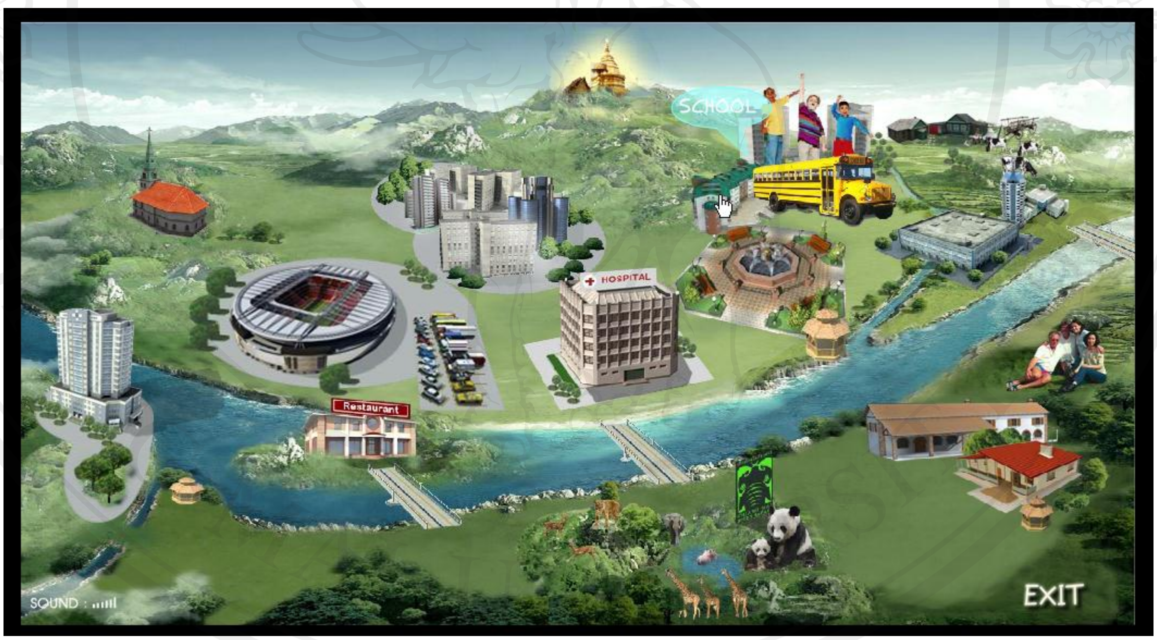


Figure 4.32 TCAD plus word place (TCAD+) Main Screen (vocabulary classified by town or location)

Figure 4.33 TCAD plus word place (TCAD+) (group of vocabulary in “school”)

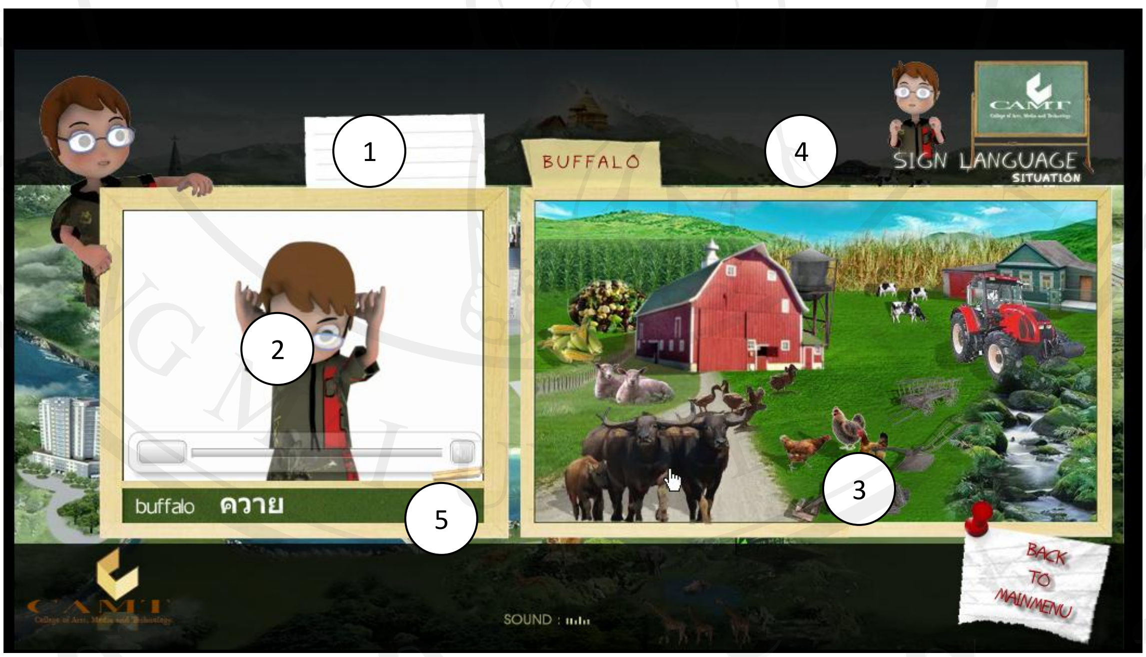


Figure 4.34 TCAD plus word place (TCAD+) (Farming group of vocabulary)

Figure 4.32 - 4.34 shows the situational sign language screens which are composed of towns or places for classifying the vocabulary group. This screen allows the student to recognize the vocabularies within an easy word group and the

application is created as an interactive tool so the student can click on the picture to learn vocabulary that translates into sign language; both Thai and English words are shown on the top and bottom of the frame. From the Figure 5, number 1 shows the group of vocabulary, number 2 shows the vocabulary sign language, number 3 shows the active picture for choosing vocabulary, number 4 shows the normal text in uppercase and number 5 shows the normal text in lowercase and the Thai meaning.

4.9.4 TCAD and Situational learning (TCAD++)

Situational learning is a general theory of knowledge acquisition. It has been applied in the context of technology-based learning activities for schools that focus on problem-solving skills (McLellan, 1995). Situate learning places a learner in an actual domain situation (authentic context) and interrelate with other people or the learning environment with real lessons, then the learning happens.This was first proposed by Jean Lave and Etienne Wenger as a model of learning in a community of practice which is learning that takes place in the same context in which it is applied. Lave and Wenger argue that situational learning is usually unintentional rather than deliberate and is not decontextualized knowledge from one individual to another, but a social process whereby knowledge is co-constructed; they suggest that such learning is situational in a specific context and embedded within an activity, a particular social and physical environment (Lave and Wenger,1991). The main principles of situational learning that are knowledge needs to be presented in an authentic context, i.e., settings and applications that would normally involve knowledge and learning and require social interaction and collaboration. Based on the finding of Lave and Wenger, some pedagogies recommended in the research literature on situational activities are as follows: Classrooms (like real world) that comprise of workshops, kitchens, greenhouses and gardens, role playing (in the real world setting) such as military training (also considered as a behaviorist approach),field trips such as archaeological digs and participant-observer studies in an unfamiliar culture, on-the-job-training such as traineeship and cooperative education and exact actions/practice (in the real setting) with the same paraphernalia or devices such as sports, music and arts practice (McDermott, 1998). In addition Anderson el al. claim that situational learning in four main areas of education are, (1) action is grounded in the concrete situation in which it occurs, (2) knowledge does not transfer between tasks, (3) training by abstraction is of little use and (4) instruction must be done in complex, social environments (Anderson el al, 1996).The term“action is grounded in the concrete situation in which it occurs" mean, in each situation knowledge occurs for problem solving in the context, specific situation and represents different knowledge required in such contexts for example, (Lave,1988) showed the case of an Orange County homemaker who did very well making a price optimization calculation when in a supermarket but did worse on question-answer mathematics problems in class, Similarly, and another cited example (Carraher and Schliemann, 1985) proposes the example of Brazilian street children who could implement mathematics when making sales in the street but were incompetent to answer the same problems presented in a school context. The term "knowledge does not transfer between tasks" means knowledge occurring in each situation cannot transfer to another and is personalized in each context. The term "training by abstraction is of little use" means the school instructional materials or methods do not match with the real-world environment and is abstract meaning the abstract instruction can be ineffective if what is taught in the classroom is not what is required on the job (Anderson el al, 1996).The term "instruction must be done in complex, social environments" means any skill must be done practically in real world contexts for example, sport skillsrequire time to practice, musical skillsrequire time to practice with the instrument. M communities of practice (COP) or group of learning are useful waysto help practice within the learning environment by people of equal status working together to enhance their individual acquisition of knowledge and skills (Anderson et al, 1996). In this study TCAD will bundle with the system that provide with the situational learning environment comprise of the Situational English vocabulary learning via a free social network game application, the TCAD Web browser add on for Firefox browser and the Learning story with vocabulary via leaning management system (LMS).

4.9.4.1 Situational English vocabulary learning via a free social network game application (TCAD++)

From the situation learning theory a real life English learning environment in is appliedusing web based multimedia technology. Situational learning theory support this work but additionally, the work from Brady 2004 proposes in “More Than Just Fun and Games” and shows that “*multimedia education improves both comprehension of the lesson material and students’ interest in the lesson topic* “(Brady, 2004). Moreover Klopfer et al 2010, argue that “games can engage players in learning that is specifically applicable to schooling and there are means by which teachers can leverage learning in such games without disrupting the worlds of either play or school” (Klopfer, et al, 2010).From related work, this research focuses on using the previous TCAD and TCAD+ with groups of vocabulary to bundled with a social networking game on Facebook (e.g. FarmVille and City Ville) to improve vocabulary acquisition and reading skills. In addition, this work provides a learning management system for the teacher to manage the lesson that they have ability to create a related lesson with they own from the online resource.

