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Thai Lip-Reading CAI for Hearing Impairment Student

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***Abstract*— This paper is proposed the lip-reading computer assisted instruction (CAI) for hearing impairment student. It consists of two units: the first unit is a part of the learning lesson. In this unit, the student can learns the various categories of vocabulary. The vocabularies come from the thing which use in day life, such as Fruit, Animal, vehicles and so on. It enables student to practice pronunciation by looking at a model speaker mouth movement. The second unit is the multiple choice game. The student has to see lip-reading video and choose the correct answer choice. Experiments are tested with ten hearing impairment primary school students. The result of before and after practicing with the CAI system are evaluated. The rate of correctly mouth shape recognition is grater after practicing with the system for improvement of pronunciation.**

Keywords—Lip Reading, Hearing Impairment Student, Computer Assisted Instruction, E-Learning.

I. INTRODUCTION

Lip-reading is a technique of understanding speech by visually interpreting the movements of the lips, face and tongue when normal sound is not available. Many deaf people use lip reading to help communicate with people who do not speak sign language. Some deaf people have practiced this skill for many years. However, their lip-reading performance is still poor. Hearing impaired people achieve an accuracy of only 17±12% even for a limited subset of 30 monosyllabic words and 21±11% for 30 compound words Therefore, lip-reading is a notoriously difficult task [2]. The problem of improving in lip-reading skill is the lack of resource for self-learning tool. Thus, using computer assisted instruction (CAI) in this topic has become widespread to help learning process. A CAI is an interactive instructional technique which uses a combination of text, graphics, sound and video in enhancing the learning performance [3]. The CAIs for lip-reading have been various proposed. Oda and Kono [1] developed the pronunciation practice CAI system for deaf children. This system provides a study unit to practice pronunciation by looking at computer graphic animation of month movements of the model speaker in Japanese language. Lipreading Practice [4], This site presents lip-reading using video clips as well as written exercises. Skills and practice material in the sessions focus on learning to recognize the lip shape and movements of most sounds. The site aims to enable those who have a hearing loss and who are unable to join a lip-reading class the opportunity to develop lip-reading skills. The material is designed to help to develop lip-reading skills and to practice them in a safe environment. Lipreading.org [5] the online lip-reading training course and game. This is a multiple choice game and, in each part, user will be presented with a list of words. User are to watch the speaker in the film clip and select choice of word from that accompanying list. If user choose correctly, the game will then automatically move on to the next multiple choice sample.

Many CAIs for lip-reading were proposed. However, there is lack of Thai vocabulary lip-reading. Therefore, the aim of our work is to develop Thai lip-reading CAI for hearing impaired student which help them to improve lip-reading skill while they use this assistive tool. Our CAI consist of two main units: (1) Learning lesson: students will see mouth movement video which they can practice. (2) Multiple Choice Game: After student learns in first unit, they can play the game to test improvement of lip-reading skill.

II. COMPUTER ASSISTED INSTRUCTION COMPONENTS

A. The Vocabularies

The vocabularies have been selected from the thing which use in daily life. There are five categories such as fruit, animal, equipment, vegetable and vehicle which have one or three syllables. Each category consists of twenty words as show in Table I. All vocabularies will be pronounced in Thai language.

TABLE I. VOCABULARY CATEGORIES.

Fruit	Animal	Equipment	Vegetable	Vehicle
Orange	Ant	Chair	Chili	Motorcycle
Banana	Bird	Glass	Lime	Van
Apple	Butterfly	Television	Ivy gourd	Ship
papaya	Bee	Bag	Cucumber	Air plane
melons	Tiger	Pencil	Convolvulus	Bus
Grape	Turtle	Pen	Kale	Train
Durian	Dog	Eraser	Galangal	Tuk tuk
Longan	Crab	Sandal	Ginger	Phothong
Pomelo	Zebra	Spoon	Lemongrass	backhoe loader
Rose apple	Snake	Table	Tomato	Tank
Rambutan	Rabbit	Refrigerator	Cabbage	Helicopter
Tamarind	Cow	Sock	Spring Onion	Truck
Goosebery	Giraffe	Clock	Humming bird tree	Wagon
Jujube	Deer	Toothbrush	Cowpea	long-tailed boat
Coconut	Duck	Fan	Chinese cabbage	Submarine
Mango	Elephant	Toothpaste	Cilantro	Electric train
Strawberry	Fish	Umbrella	Eggplant	Carriages
Mangos teen	Lion	Shirt	Onion	Spaceship
Pineapple	Monkey	Fork	Gourd	Car
Lychee	Pig	Skirt	Bean	Bike

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B. *The Learning Lesson*

The CAI also provides a learning lesson to practice pronunciation by looking at a model speaker mouth movement. A lip-reading video shows mouth movement of the model speaker. Therefore, the students can compare from video with their own mouth movement. In the system, there are sign language video and image. Thus, students can understand the meaning of lip-reading video in each vocabulary. Furthermore, there is search component which students can search for specific vocabulary as they want to learn. The learning lesson example for each vocabulary category can be shown in Fig.1.

