

Assessing of English Morpheme Acquisition Order of Thai Deaf University Students

Natdanai Subin

Faculty of Liberal Arts, Mahidol University, Nakhon Pathom, Thailand

Krisna Lertsukprasert

Department of Communication Sciences and Disorder, Mahidol University, Bangkok, Thailand

Natthapong Chanyoo

Faculty of Liberal Arts, Mahidol University, Nakhon Pathom, Thailand

Abstract—The purposes of this study were to assess the acquisition order of nine English grammatical morphemes and to identify types of grammatical morphemes which seem difficult for Thai deaf university students. Thirty-seven Thai deaf university students completed 18 fill-in-the-blank questions. Data were analyzed by frequency, percentage, mean, and standard deviation. The results indicated that the English grammatical morpheme acquisition order of Thai deaf university students was as follows: 1) article ($M = 1.38/3.00$), 2) plural ($M = 1.36/3.00$), 3) regular past tense ($M = 1.28/3.00$), 4) progressive ($M = 1.22/3.00$), 5) the 3rd person singular simple present tense ($M = 1.16/3.00$), 6) auxiliary ($M = 1.53/3.00$), 7) irregular past tense ($M = 1.46/3.00$), 8) copula ($M = 0.41/3.00$), and 9) possessive ($M = 0.39/3.00$). From the results, the 3rd person singular simple present tense, auxiliary, irregular past tense, copula, and possessive were considered difficult for the deaf participants. The findings from this study can be used for further pedagogical and curriculum development in teaching English grammatical morphemes to Thai deaf students.

Index Terms—English morpheme acquisition, grammatical morphemes, Thai deaf university students

I. INTRODUCTION

Mastering the English language takes time and effort. According to Bloom and Lahey (1978), three aspects of English serve as the foundations for language development are phonemes (the sounds which represent linguistic content); morphemes (the units which indicate the meanings and forms of words); and syntax (the structures and order of words of sentences). Figure 1 shows the levels in language development proposed by Bloom & Lahey in 1978. Hearing students usually develop an awareness of these three linguistic features prior to developing semantical knowledge (the meanings of phrases and sentences) and pragmatic knowledge (the actual use of language in specific contexts). In contrast, students with a hearing disability, especially with profound deafness, may lack phonological input and thus phonological knowledge. As a result, students who are profoundly deaf have to heavily rely upon morphemes and syntax. Deaf students typically develop gesture-based communication based primarily on a finite set of signed words with iconicity (Liddell, 1984; Wilbur, 1987). Iconicity refers to the degree of a resemblance between a gestural sign and a word. Since the language learning pathways and communication systems of the deaf are different from their hearing counterparts, the morphological development and knowledge of these two groups of students are also different.

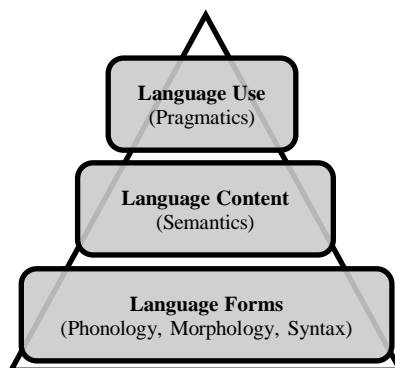


Figure 1. Proposed Levels in Language Development

II. LITERATURE REVIEW

There is a strong association between morphological knowledge and academic performance in English language study (Pratt & Brady, 1988; Powers et al., 1998; Reilly et al., 2009). Morphemes appear widely in printed texts and academic settings in almost all groups of English language students (Deacon & Kirby, 2004). Carlisle and Stone (2005) found that English language is morphophonemic, implying that students need to develop phonological and morphological knowledge as basic elements before acquiring more complicated concepts in English language learning. However, deaf students are likely to lack authentic auditory experience, resulting in a sole dependency on morphemes and other visual cues such as signed gestures, printed texts, and pictures. This usually results in a different, more challenging rate of language development in comparison to hearing students. In addition to the impeded language development of deaf students, the studies in Thailand undertaken in relation to English morphemes and Thai deaf students are very limited. Insightful studies and public awareness of this issue are necessary to develop appropriate curricula and teaching techniques for Thai deaf students.