4.9.4.2 TCAD Web browser add on for Firefox browser

Concept

Users can choose the words from the text displayed on the Firefox browser by dragging the mouse over to the vocabulary needed to display the picture and animation of sign language that represents the meaning of those words. The aim is to create a firefox plugin, which allows the user to compile the programs online. When user selects the program code and press the button on the toolbar, the result of the program execution must be shown.

Solution Design

When the user selects the program code, it will be compiled and the result is displayed in a pop up window (*Showing the picture and sign language animation related to the meaning of this word).If the program code contains any errors or warnings, they will also be displayed. Modules involved are extracting the user selected code, compiling the code and displaying the result.

Implementation Plan

Technologies used for developing Firefox plugins include the following:

- XUL stands for "the XML User Interface Language"; it is a XML user interface markup language developed by the Mozilla project. XUL operates in Mozilla cross-platform applications such as Firefox and Flock. The Mozilla Gecko layout engine provides an implementation of XUL used in the Firefox browser (Feldt, Kenneth C. 2007).The XUL is operated with the Firefox user interface via .xul and working control by Java Script (https://developer.mozilla.org/en/XUL_School). The example of XUL is shown in Figure 4.35

Example

This example shows 3 buttons stacked on top of each other in a vertical box container:[8]

```
<?xml version="1.0"?>
<?xml-stylesheet href="chrome://global/skin/" type="text/css"?>

<window id="vbox example" title="Example 3...."
xmlns="http://www.mozilla.org/keymaster/gatekeeper/there.is.only.xul">
  <vbox>
    <button id="yes" label="Yes"/>
    <button id="no" label="No"/>
    <button id="maybe" label="Maybe"/>
  </vbox>
</window>
```

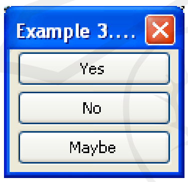


Figure 4.35 The example of XUL

- CSS

  Cascading Style Sheets (CSS) is a style sheet language used to describe the presentation semantics (the look and formatting) of a document written in a markup language. Its most common application is to style web pages written in HTML and XHTML, but the language can also be applied to any kind of XML document, including plain XML, SVG and XUL.

  CSS is designed primarily to enable the separation of document content (written in HTML or a similar markup language) from document presentation, including elements such as the layout, colors, and fonts. (Wikipedia, 2011)

- JavaScript

  JavaScript is a prototype-based, object-oriented[6] scripting language that is dynamic, weakly typed and has first-class functions. It is also considered a functional programming language.(Wikipedia, 2011)

- XPCOM

  XPCOM (Cross Platform Component Object Model) is a cross-platform component model from Mozilla. It has multiple language bindings and descriptions, so programmers can plug their custom functionality into the framework and connect it with other components. XPCOM is one of the main things that make the Mozilla application environment an actual framework. It is a development environment that provides the following features for the cross-platform software developer, Component management, File abstraction, Object message passing and Memory management.

The developer also needs to use compilers to execute programs. The figure below shows a layout of which technology is what to a plugin.

Figure 4.36 The layout of Firefox technology plugin architecture

From the architecture XPCOM is the memory function of plugin as same as the brain. The XUL processing is like a skeleton, and JavaScript is the programing language that function as the muscle. The CSS process represent the plugin as the skin.

Flow Chart

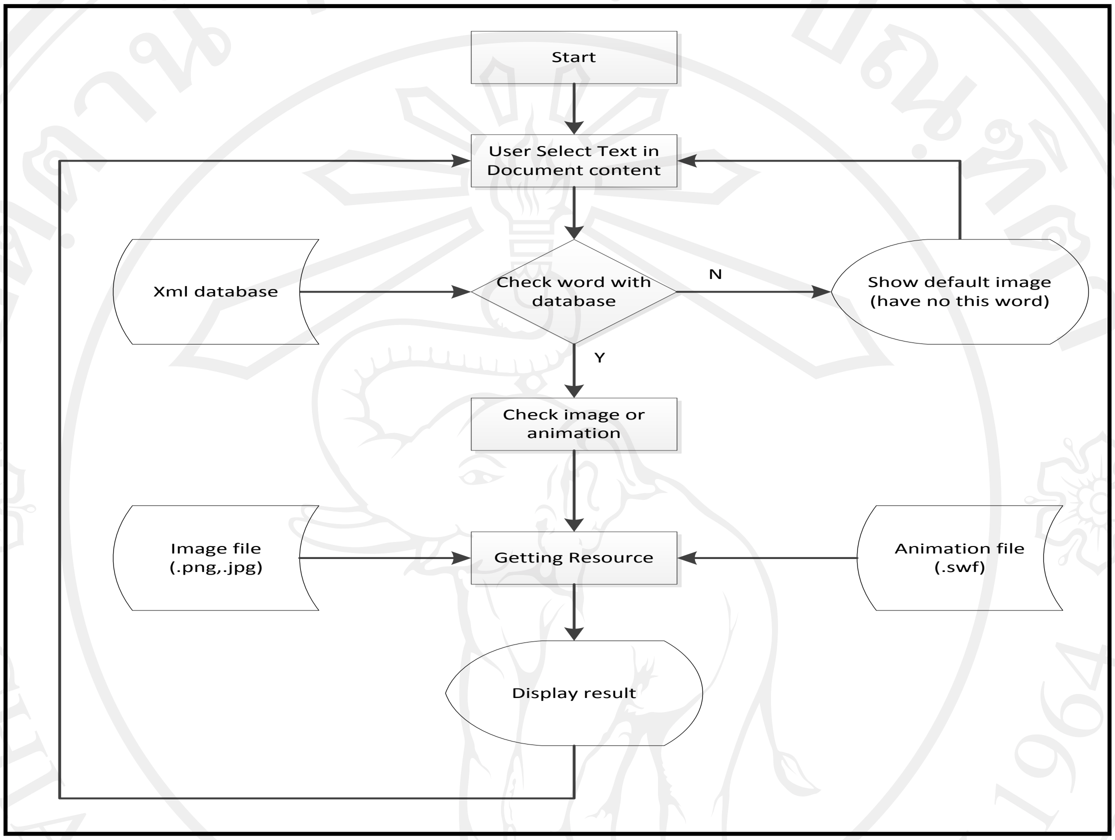


Figure 4.37 TCAD Web browser Add-on systems flow chart

Development process

- Created the extensionfile for Firefoxwith.xpi file.
- The .xpi creates a process comprising of file and folder creation that is flowing from Figure 4.38 to Figure 4.39 (https://developer.mozilla.org/en/chrome_registration)

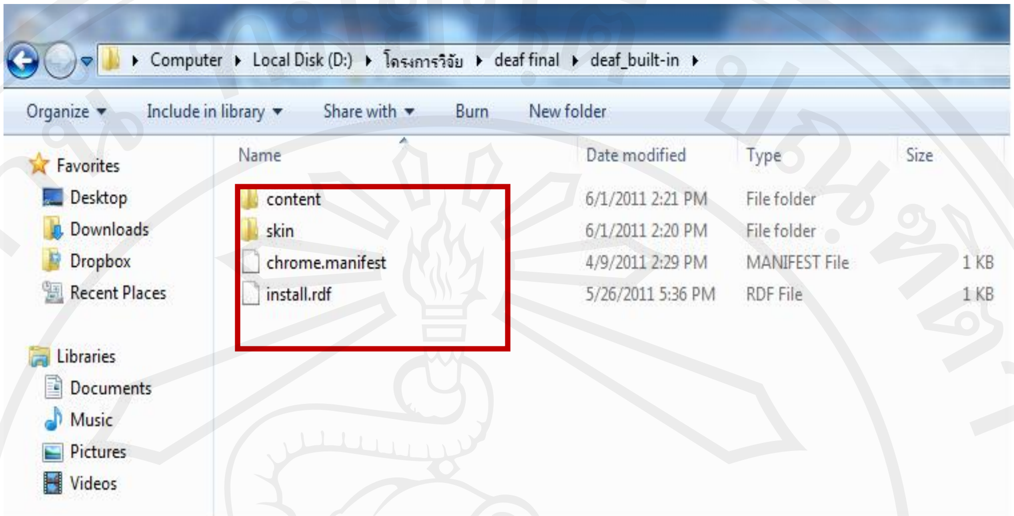


Figure 4.38 The content folder files

1. "Content" Folder is the folder containing the files for the program. The files are 2 files of .xul and .js (XUL and JAVA Script file).