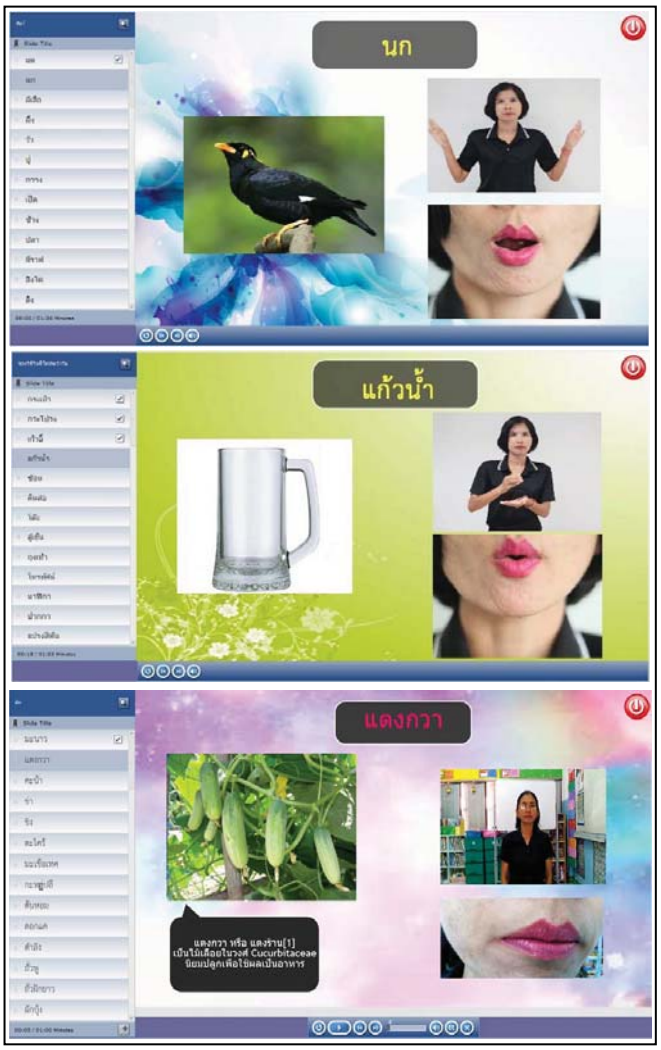

Fig. 1. The learning lesson example

C. *The Multiple Choice Game*

We have chosen to develop multiple-choice games because The multiple choice format is most frequently used in educational testing. The student has to see lip-reading video and choose the correct answer choice. A correct answer earns a set number of points toward the total score. The question will be randomized from question pool to give a different question when student plays this game next time. There are twenty questions per round. In addition, there is solution which student can see correct or wrong answer. The multiple choice game example can be shown in Fig.2

Fig. 2. The multiple choice game example

III. EXPERIMENTATION

A. *Sample Group*

This is a quantitative research with the sample size of ten. The students are from the fourth grade of Phuketpanyanukul School for the hearing impairment student. There are four males and six female students. The average age of all students are about ten years old. They have various in terms of ability of hearing and basic of lip-reading. Fig.3 show sample student who test the CAI system.

Fig. 3. Testing CAI by sample student.

B. User Testing

We used the pre-test and post-test analysis process for eight times. Both tests consist of twenty question with multiple choices for each lip-reading video which random from question pool, the student has to choose what each represents. Students have to do the pre-test question. After that, teacher will use our CAI to teach lip-reading skill. When student finish lesson, they have to do the post-test question. We calculated the score of each student by adding the points of each question when they get correct. Table II shows how each student performed on their pre-test and post-test in each experiment.

TABLE II. EXPERIMENT RESULT.

The 1st experiment result										
Student	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Pre-test	1	2	2	3	2	2	1	2	1	3
Post-test	2	3	3	2	1	3	2	2	2	3
The 2nd experiment result										
Student	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Pre-test	2	1	3	2	2	2	1	2	2	3
Post-test	1	2	1	3	2	2	2	3	2	3
The 3rd experiment result										
Student	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Pre-test	4	7	5	6	4	8	4	5	4	6
Post-test	5	8	8	7	5	8	9	5	6	9
The 4th experiment result										
Student	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Pre-test	2	5	5	5	8	11	10	16	19	20
Post-test	7	7	8	6	9	10	12	16	17	20
The 5th experiment result										
Student	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Pre-test	5	6	6	6	10	12	11	16	19	20
Post-test	9	8	7	7	11	12	14	17	20	20
The 6th experiment result										
Student	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Pre-test	6	6	9	7	10	12	9	17	19	20
Post-test	7	8	11	8	10	13	11	18	19	20
The 7th experiment result										
Student	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Pre-test	7	6	9	8	8	12	10	16	19	20
Post-test	10	8	9	11	10	13	11	18	19	20
The 8th experiment result										
Student	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Pre-test	8	7	9	8	10	13	12	18	19	20
Post-test	10	8	9	11	17	15	15	18	20	20