Morphemes are one of the most fundamental linguistic units for English language students. As a result, researchers started to investigate whether there could be a pattern for English morpheme acquisition among English language students (Berko, 1958; Brown, 1973; Dulay & Burt, 1973, 1974a, 1974b; Larsen-Freeman, 1975, 1976). One of the most well-known proposals of the English morpheme acquisition order is the “Natural Order Hypothesis (NOH)” proposed by Krashen et al. (1975, 1976, 1977, 1978, 1981). Some researchers such as Newkirk et al. (1980), Mayberry and Fischer (1989), and Gaustad et al. (1998, 2000, 2002, 2004) assessed the morphological knowledge of deaf English language students whose first language (L1) was American Sign Language (ASL). These studies offer some mutual insights that both auditory and visual inputs are necessary for morphological knowledge development. When students have hearing problems such as profound deafness, their morphological knowledge is severely affected. As a result, deaf students tend to experience underachievement in English language proficiency (Sterne & Goswami, 2000; Lederberg & Spancer, 2001; Gaustad et al., 2002; Breadmore, 2008).

The number of studies in English morphological development of Thai deaf students is limited. The major points of previous studies in Thai deaf community were mostly in pedagogical principles, special teaching tools, the integration of computer software applications, and exclusive teaching procedures to facilitate in teaching deaf students (Saksiri et al., 2006; Dangsaart et al., 2008; Plaewfueang & Suksakulchai, 2012; Wicha et al., 2012). One study conducted by Subin and Chanyoo (2018) exclusively assessing the morphological development and knowledge of Thai deaf university students. In the study, the authors assessed the students’ knowledge of English derivations, inflections, and a combination between roots and affixes by using multiple-choice questions. In conclusion, the students scored very low in all three types of morphemes being assessed. There was a need to further investigate Thai deaf university students’ acquisition of English morphemes was highly recommended, leading to more effective English language assessment and development in Thai deaf students.

A. Objectives of the Study

1. To assess the order of English grammatical morpheme acquisition of Thai deaf university students; and
2. To identify types of grammatical morphemes that are difficult for Thai deaf university students.

B. Research Questions

1. What is the order of English grammatical morpheme acquisition for Thai deaf university students?
2. Which types of grammatical morphemes seem difficult for Thai deaf university students?

C. Theoretical Framework

This study was primarily based on a key concept from Krashen et al.’s NOH in 1977, referring to a predictable sequence of English morpheme acquisition in students studying English as a second language (L2). Nine types of morphemes were grouped into four stages of acquisition in NOH, ranging from morphemes which were acquired early to those that were acquired later. Theoretically, English language students acquire morphemes in stage one before acquiring more morphemes in latter stages. Morphemes within the same stage may be acquired in any order. For example, one student may acquire a knowledge of plural (-s) before progressive (-ing) and the copula (be) while another student may acquire the copula before the other two morphemes of stage one. Although these two students may show a potential variation in morpheme acquisition rate within the same stage, they should acquire all three morphemes in stage one before acquiring morphemes in the next stages. Figure 2 shows a summary of the NOH concept and the morphemes being assessed by Krashen et al. (1977).

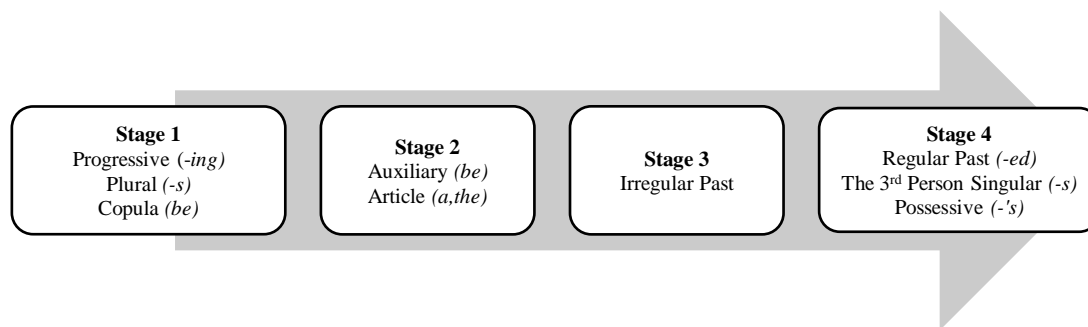


Figure 2. The Order of English Morpheme Acquisition in English as a Second Language