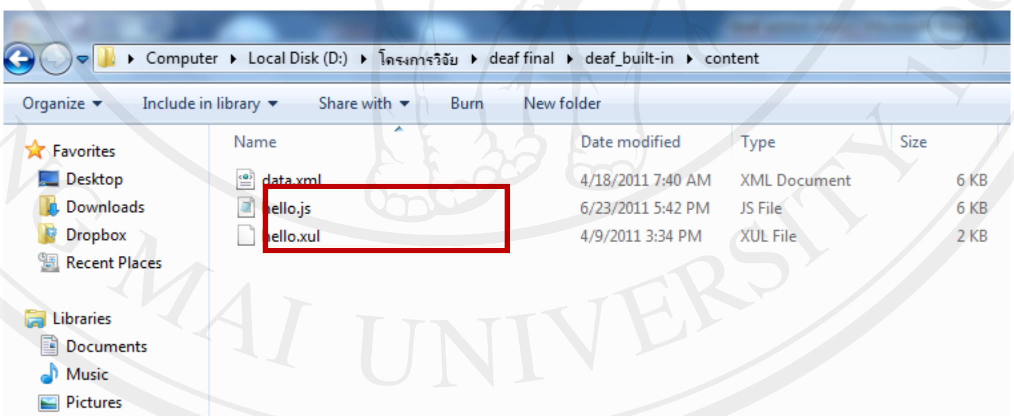
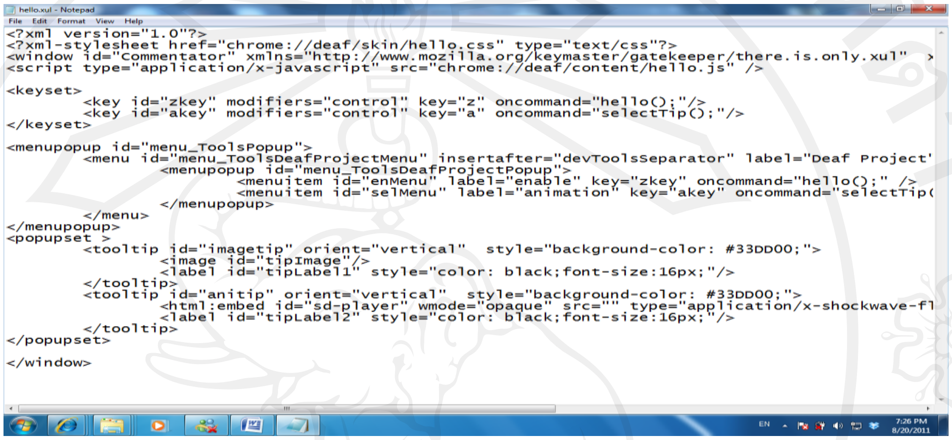


Figure 4.39 Files of content folder

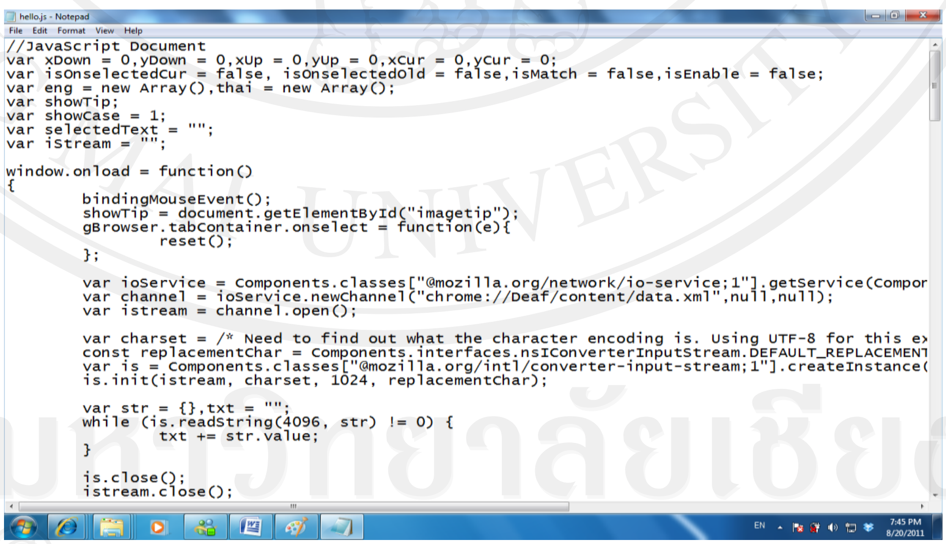
1.1 The. Xulfile is an xml file used for declaring the user interface object in Firefox and the files connected to the control file (.Jsfile). By tagging the name of a script in which this project has announced, the user interface object are the key set, menu pop up, menu, pop up set and tool tip.



```
<?xml version="1.0"?>
<?xml-stylesheet href="chrome://deaf/skin/hello.css" type="text/css"?>
<window id="Commentator" xmlns="http://www.mozilla.org/keymaster/gatekeeper/there.is.only.xul"
<script type="application/x-javascript" src="chrome://deaf/content/hello.js" />

<keyset>
        <key id="zkey" modifiers="control" key="z" oncommand="hello();"/>
        <key id="akey" modifiers="control" key="a" oncommand="selectTip();"/>
</keyset>

<menupopup id="menu_ToolsPopup">
        <menu id="menu_ToolsDeafProjectMenu" insertafter="devToolsSeparator" label="Deaf Project'
                <menupopup id="menu_ToolsDeafProjectPopup">
                        <menuitem id="enMenu" label="enable" key="zkey" oncommand="hello();" />
                        <menuitem id="selMenu" label="animation" key="akey" oncommand="selectTip(
                </menupopup>
        </menu>
</menupopup>
<popupset >
        <tooltip id="imagetip" orient="vertical"  style="background-color: #33DD00;">
                <image id="tipImage"/>
                <label id="tipLabel1" style="color: black;font-size:16px;"/>
        </tooltip>
        <tooltip id="anitip" orient="vertical"  style="background-color: #33DD00;">
                <html:embed id="sd-player" wmode="opaque" src="" type="application/x-shockwave-fl
                <label id="tipLabel2" style="color: black;font-size:16px;"/>
        </tooltip>
</popupset>

</window>
```

Figure 4.39 XUL file

1.2 The .js file is the java script language for contain add-on the control program that show on Figure 4.40



```
//JavaScript Document
var xDown = 0,yDown = 0,xUp = 0,yUp = 0,xCur = 0,yCur = 0;
var isOnselectedCur = false, isOnselectedOld = false,isMatch = false,isEnable = false;
var eng = new Array(),thai = new Array();
var showTip;
var showCase = 1;
var selectedText = "";
var iStream = "";

window.onload = function()
{
        bindingMouseEvent();
        showTip = document.getElementById("imagetip");
        gBrowser.tabContainer.onselect = function(e){
                reset();
        };

        var ioService = Components.classes["@mozilla.org/network/io-service;1"].getService(Compor
        var channel = ioService.newChannel("chrome://Deaf/content/data.xml",null,null);
        var istream = channel.open();

        var charset = /* Need to find out what the character encoding is. Using UTF-8 for this ex
        const replacementChar = Components.interfaces.nsIConverterInputStream.DEFAULT_REPLACEMENT
        var is = Components.classes["@mozilla.org/intl/converter-input-stream;1"].createInstance(
        is.init(istream, charset, 1024, replacementChar);

        var str = {},txt = "";
        while (is.readString(4096, str) != 0) {
                txt += str.value;
        }

        is.close();
        istream.close();
```

Figure 4.40 The .js file

2. “Skin” folder is the container for resource file for using to program appearance such as picture and animation file comprising of .css file (Figure 4.42); that is the file for connecting the Firefox to connect with other resources shown in Figure 4.43

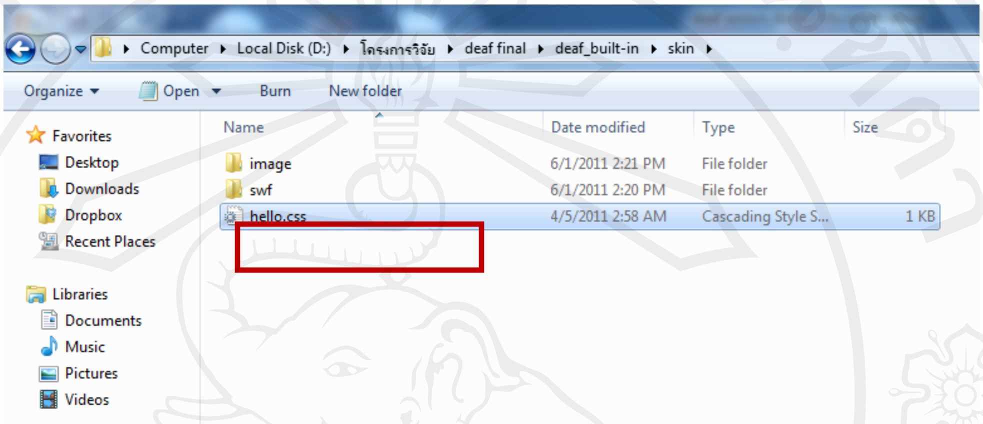


Figure 4.42 Skin folder

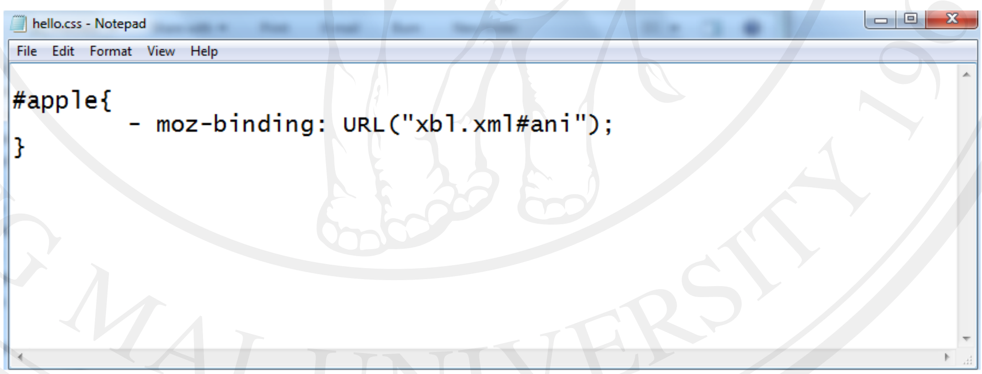


Figure 4.43.css file

3. The chrome.manifest file is the root file for add-on that is used for other component mapping file for run on Firefox.

```
content deaf content/
skin deaf classic/1.0 skin/

overlay chrome://browser/content/browser.xul chrome://deaf/content/hello.xul
style chrome://browser/content/browser.xul chrome://deaf/skin/hello.css
```

