

# Thai Finger-Spelling Computer-Assisted Instruction for Hearing and Speaking Impaired Children

Kittasil Silanon

Department of Computer Engineering,  
Prince of Songkla University,  
Phuket Campus,  
Thailand,83120

kittasil.silanon@gmail.com

## ABSTRACT

In this paper, we describe our finger-spelling computer-assisted instruction tool which is available to help persons; especially hearing and speaking impaired children whom are studying in primary school. The problem of inexperienced in finger-spelling skill are lacking of expert for monitoring and of self-learning tool. Thus, the use of computer-assisted instruction technology to enhance learning is an effective approach for the children. We will focus specifically on Thai finger-spelling which includes 42 letters and 24 vowels/tone marks. Most of children thought finger-spelling were the toughest part of learning sign language. Therefore, our computer-assistive instruction tool is designed both as an instructional material presented by computer system and as a practical game interface which help them to improve working memory and to read finger-spelling skills while they use this assistive tool.

## Keywords

Thai finger-spelling, Assistive Technology, Computer assistive instruction

## 1. INTRODUCTION

A sign language system can be separated into 2 categories, as follows: 1). word-level vocabulary signs, those are the signing of hand shapes, direction and movement of the hands, arms or body, and facial expressions simultaneously to express meanings which are used in the majority of communication. 2). finger-spellings, which are using finger postures to alphabetically word in spoken language, for communicating names, places, technical words, or anything else which is not in sign language, and can be used as a source of new word. From research, we found that hearing and speaking impaired persons, especially children, who use sign language have problems with finger-spelling skill because they use word-level vocabulary signs for communicating each other. In contrast, finger-spelling has been used for 7% to 10% of communication with sign language in daily life. Thus, acquisition of finger-spelling skill typically lags far behind other sign language skills (finger-spelling is the first skill learned and the last skill mastered). The problem of improving in finger-spelling skill is the lack of resources for self-learning and requires sign language expert for monitoring which may be insufficient for classroom learners. Therefore, Computer-assisted instruction (CAI) [2] use in learning has become widespread from primary education through university level. CAI is an interactive

instructional technique which uses a combination of text, graphics, sound and video in enhancing the learning process. There are many types of CAI; **(1) Drill-and-practice:** drill and practice provide opportunities or students to repeatedly practice the skills that have previously been presented and that further practice is necessary for mastery. **(2).Tutorial:** tutorial activity includes both the presentation of information and its extension into different forms of work, including drill and practice, games and simulation. **(3).Games:** game software often creates a contest to achieve the highest score and either beat others or beat the computer. **(4).Simulation:** simulation software can provide an approximation of reality that does not require the expense of real life or its risks. **(5).Discovery:** discovery approach provides a large database of information specific to a course or content area and challenges the learner to analyze, compare, infer and evaluate based on their explorations of the data. **(6).Problem solving:** this approach helps children develop specific problem solving skills and strategies.

The CAIs for finger spelling has been various proposed. Wolfe et al. [1] introduced practice software displays realistic animations of American finger-spelling (ASL), including naturalistic transition between letters that were previously impossible. Jeffrey Cougler [3] established interactive computer assisted instructional which designed to ASL improve students' receptive abilities when using the application. Poobrasert et al. [4] developed multimedia support system (animation and colorful graphics) as assistive technology for hearing impaired student in Thailand to learn ASL finger-spelling. Information Technology Education Center (ITEC) [5] proposes the fifty sound of Japanese finger-spelling (JSL) which written hiragana, katakana and Romanized script. If the application cursor is moved over the top of a sound, the matching hand posture in JSL will be revealed. British finger-spelling (BSL) game [6] was proposed which learners need to read as many finger-spelling word as they can in three minutes to record score and learner can practice fingerspelling skills by finding the words for the British sign language hand posture. Thai Sign Language Online Dictionary [7] has been proposed to serve as an Assistive Technology (AT) tool based on Linguistic analysis of Thai sign language (ThSL). Example CAI for finger-spelling is shown in Figure 1.

Many CAIs for finger-spelling were proposed. However, there is lack of Thai finger-spelling. Therefore, the aim of our work is to develop Thai finger-spelling CAI for hearing and speaking impaired children which help them to improve working memory and to read finger-spelling skills while they use this assistive tool.