From the experiment result, all students show some improvement of lip-reading testing. In 1st and 2nd experiment, we found that these experiments give poor result because we design the multiple choice game as image question and lip-reading video choices, as shown in Fig.4 (a). This design cause game difficult to play because student cannot distinguish the difference in each video choice. Therefore, we have discussed with teacher to change the design of multiple choice game. The new design for multiple choice game consists of the question lip-reading video and the choices are text answers as shown in Fig.4 (b). During the test, we notice that sample students can be separated into two categories: quick learners (student 6-10) and slow learner (student 1-5). They vary in terms of ability of hearing and basic of lip-reading skill, which results in different learning step. In Fig. 5, we show the average number of correct answer in each experiment. According to the graph, we receive 52.3% average improvement from pre-test experiment that students can recognize mouth movement and 60% average improvement from post-test experiment that students can recognize mouth movement. Furthermore, we also asked the student to rate how they feel about learning and playing the game. All students are satisfied with the learning lesson and game, and found it more enjoyable than studying without CAI.

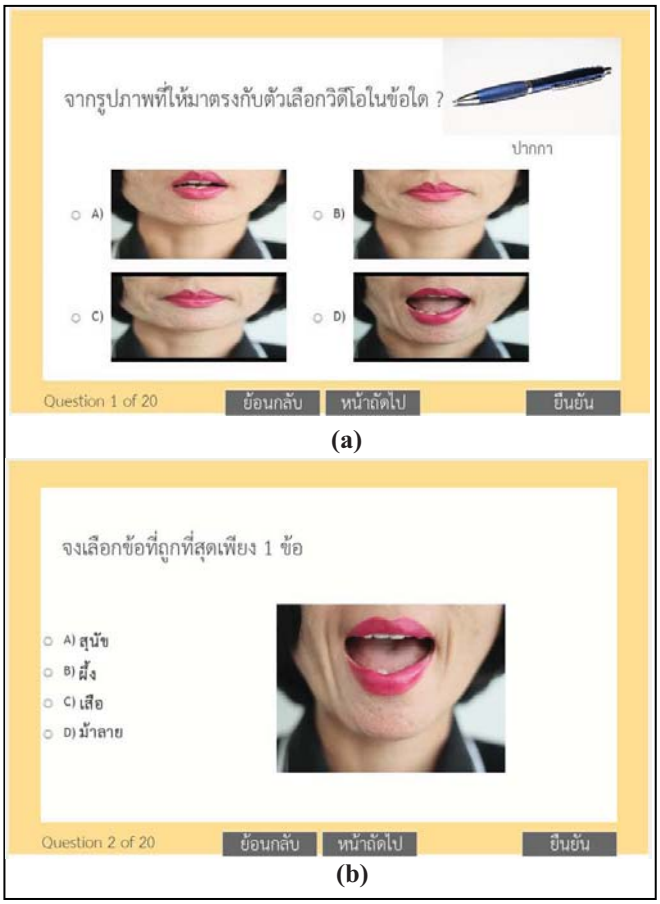

Fig. 4. Multiple Choice Game: (a) previous design (b) new design.

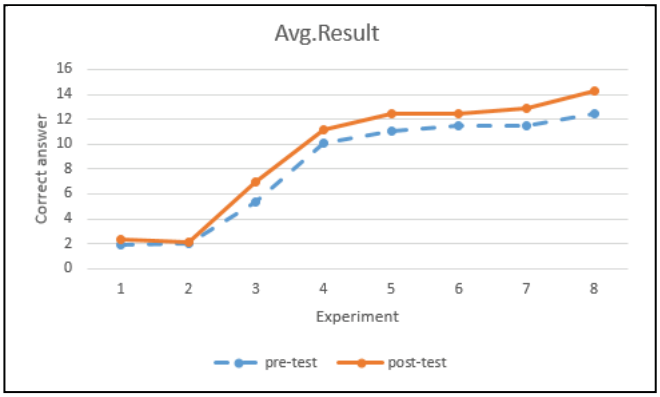

Fig. 5. Average Result (pre-test, post-test).

IV. CONCLUSION

we developed the CAI application that is used as a lip-reading learning tool for hearing impaired student. Structure

of this CAI consist of learning lesson unit and game unit. For The learning lesson unit, student will learn to understand mouth movement of each vocabulary that use in daily life. They can practice and compare their mouth shape with example mouth model. For the game unit, student plays the multiple-choice game to select the correct answer of the question. We conducted an experiment to test if the CAI can help and serve as a learning platform. The result is measured from effectiveness. The test for effectiveness showed positive results. From the pre-test and post-test process, all student scored are more after learning the CAI. Experiment data showed that the number of correct answer increased. In addition, the feedback after CAI using, the students attend to learn and would like to play the game. Therefore, these results indicated that our CAI could help students to learn in lip-reading.

V. Future Work

Currently, our CAI has been used in Phuketpanyanukul School for the hearing impairment student (Phuket province). For our future work, we will distribute our CAI to other province where there are school for the hearing impairment school. For example, Phangnga and Songkla provinces. Furthermore, we would like to add other vocabularies which help student to practice more and more lip-reading skill.

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