Figure 4.44 Chrome.manifest file

4. The install.rdf file is the XML file for identifying the detail of program before installing the working process, such as the program being named on the version development or the minimum and maximum of the Firefox compatible version.

```
<?xml version="1.0"?>
<RDF xmlns="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
xmlns:em="http://www.mozilla.org/2004/em-rdf#">

<Description about="urn:mozilla:install-manifest">

<!-- Required Items -->
<em:id>patcharapongw@gmail.com</em:id>
<em:name>deaf project</em:name>
<em:version>0.9</em:version>

<!-- Required Items - Target Application - Firefox -->
<em:targetApplication>
<Description>
<em:id>{ec8030f7-c20a-464f-9b0e-13a3a9e97384}</em:id>
<em:minVersion>3.6</em:minVersion>
<em:maxVersion>3.6.*</em:maxVersion>
</Description>
</em:targetApplication>

<!-- Optional Items -->
<em:creator>Aob</em:creator>
<em:description>dictionary for deaf people</em:description>
</Description>
</RDF>
```

Figure 4.45 Install.rdf file

Database connection with XPCom is a cross platform component object model, similar to Microsoft COM. It has multiple language bindings, letting the XPCOM components be used and implemented in JavaScript, Java, and Python in addition to C++. Interfaces in XPCOM are defined in a dialect of IDL called XPIDL. XPCOM itself provides a set of core components and classes, e.g. file and memory management, threads, basic data structures (strings, arrays, variants), etc. The majority of XPCOM components is not part of this core set and is provided by other parts of the platform (e.g. Gecko or Necko) or by an application or even by an extension. This project uses the XPCOM component for connecting the database system with the XMLfile.(https://developer.mozilla.org/en/XPCOM) The connection code is shown in Figure 4.46.

```
var ioService = Components.classes["@mozilla.org/network/io-service;1"].getService
                (Components.interfaces.nsIIOService);
var channel = ioService.newChannel("chrome://Deaf/content/data.xml",null,null);
var istream = channel.open();

var charset =  "windows-874";
const replacementChar = Components.interfaces.nsIConverterInputStream
                .DEFAULT_REPLACEMENT_CHARACTER;
var is = Components.classes["@mozilla.org/intl/converter-input-stream;1"]
                .createInstance(Components.interfaces.nsIConverterInputStream);
is.init(istream, charset, 1024, replacementChar);
```

Figure 4.46 XPCOMdatabase connection component

Tool for Add-on development

1. Notepad – Text Editer for edit and typing the related programing code.
2. FireFox – web browserfor program testing and debugging.
3. extension_developer-0.3.0.20100706-fx+tb+sb.xpi is the extension builder that is an add-on that working withFirefox using forrelated file compactinginto the.xpi file.

The.xpi creation

1. Installing theextension builder onFirefox web browser.
2. After installing user can use the file with Firefoxthat aretool > extension developer>extension builder. Show in Figure 4.47.

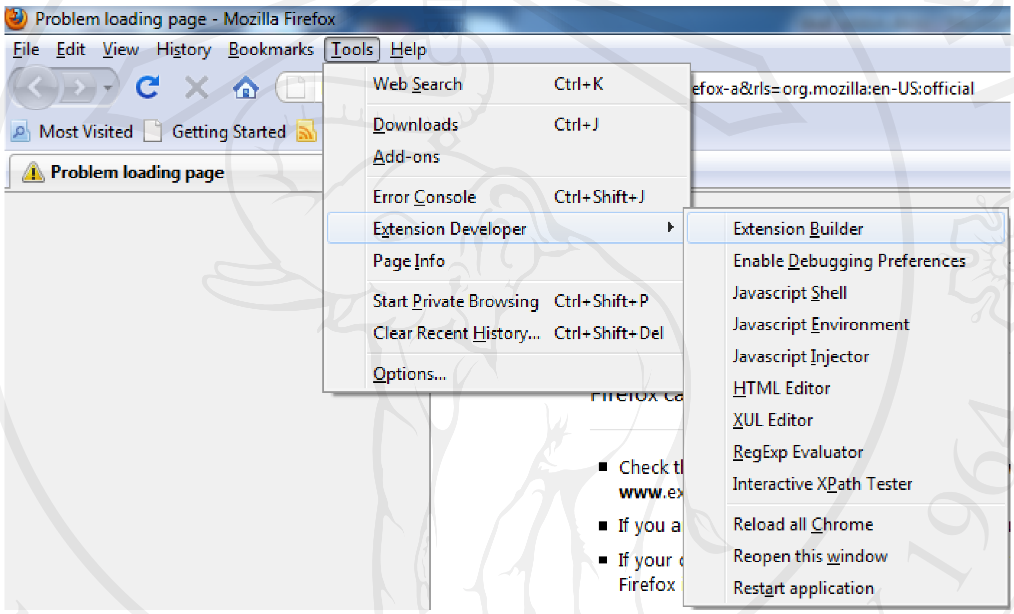


Figure 4.47 .xpi creation file

3. From the step 2 theextension builder show in Figure 4.50 (above) the creation process occur when user choosing the destination folder for save the requirement file and compacting file into .xpi and build extension show in Figure 4.48

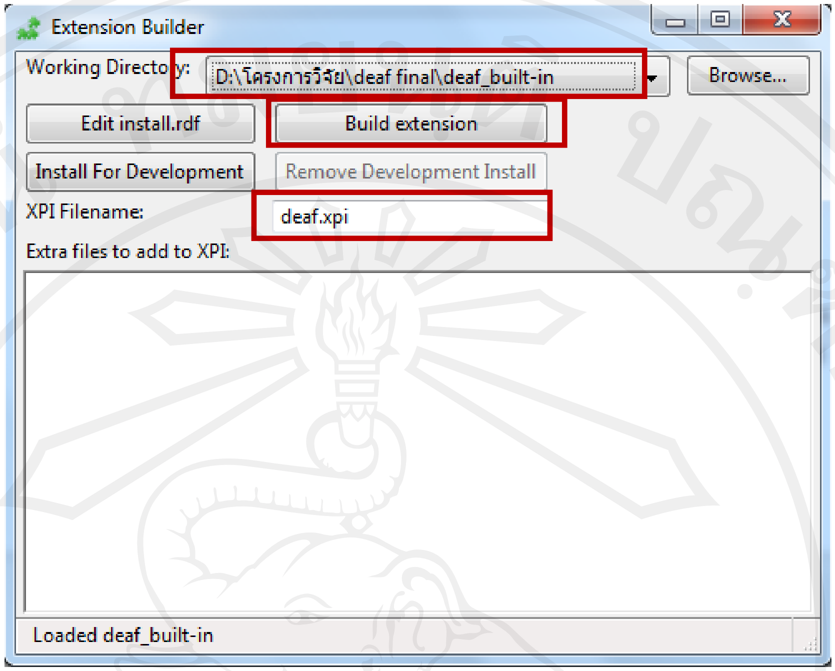


Figure 4.48 Building the extension file

4. After building the extension file the result show in figure 4.49.

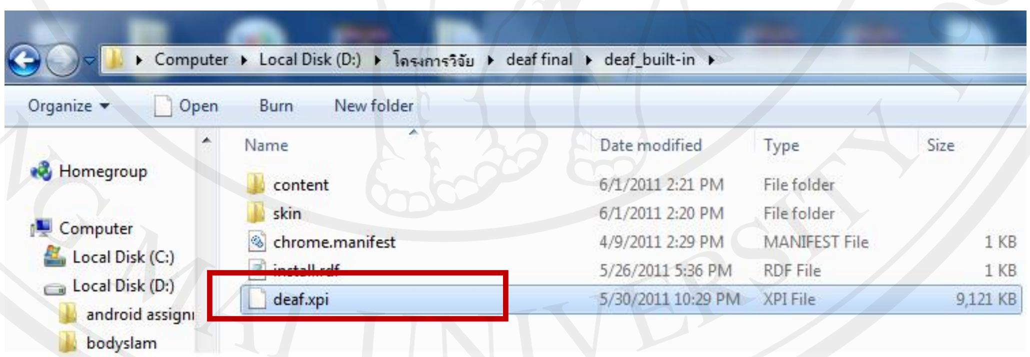


Figure 4.49 Output of .xpi file

5. After building the extension file - the result is shown in figure 4.49. The install and using the .xpi file for Firefox add-on for the hearing impaired is shown in Figure 4.50 to Figure 4.53.