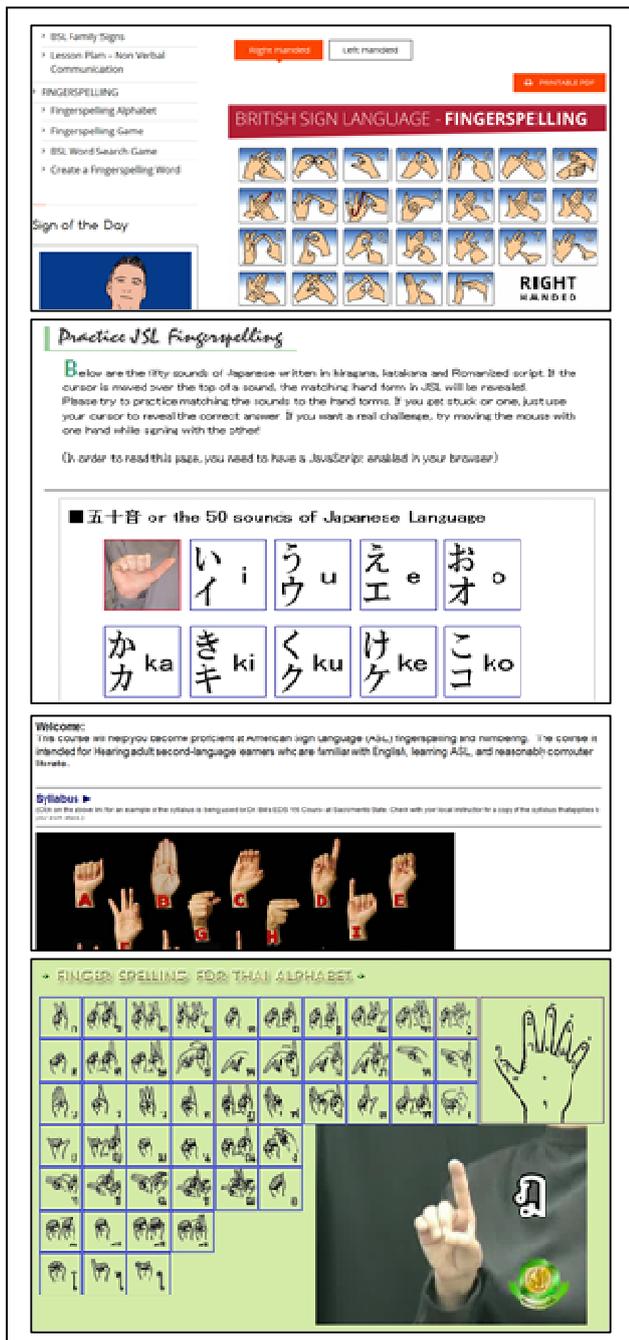


Figure 1. Example CAI for finger-spelling.

## 2. THAI FINGER-SPELLING

Thai finger-spelling is the usage of hand posture for representing the alphabet, vowels, intonation marks, and numbers to spell the specific names, places, or technical words. Thai finger-spelling was developed in A.D. 1956 (Lady Kamala Kraireuk). It is based on American finger-spelling, as shown in Figure 2.

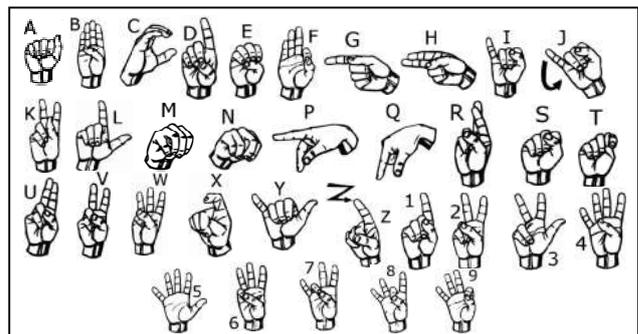


Figure 2. American finger-spelling hand shape.

The Thai finger-spelling is compared to the phonetics of American finger-spelling. Finger-spelling will be matched to American finger-spelling whose sound particular character is similar [8]. For example, Thai letter “*n* (Ko kai)” has a similar sound to the “*K*” letter in American finger-spelling. Therefore, the hand posture of “*K*” letter in American finger-spelling will be used to represent “*n* (ko kai)” in Thai finger-spelling. The combination of American finger-spelling hand posture is extended in order to represent all 42 Thai letters, such as “*u* (Kho khai)” =  $k+1$ , “*n* (Kho khwaiand)” =  $k+2$ , “*n* (Kho khwai)” =  $k+3$ , as shown in Figure 3., respectively.