III. METHODOLOGY

A. Research Context and Participants

This study was conducted at *Sunshine University* (a pseudonym for confidentiality) with three major criteria:

1. This university offers academic programs for students with disabilities including deaf students, which satisfies the objectives of the study.
2. The number of deaf students enrolled in the university during the study period was adequate for statistical analysis.
3. At least three mandatory English courses of ASL are taught to deaf students at Sunshine University. This point helped to ensure that deaf students at Sunshine University had been exposed to an ASL background to some extent.

A total of 48 students with profound deafness were enrolled at Sunshine University; thus, that was the population number targeted in this study. As for the initial plan, all profoundly deaf students were expected to be recruited for this study. It was planned that three students would be recruited for a pilot phase and 45 students would be included in a study phase. There were four criteria employed in recruiting participants for this study:

1. All participants were required to enroll and study at Sunshine University, ensuring exposure to English grammatical morphemes prior to the commencement of the study. Brown (1973) claimed that English language students should acquire a concept of 14 types of morphemes as early as five years old. All of the participants in this study were at least 18 years old prior to the study. They should have mastered all types of morphemes by the time the study was conducted.
2. All participants must use Thai Sign Language (TSL) as their L1 and have studied the English language through ASL. All participants had already finished two compulsory English courses before the study commenced.
3. All participants in this study were required to be congenitally profoundly deaf. This condition was set to avoid previous auditory experience, which might interfere with the study. It is noteworthy to state that recruitment procedures were carried out by a professor and teachers of English courses at Sunshine University upon the request of the researchers.
4. No hearing aids were needed or used by the participants.

Initially the researchers planned to recruit all 48 students to take part in this study. Prior to the actual study, three students were randomly asked to participate in the pilot phase. The remaining 45 were expected to participate in the actual study. However, eight students did not show up during the time of actual data collection. Therefore, there were eventually 37 students who took part in the study phase.

B. Research Instrument

The 18 fill-in-the-blank questions related to grammatical morphemes were based on Berko's WUG test (1958). Berko specially designed the WUG test, which contains nonsense words to minimize potential confounding factors such as age of acquisition, difficulty of roots, and complexity of prompts. The researchers in this study asked for permission to use and adapt the original WUG test from Berko via emails, and permission to adapt the test was generously granted by the developer. Regarding the question items, simple sentences and nonsense words were used to assess participants' knowledge of grammatical morphemes. The test was designed and developed to be highly visual and colorful to elicit participants' recollection of English morphemes.

Answers from participants were analyzed by using Dulay and Burt's scoring system (1973) known as the "Bilingual Syntax Measure (BSM)". The BSM scoring system was used in this study because 1) it was based on a notion of grammatical correctness, for those who are non-native English speakers, which was congruent with participants' L1 background in this study; 2) Dulay and Burt suggested that a level around 60-70% of accuracy was adequate to claim morpheme acquisition; and 3) BSM was universally applicable regardless of participants' age differences.

C. Validity and Reliability Assessment

The research instrument and research outline were both submitted to three people who are experts in both the SLA field and in special education for communicative-impaired students to hear their suggestions. In addition, the study outline and all 18 fill-in-the-blank questions adapted from WUG test were approved by the Institutional Review Board

(IRB) committee. The validity of the research instrument and outline achieved an acceptable level of satisfaction. In addition to this validity assessment, the reliability of scoring consistency was also measured through Fleiss's Kappa from four different raters. Six randomized answer sheets from participants in this study were selected and scored by four raters using an answer key offered by the researchers. After a final calculation from Fleiss's Kappa assessment, the overall result of raters' scoring consistency is 1.00 – meaning the test and scoring system used in this study were totally reliable.

D. Data Collection Procedures

1. A research proposal report, an approval document from IRB, and consent letters were submitted to a teacher and sign language interpreters at Sunshine University. The same teacher helped in recruiting the final 37 participants who met four criteria, and the interpreters assisted in communication between the researchers and the participants.