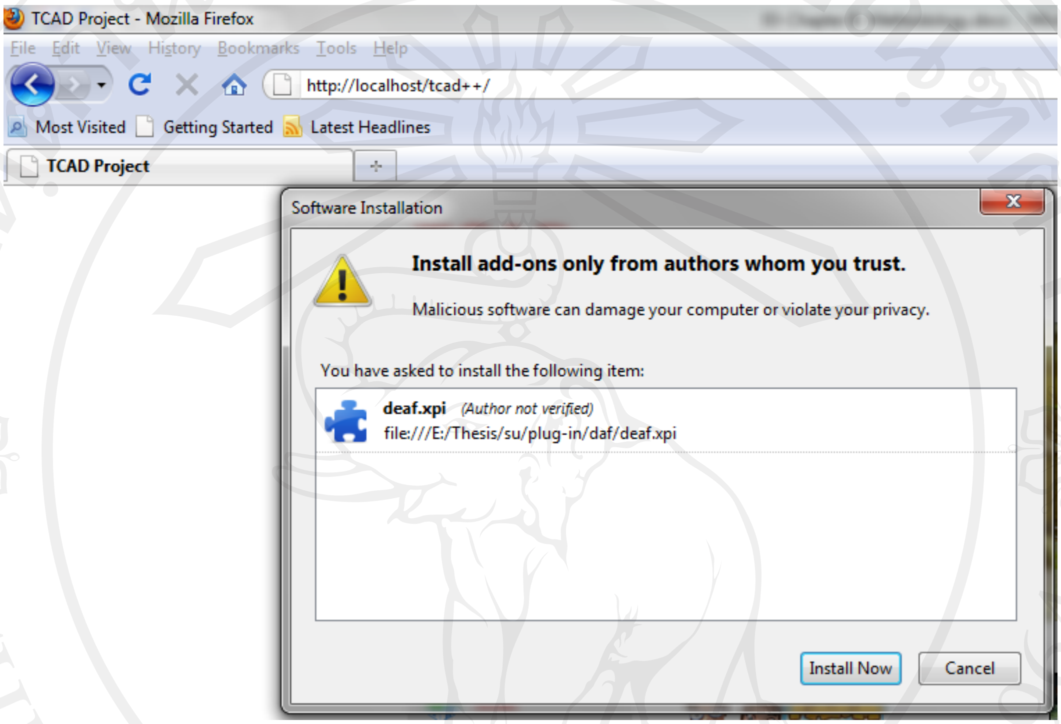


Figure 4.50 The installing process of .xpi add-on file.

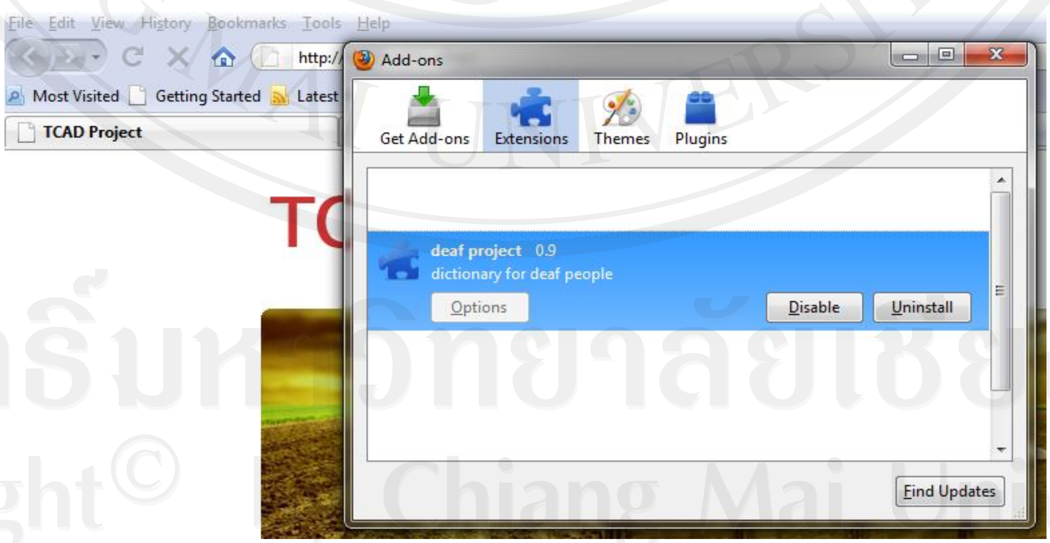


Figure 4.51 The result after installing process of .xpi add-on file

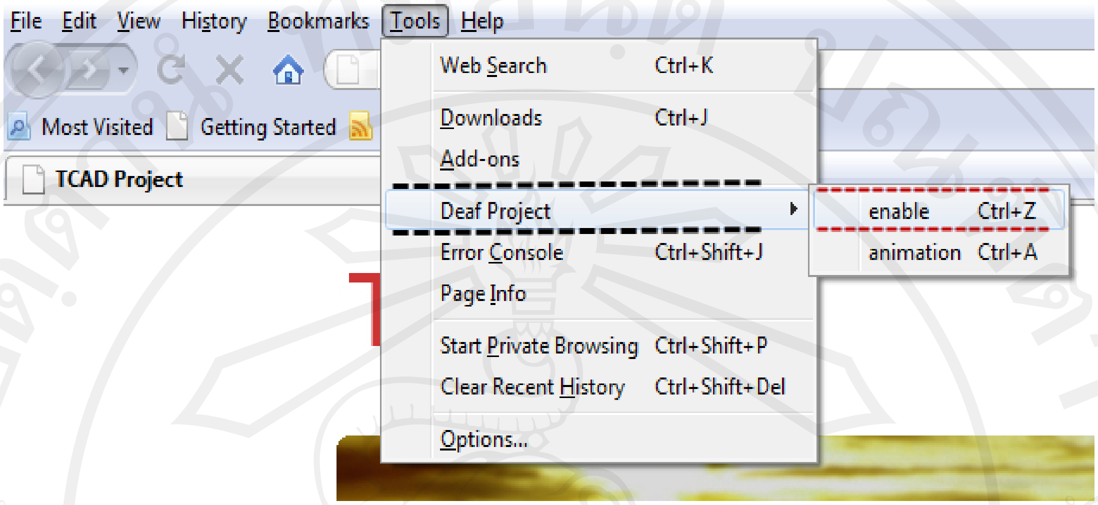


Figure 4.52 The TCAD Firefox add-on control for the hearing impaired

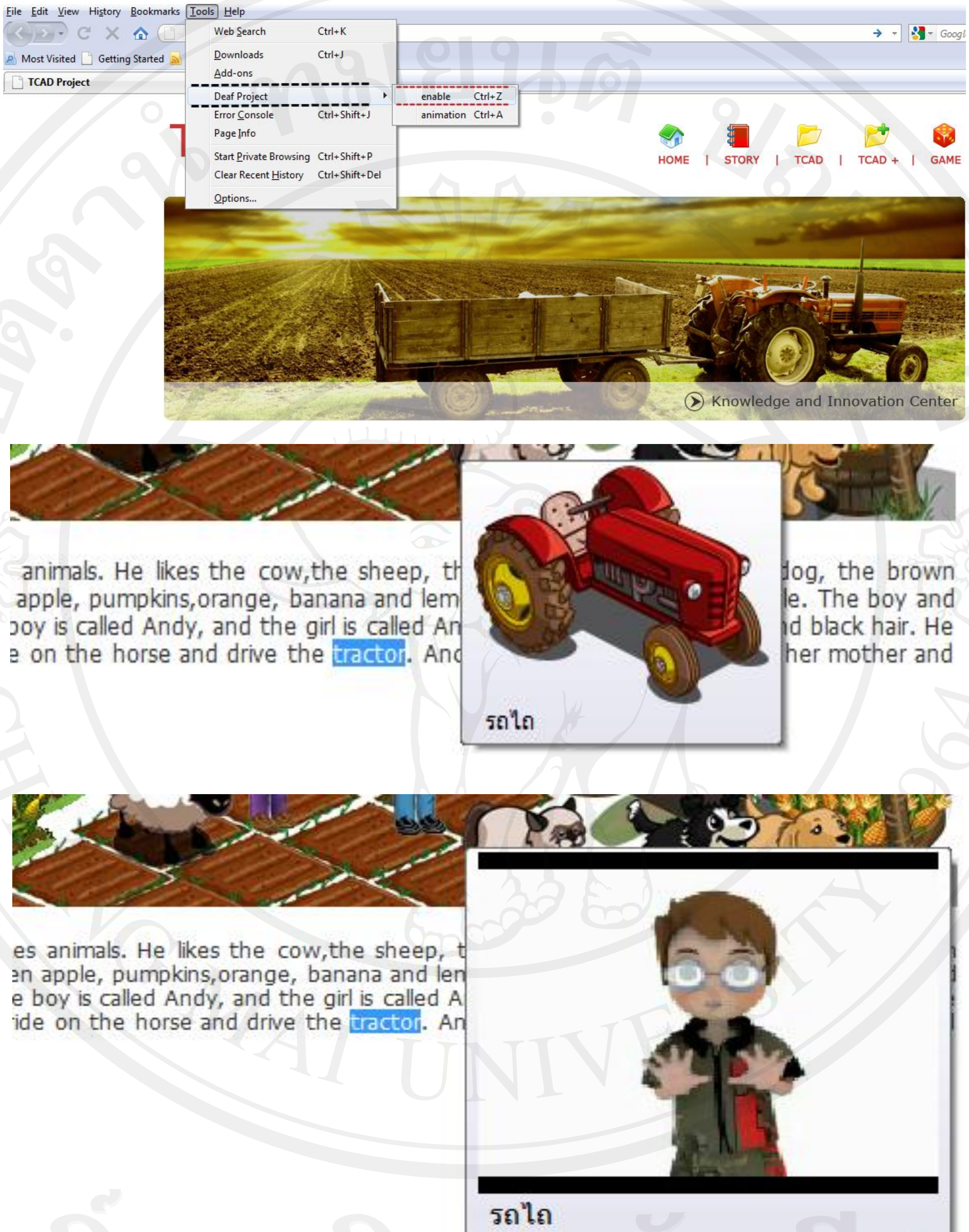


Figure 4.53 The TCAD Firefox add-on show the picture and sign language animation for the hearing impaired

4.9.4.3 Learning story with vocabulary via leaning management system (TCAD LMS)

TCAD++ provides the teacher with a learning management system (LMS), LMS support in three main parts, lesson management, vocabulary management and the quiz report. In lesson management they have ability to create learning lesson with TCAD vocabulary and related games (for example the story that shown below is about a farming story related with the FarmVille game on Facebook) and add the content of story in English and Thai, that are related to the story and quiz for the test Pre-test and Post-test. In the vocabulary part, they can add vocabulary with pictures and sign language animations by a picture file or video format file in the LMS and the quiz report shows the student quiz result by date and time. For the students, they can highlight the vocabulary in the TCAD++ system to translate the text into pictures and sign language in each vocabulary.