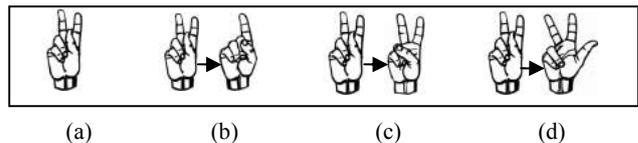


Figure 3. Thai finger-spelling example: (a) “*n* (ko kai)” (b) “*u* (Kho khai)” (c) “*n* (Kho khwaiand)” (d) “*n* (Kho khwai)”

Moreover, combination of two hands is defined in order to represent vowels and intonation marks. For instance, some vowels such as “*-a* (Sara a)”, “*-ar* (Sara ar)” or “*-ae* (Sara ae)” or intonation marks “*-* (Mai tho)” are made this way, as shown in Figure 4.

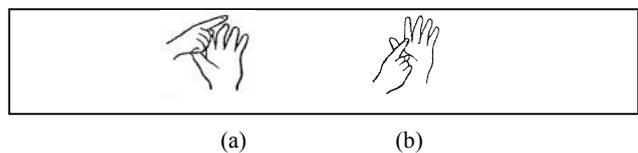


Figure 4. Two-hand finger-spelling: (a) spelling “*-* (Mai tho)” (b) spelling “*-ar* (Sara ar)”.

## 3. PROPOSED METHOD

This section described the methodology use in our work. The method combined interactive illustrations and video tutorial for American and Thai finger-spelling and finger-spelling game to quickly teach and improve fingerspelling skills. Moreover, our CAI has used flat design concept as graphical learner interface

(GUI) which focused on a minimalist use of simple elements, typography and flat colors that was learner friendly.

### 3.1 Illustration and Video Tutorial

The tutorials for American and Thai finger-spelling have been represented in this part. For the American finger-spelling, hand shape illustrations for each letter in American finger-spelling are collected from sign language expert. The American finger-spelling letter consists of 26 hand shapes. Some of the hand shapes are similar such as E, M, N, T, S, and so on. Thus, there are video examples which learner can observe in certain positions and certain movements of all fingers. Learners can review each video repeatedly to practice until they are familiar with each hand shape. Furthermore, there are collections for hand shapes of number spelling in American finger-spelling. Learners can learn theory for basic American finger-spelling which is used as based for Thai finger-spelling. For Thai finger-spelling, as we mention above. Thai finger-spelling is based on American finger-spelling by compared to the phonetics. When learner is familiar with American finger-spelling, learner can learn to use Thai finger-spelling easily. Similarity to American finger-spelling, hand shape illustrations and video tutorial for each letter in Thai finger-spelling are collected from sign language expert. Thai finger-spelling use both one hand and two hand shape. There are 42 letters, 17 vowels, 4 tone marks, and 3 special characters. Each letter will be grouped into subgroup, each with the same hand shape as a basic component of compound sign such as ก, ข, ค, ฆ and so on. Therefore, learner will learn the correlative between hand shapes in finger-spelling and Thai letter in Thai orthography. Example for this part can be shown in Figure 5.

### 3.2 Finger-Spelling Interactive Games

This section represents interactive game for finger-spelling which make learning as interesting, fun and interactive for learner. This is the quickest and easiest way to learn or improve fingerspelling skills. Interactive games have been proposed such as (1) **Drag and Drop Game**: learners has to select hand shape images or letter images by grabbing and dragging them to where they think it should go, (2) **Memory Game**: the objective of this game is to find a match for a hand shape image with letter image. By default, the image will be hidden. When learner selects each image, image will appear. Then learner need to find a suitable match for that opened image by randomly select other images, (3) **Word Search Game**: This game provides clues to learner to search words from finger-spelling. Learner can choose first and last letters of the words based on clues within a stipulated number of attempts, (4) **Hangman Game**: the game are shown a set of blank letter by a row of dashes from finger-spelling and learners have to guess what the word is. Learner guesses by picking letters image and seeing if they are in the word. However if learner pick a letter image that is not in the word a man is slowly drawn. When the man is finished he is hung and the game is lost, (5) **Jigsaw Puzzle Game**: a type of puzzle game in which the aim is to reconstruct a hand shape image that has been cut (originally, with a jigsaw) into many small interlocking pieces which is relate to letter image, (6) **Multiple Choice Quiz Game**: multiple choice quizzes are a form of game in which the learner attempt to answer questions correctly before time runs out. A quiz is also a brief assessment used in learning to measure growth in knowledge,