2. Participants were thoroughly informed about the details of the study and were asked to signed consent forms if they were willing to participate in the study.

3. Test procedures were carefully explained to participants. Participants were asked to sit separately from one another to prevent interference from peers. Question sheets containing 18 questions were given to participants on sheets of A4 paper. Each question was explained by the sign language interpreters. Therefore, all participants went through each question at the same time. A maximum of 20 minutes was set to complete all questions.

4. When the time was over, the participants' answer sheets were collected for further data analysis.

IV. RESULTS

A. Results for Research Question One

Research question one asks “What is the order of English grammatical morpheme acquisition for Thai deaf university students?” The answer to this research question was based on the accuracy percentage and mean score (*M*) according to the BSM scoring system, as follows: 1) article (69.0% accuracy), 2) plural (68.2% accuracy), 3) regular past tense (63.51% accuracy), 4) progressive (60.81% accuracy), 5) the third person singular simple present tense (58.11% accuracy), 6) auxiliary (50.90% accuracy), 7) irregular past tense (48.65% accuracy), 8) copula (40.54% accuracy), and 9) possessive (39.19% accuracy). Table 1 shows a summary of the English grammatical morpheme acquisition order observed in this study.

TABLE 1
RESULTS FOR THE MORPHEME ACQUISITION ORDER OF THAI DEAF UNIVERSITY STUDENTS

Rank	Type of grammatical morpheme	Percentage of accuracy	Mean	Frequency of point on Bilingual Syntax Measure		
				0	0.5	1
1	Article (<i>a, an</i>)	69.00	1.38/2.00	10	26	38
2	Plural (<i>-s</i>)	68.20	1.36/2.00	6	35	33
3	Regular past tense (<i>-ed</i>)	63.51	1.28/2.00	10	34	30
4	Progressive (<i>-ing</i>)	60.81	1.22/2.00	13	32	29
5	The 3 rd person singular simple present tense (<i>-s</i>)	58.11	1.16/2.00	14	33	27
6	Auxiliary (<i>be</i>)	50.90	1.53/3.00	29	51	31
7	Irregular past tense	48.65	1.46/3.00	19	76	16
8	Copula (<i>be</i>)	40.54	0.41/1.00	12	20	5
9	Possessive (<i>- 's</i>)	39.19	0.39/1.00	17	11	9

B. Results for Research Question Two

Research question two was “Which types of grammatical morphemes seem difficult for Thai deaf university students?” According to Dulay and Burt's BSM scoring system (1973), an accuracy level of 60.00% is the minimum criterion to claim morpheme acquisition for non-native English-speaking students. As a result, five types of grammatical morphemes were scored below 60.00%, including the third person singular simple present tense (*-s*) with 58.11% accuracy; auxiliary (*be*) with 50.90%; irregular past tense with 48.65%; Copula (*be*) with 40.54%; and the possessive (*- 's*) with 39.19%. Therefore, these results suggested that the possessive (*- 's*) is considered the most difficult type of grammatical morpheme for Thai deaf university students.

V. DISCUSSION

A. Discussion of the Results from Research Question One

An initial assumption of research question one was that the order of morpheme acquisition in this study should follow Krashen (1977)'s NOH. However, the morpheme acquisition order based on the results of this study actually contradicts the initial assumption. Many potential factors might play a role in the differences between the two orders. For example, the fingerspelling technique, which is considered an effective way for teaching and learning English, is somewhat rarely used in the Thai context (Tumtavitikul & Niwatapant, 2008). Some grammatical morphemes such as

copula, auxiliary, and tense-related morphemes are not present in TSL nor in the Thai language; thus, becoming difficult concepts for Thai deaf students to understand. Overly complicated visual cues (as in 'jed') might also somewhat confuse participants when compared to simple cues (as in 'lik'). On the other hand, number-related morphemes (article, plural) were acquired before other types of morphemes. This may be because numbers and their corresponding morphemes are usually taught early on in school. Table 2 shows a comparison between Krashen's NOH and the order in this study.