The learning management system design

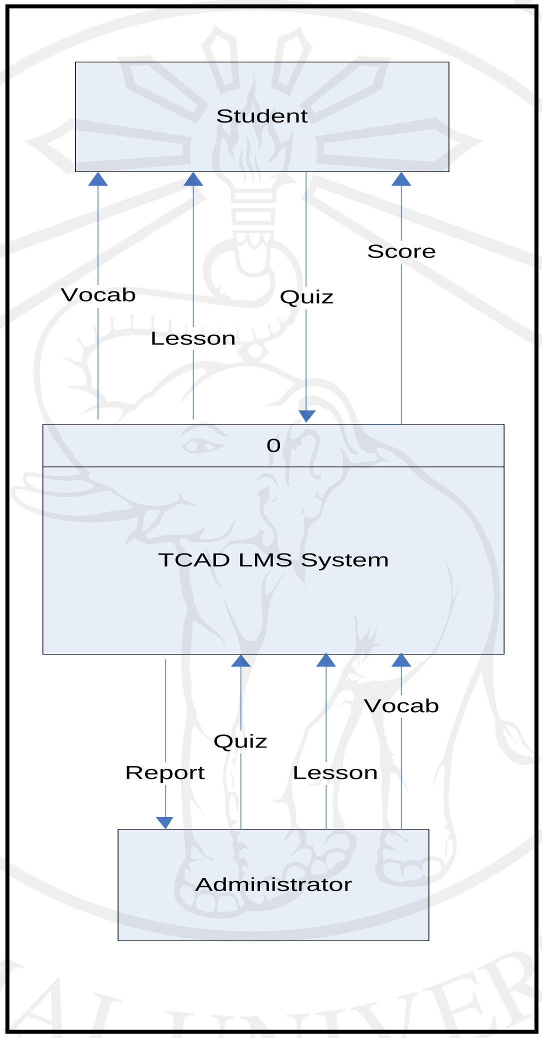


Figure 4.54 TCAD LMS Data flow diagram (Context Diagram)

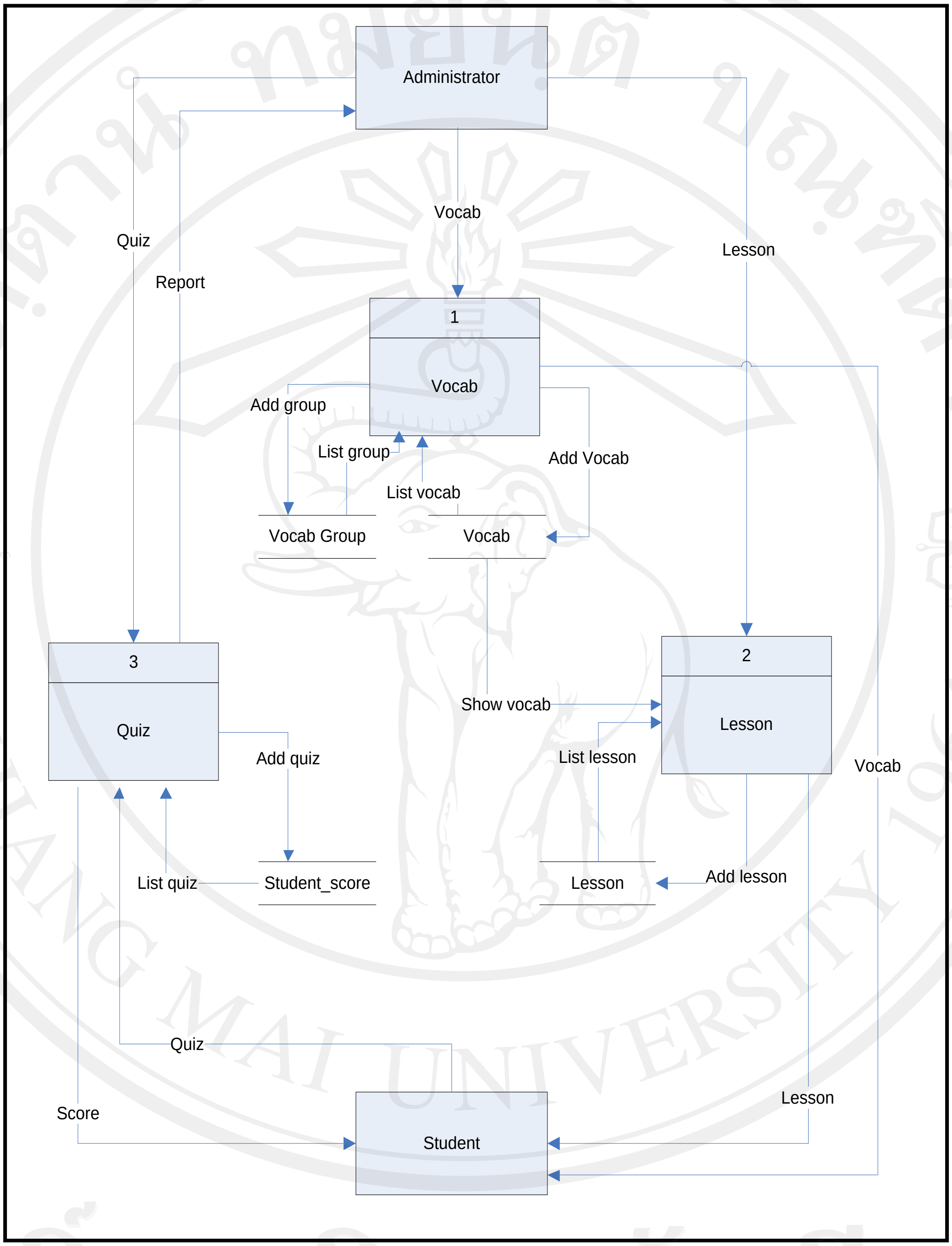


Figure 4.55 TCAD LMS Data flow diagram

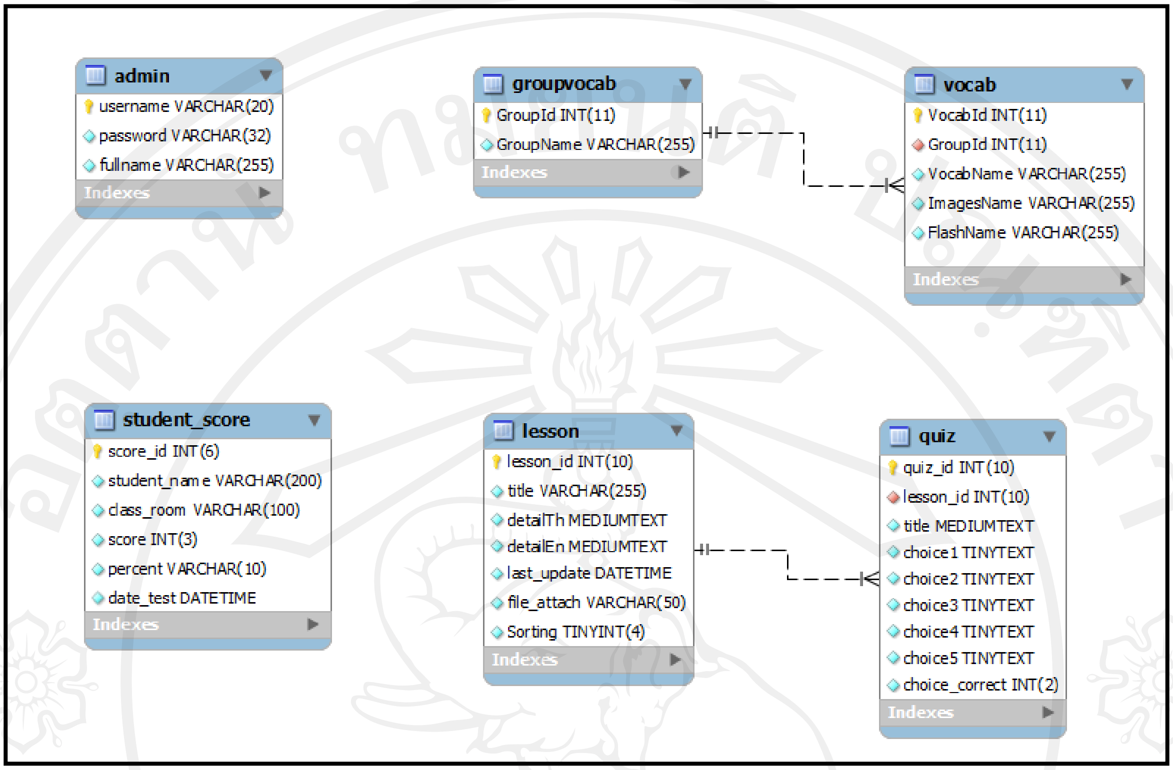
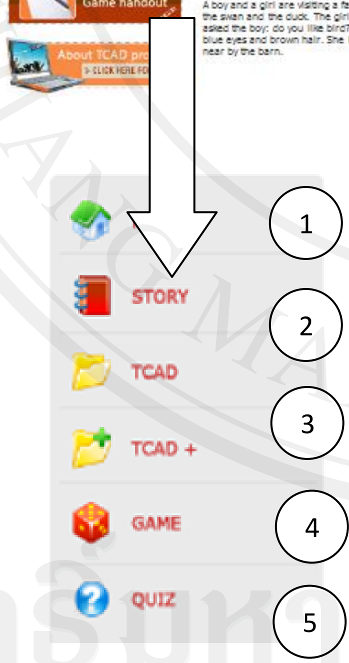


Figure 4.56 TCAD LMS Entity relationship diagram (ER)

The picture of TCAD++ system as shown below;



The TCAD++ portal page for the students shows as; Story link with number 1 show the story page,TCAD link with number 2 show the TCAD vocabulary page, TCAD+ link with number 3 show the TCAD with the group of vocabulary, Game link with number 4 link with the game on Facebook and quiz link with number 5 show the quiz page.