abilities, and skills in finger-spelling. Learner can play these games to having fun and practice both American and Thai finger-spelling. The example for interactive game can be shown in Figure 6.



Figure 5. Illustration and video tutorial for American and Thai finger-spelling.



Figure 6. Finger-spelling interactive games.

#### 4. CONCLUSION

The learning in a computer-assistive instruction (CAI) environment were developed for Thai finger-spelling which is suitable with beginner and improver learner; especially hearing and speaking impaired children. The CAI combined interactive illustrations and video tutorial for American and Thai finger-spelling and finger-spelling game to quickly teach and improve fingerspelling skills. The proficiency objectives of using the CAI for our expectation:

- \* Knows proper placement of hand shape for each letter and number in American and Thai finger-spelling.
- \* Can recognize letter and number of the American and Thai finger-spelling when signed slowly.
- \* Can recognize letters and number finger spelled quickly and in random order.

- \* Understands principles and circumstances related to phonetically correct between American and Thai finger-spelling.
- \* Can recognize long words spelled at a moderate pace.
- \* Can recognize long words finger-spelling quickly.
- \* Can recognize finger spell of specific words.

The learners have been expected to improve skill in Thai finger-spelling which help them become to proficient spell specific word such as name, place, or technical word and so on. Furthermore, this course is intended for hearing person second-language learners who are familiar with sign language, learning American and Thai finger-spelling, and reasonably computer literate.

#### 5. FUTHER WORK

The CAI will be applied with students who have hearing and speaking impairment (Phuketpanyanukul School). The learning process for the students in the print-based technique group is same as the learning process for the students in the CAI group. The students in the print-based technique learn from their teacher while the students in the CAI learn from our application. This is to examine the degree of helpfulness of CAI technology compared to print based learning which is expected to improve to finger-spelling skill.

#### 6. REFERENCES

- [1] R. Wolfe and et al. "An Improved tool for practicing fingerspelling recognition," International Conference on Technology and Persons with Disabilities, 2006, pp.17-22.
- [2] WikiEducator. "Computer Assisted Instruction." Internet: [http://wikieducator.org/Computer\\_Assisted\\_Instruction](http://wikieducator.org/Computer_Assisted_Instruction), Feb. 19, 2016 [Apr. 15, 2016].
- [3] C. Jeffrey. "American sign language finger challenge," Thesis, Rochester Institute of Technology, 2010
- [4] O. Poobrasert and N. Cercone. "Multimedia Support Systems as Assistive Technology for Hearing Impaired Students," Computational Approaches to Assistive Technologies for People with Disabilities, Vol.253, pp.224-323, 2013.
- [5] Information Technology Education Center (ITEC). "Practice JSL Fingerspelling," Internet:[http://www.kyoto-be.ne.jp/ed-center/gakko/jsl/zen\\_jsl04.htm](http://www.kyoto-be.ne.jp/ed-center/gakko/jsl/zen_jsl04.htm), [Apr. 15, 2016].
- [6] "BRITISH SIGN LANGUAGE – FINGERSPELLING," Internet: <http://www.british-sign.co.uk/fingerspelling-alphabet-charts>, [Apr. 15, 2016].
- [7] "Finger Spelling for Thai Alphabet," Internet: [http://pirun.ku.ac.th/~fhumalt/THSL/THSL/html/Fspell\\_en/fs25\\_e.htm](http://pirun.ku.ac.th/~fhumalt/THSL/THSL/html/Fspell_en/fs25_e.htm), [Apr. 15, 2016].
- [8] A. Tumtavitikul. "How are handshapes related to alphabet letters in Thai Fingerspelling?," Journal of Ratchasuda College for Research and Development of Persons With Disabilities, pp.34-45, 2010.