TABLE 2
A COMPARISON BETWEEN THE KRASHEN'S NOH (1977) AND THE ORDER OF MORPHEME ACQUISITION IN THIS STUDY

Rank	The order of English morpheme acquisition in Krashen's NOH (1977)	Rank	The order of English morpheme acquisition in this study	Percentage of accuracy
Stage 1	copula	1	article	69.00
	plural	2	plural	68.20
	progressive	3	regular past tense	63.51
Stage 2	article	4	progressive	60.81
	auxiliary	5	the 3 rd person singular simple present tense	58.11
Stage 3	irregular past tense	6	auxiliary	50.90
Stage 4	possessive	7	irregular past tense	48.65
	the 3 rd person singular simple present tense	8	copula	40.54
	regular past tense	9	possessive	39.19

B. Discussion of the Results from Research Question Two

The results show that participants' accuracy percentage for the third person singular simple present tense, auxiliary, irregular past tense, copula, and possessive were lower than the 60.00% threshold of morpheme acquisition (Dulay & Burt, 1973) displaying accuracy percentages of 58.11%, 50.90%, 48.65%, 40.54% and 39.19%, respectively. According to Goldschneider and DeKeyser (2001), there are 5 potential determinants that influence on grammatical morpheme acquisition, including perceptual salience, semantic complexity, morphophonological regularity, syntactic category, and frequency. The authors will then discuss the result by these determinants.

In this study, effects of auditory factors - perceptual salience and morphophonological regularity - could technically be disregarded due to the participants' hearing impairment. Perceptual salience refers to phonetic perception of a language student such as stress level, number of phones in particular morphemes, syllabicity, and sonority level. Morphophonological regularity refers to a relationship between morphemes and their phonological environment, including allomorphy variation and contractibility. Perceptual salience and morphophonological regularity were deemed as significant determinants upon the order of English morpheme acquisition as L2 as mentioned by Ravid (1995) and Peters (1995). Other researchers also highlighted an importance of auditory inputs and oral productions in language acquisition (Dulay & Burt, 1978; Brown, 1973; Cook 1993). However, auditory and oral experiences are not applicable to the participants in this study as they are medically diagnosed as profoundly deaf, resulting in an absence of sound perception and oral language production. These two determinants, therefore, influence on participants difficulties in perceiving abovementioned morphemes.

Semantic complexity influences an acquisition of word meaning. This point is supported by Brown's study (1973), which claimed that semantic complexity –the number of meanings in a particular morphological form – affects the order of morpheme acquisition. That is, the forms which consist of more meanings tend to be acquired later than forms with fewer meaning. Brown gave a specific example of the third person singular simple present tense of a form with multiple semantic elements – the number of a subject (a person), a subject-verb agreement, and tense (time). Compared to plural (-s) form, which mainly expresses the number of a subject, the third person singular simple present tense of a form with multiple semantic elements should theoretically be acquired later. This study shows the same result as proposed by Brown (1973). Semantic complexity might also be a reason on late acquisition of auxiliary, irregular past tense, and copula since these morphological forms require knowledge on tense variation and subject-verb agreement, which are more semantically complex than article and plural.

The third point to discuss is the influence of syntactic category. There are multiple ways to group morphemes based on Syntactic theory, or Functional Category theory. Krashen et al. (1975) proposed that morphemes which related to verb phase (VP), such as tense-related morphemes, tend to be acquired later than noun-phase (NP) morphemes, such as article and plural. Likewise, Zobl and Licerias (1994) gave an example of plural morphemes for an early-acquired morphological form. An influence of syntactic category might explain why the participants in this study showed two highest score of accuracy on NP morphemes - article (69.00%) and plural (68.20%) – among other types of morphemes. An early acquisition of NP morphemes might be because Thai deaf students are likely to expose to number-related inputs at very young age in language classes prior than other language aspects such as subject-verb agreement and tenses (Tumtavitikul et al., 2009). However, a conclusive explanation upon an effect of syntactic category and Thai deaf university students' order of English morpheme acquisition is yet to be exclusively proposed.