Figure 4.57 TCAD++ portal page for the students

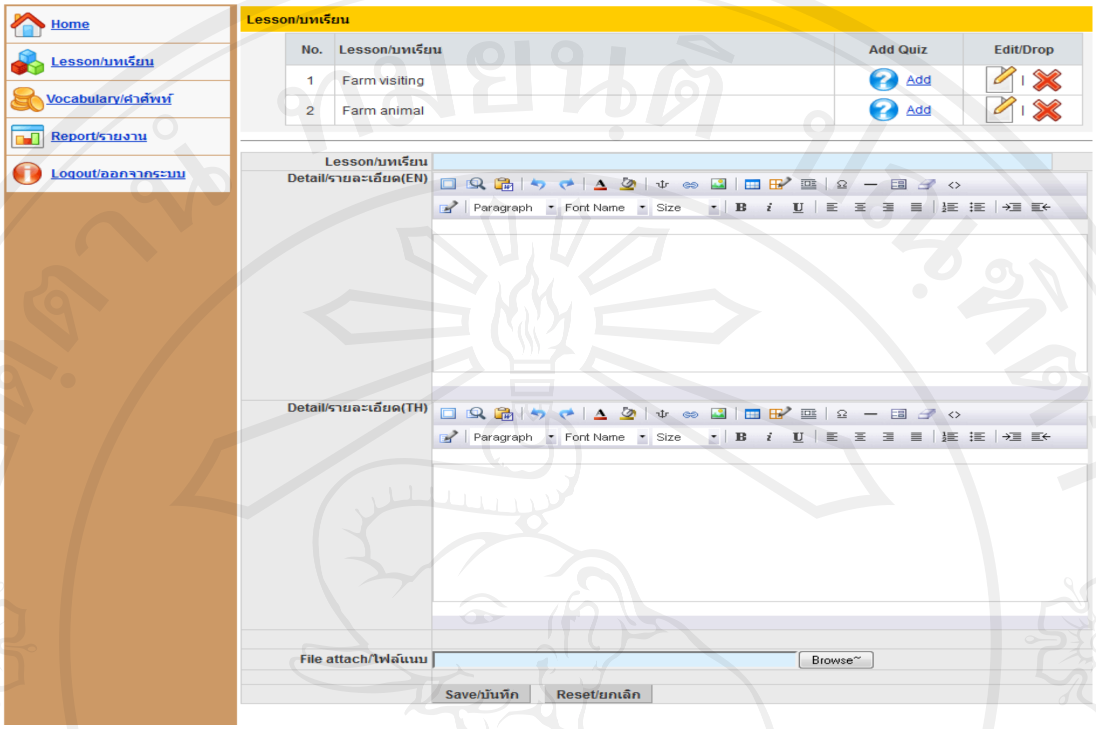


Figure 4.58 Learning management system (LMS) for the teacher, lesson management part

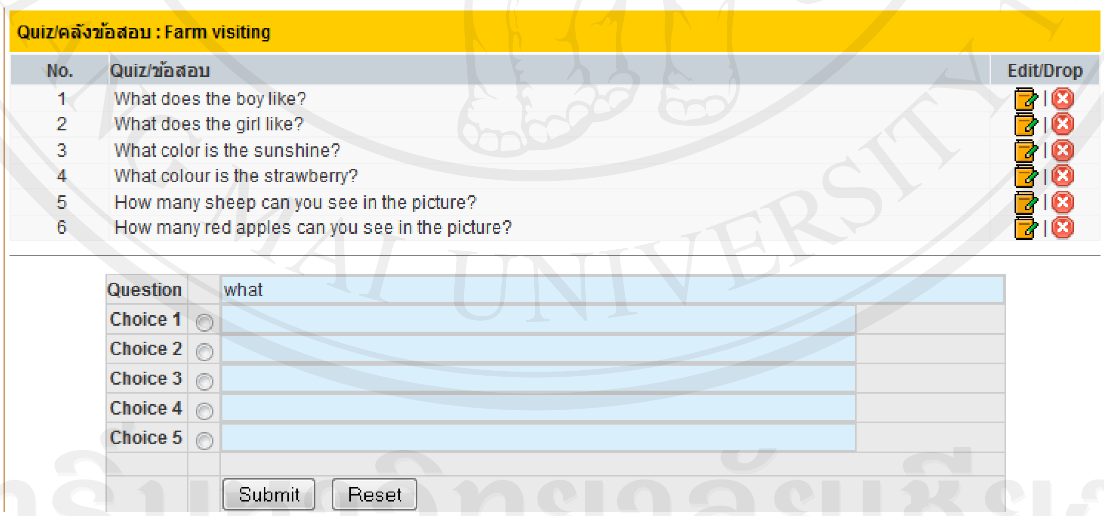


Figure 4.59 Learning management system (LMS), Quiz management in lesson management part

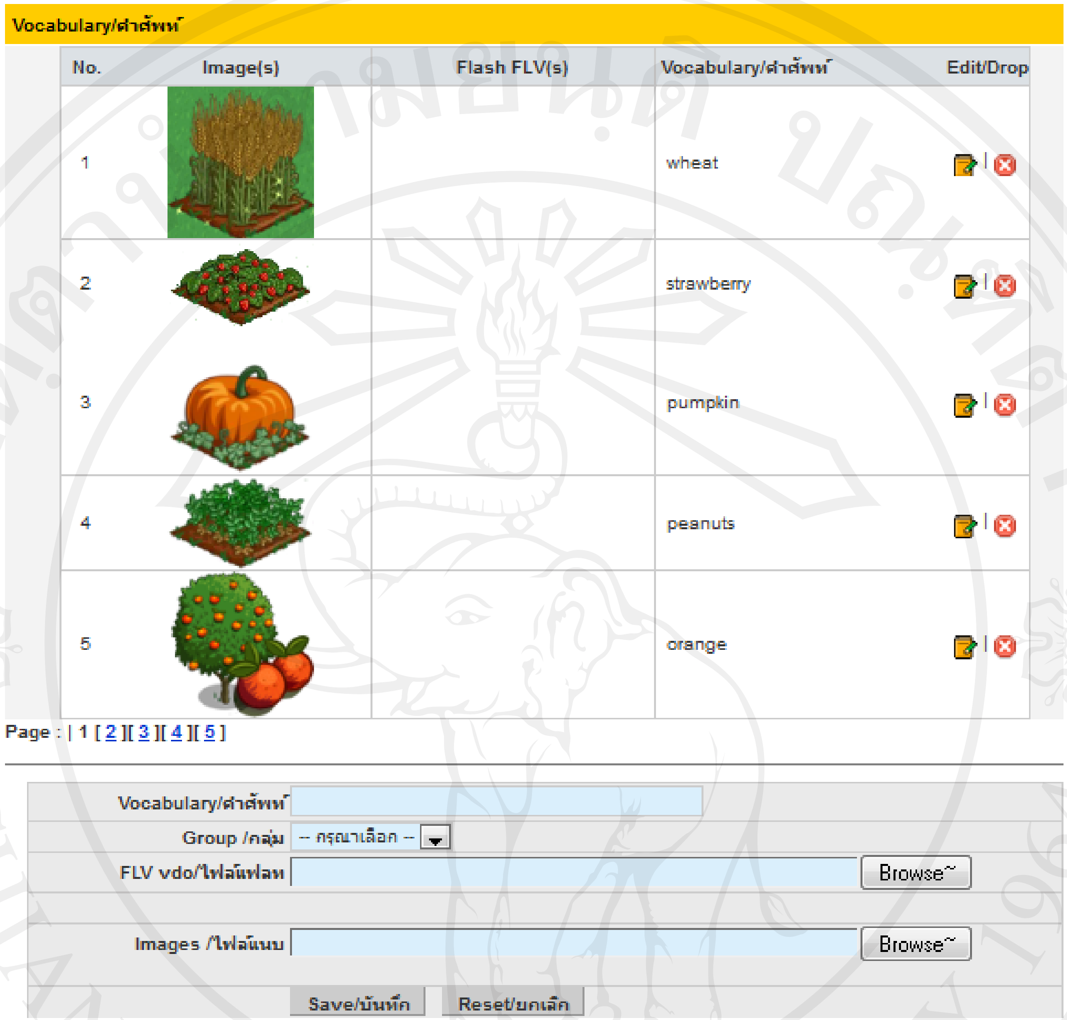


Figure 4.60 Learning management system (LMS), Vocabulary management part

Report/รายงาน

No	Student Name	Class room	Score	Percentage(%)	Date quiz
1	Santi Jaidee	4/2	5	100.00	09.04.2011 17:33:34
2	bernie	6/1	5	100.00	04.04.2011 15:12:04
3	Arut	3/2	2	40.00	03.04.2011 16:32:26
4	santichai wicha	3/1	5	100.00	03.04.2011 01:19:06

Page : | 1

Figure 4.61 Quiz report for the teacher

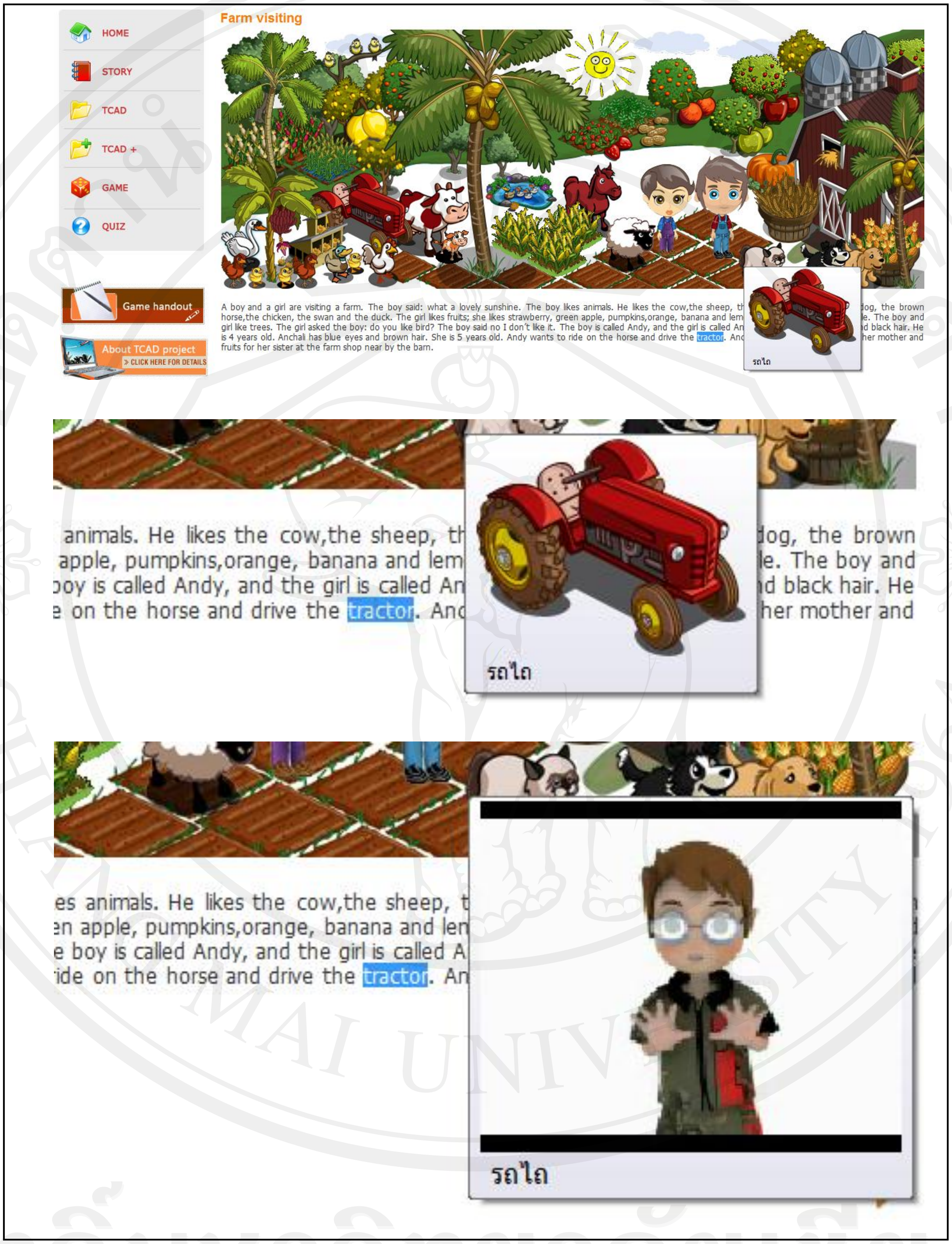


Figure 4.62 Story display and translation from text into picture and Thai sign language of vocabulary

Figure 4.63 Quiz display and translation from text into picture and Thai sign language of vocabulary

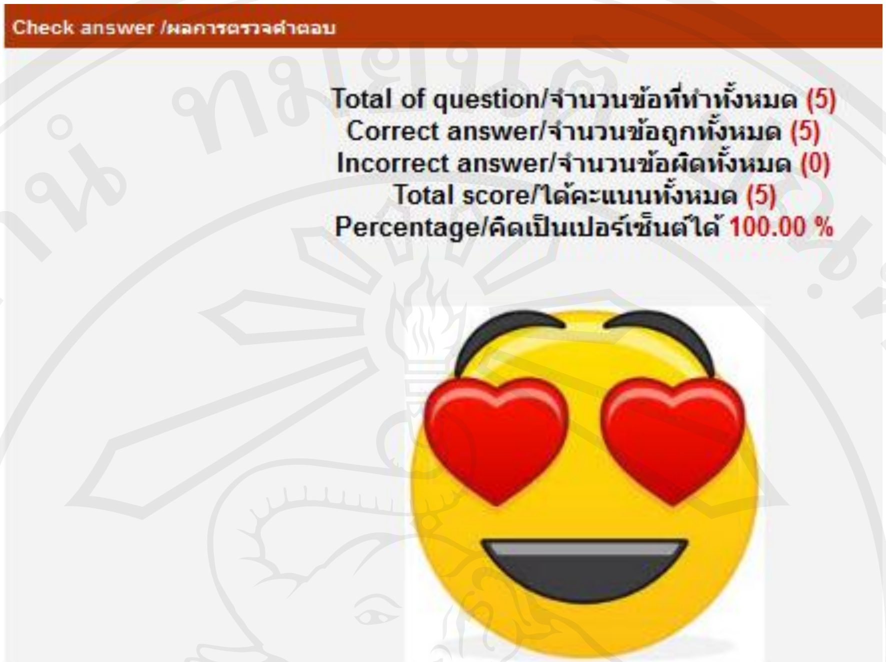


Figure 4.64 Quiz result from the student

4.10 TCAD system Implementation and testing plan

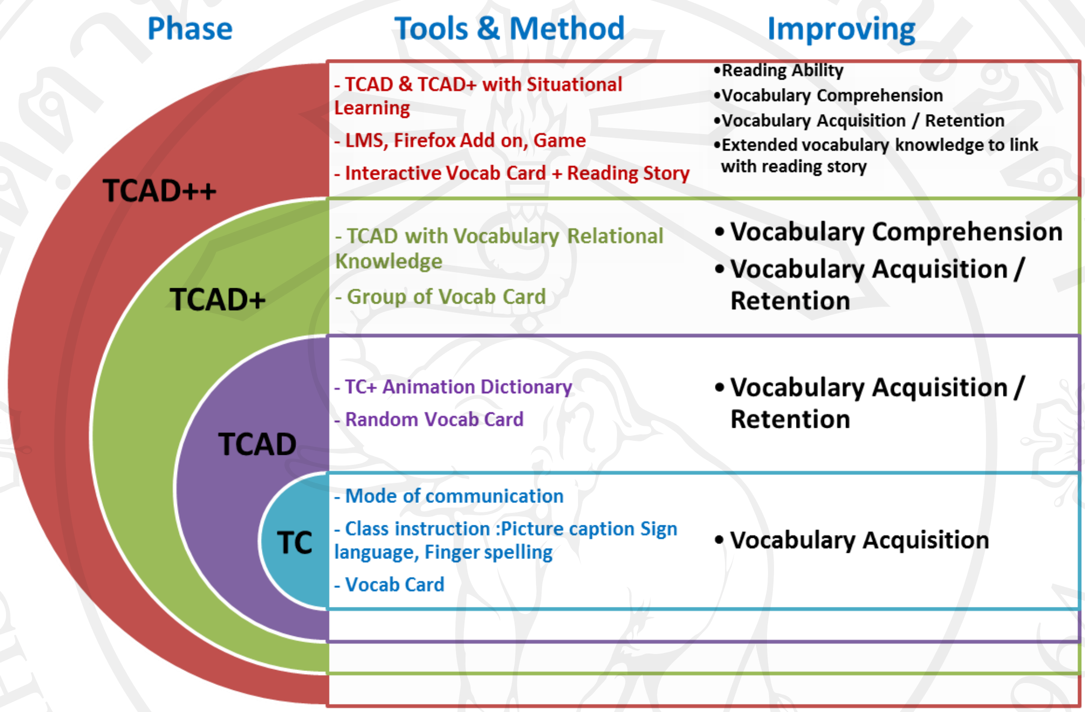


Figure 4.65 TCAD system implementation details

Figure 4.65 describes the TCAD system implementation details. It is comprised of the fourth phase of development and demonstrates the implementation of the Total communication or TC from the first phase using the mode of communication as the tool in the class instruction. The second phase is the TCAD that applies the TC and the animation dictionary system in the class instruction. The third phase is the TCAD+. It uses the TCAD with the relational vocabulary knowledge that classifies the TCAD vocabulary by group. The fourth phase is the use of TCAD+ with a situational learning tool that comprises of a learning story with game on the learning management system. The TCAD system was applied to the hearing impaired students in primary level 1-6 at the Chiangmai Anusarnsoontorn School for the Deaf, Thailand. The learning plan is to determine whether the TCAD system, as a supplementary tool for teaching how to communicate in English as a second language, is effective in helping students learn. The students are tasked with learning how to use the vocabulary in situations for 25- 30 minutes every day. From there, they are checked on their results from using the vocabulary and the game through a pretest and posttest. The data results are gathered to produce a statistical analysis (Chapter 4). The reason for using the 25 -30 minute class is to reduce the concentration span of hearing impaired students (LandesinstitutfürSchule, 2003 cited in A.Stoppok, 2010).