Another support for difficulty in morpheme acquisition among deaf participants is frequency of exposure. Frequency regards the number of inputs exposed by an individual. It is not unusual that frequently exposed grammatical morphemes are likely to be acquired before those with less exposure frequency. Larsen-Freeman and Long (1991) also supported an influence of input exposure as a significant determinant of morpheme acquisition order. Low-scored morphemes in this study - the third person singular simple present tense, auxiliary, irregular past tense, copula, and possessive – are less likely to be taught nor used by Thai deaf university students. This group of students typically rely on adverbial elements such as time markers due to convenience in hand gestures and nature of sign languages (Liddell, 1984; Wilbur, 1987). For instance, Thai deaf students gesturally emphasize on ‘yesterday’ in a sentence with a past action rather than manually fingerspelled irregular form of a past-tense verb. Furthermore, concepts about auxiliary and copula are also uncommon for Thai deaf people owing to a nature of TSL. Thai signers are likely to omit auxiliary and copula elements when signing. Although frequency of exposure and use might be possible factors for English morpheme acquisition, exclusive studies on this regard with Thai deaf students are relatively scarce.

In addition, the effect of L1 transference is still debatable among researchers. To some researchers, L1 transference might play a little role in language performance. For instance, Dulay and Burt (1973) claimed that L1 transference only accounted for only 3% of language errors in children. On the other hands, researchers such as Andersen (1977) and Anderson (1978) believed that language transference between L1 and L2 is a significant determinant regarding morpheme acquisition and language accuracy. A more exclusive question arises whether L1 transference between TSL and ASL influences Thai deaf students’ morphological knowledge, and to what extent. TSL and ASL share up to 52% of cognates (similarities in linguistic elements) since TSL is a result of creolization among indigenous Thai sign languages and ASL (Woodward, 1996). There is very limited number of studies about L1 transference and English language performance in deaf community in Thailand. It would be insightful to further investigate whether L1 transference really has an impact on Thai deaf students’ performance in morphemes and the order of morpheme acquisition.

C. Limitations of the Study

Firstly, this study was carried out as a cross-sectional study due to time constraints. It may not be possible to acquire extensive insights from a cross-sectional study. There are many further factors, such as L1 transference, frequency of using morphemes, and communicative strategies of individuals, which should be further investigated. Secondly, ideally there should have been more participants sourced from different universities, as different universities might have employed different curricula in their English courses. Those differences might affect students’ morpheme acquisition (Larsen-Freeman, 1975, 1976). Thirdly, this study would have benefited from using more recent research as reference points. This study was based on studies that were carried out decades ago due to a previous lack of interest in this topic being explored in a Thai context.

VI. CONCLUSION

In conclusion, the learning and acquiring of the English language has proven to be challenging for Thai deaf university students. Although the students were taught about fundamental English morphemes, they still showed difficulty in using grammatically correct morphemes in response to given prompts. Types of morphemes which Thai deaf university students acquired at an acceptable level include article, plural, regular past tense, and progressive tense. In contrast, the third person singular simple tense, auxiliary, irregular past tense, copula, and possessive were considered “difficult to acquire” by the students. There are several potential factors which contribute to the aforementioned results, such as semantic complexity, syntactic category, frequency of inputs and uses of morphemes, and perhaps an effect of language transference. The further insightful investigation of potential factors for language acquisition difficulties, and effective pedagogical interventions, are highly suggested in order to improve the language comprehensibility and intelligibility of deaf students. Any insights derived from future studies could also be beneficial to other groups of people with special needs.

REFERENCES

- [1] Andersen, R.W. (1977). The impoverished state of cross-sectional morpheme acquisition/accuracy methodology (or: The leftovers are more nourishing than the main course). *Working Papers on Bilingualism*, 14, 47-82
- [2] Anderson, J. I. (1978). An implication model for second language research. *Language Learning*, 28, 221-282.
- [3] Berko, J. (1958). The child's learning of English morphology. *Word*, 14(2-3), 150-177.
- [4] Breadmore, H. L. (2008). *Inflectional morphology in the literacy of deaf children* (Doctoral dissertation, University of Birmingham). Retrieved from <https://etheses.bham.ac.uk/id/eprint/591/1/BreadmorePhd10.pdf>
- [5] Brown, R. (1973). *A first language: The early stages*. Harvard University Press.
- [6] Bloom, L., & Lahey, M. (1978). *Language development and language disorders*. New Jersey, NJ: John Wiley & Sons.
- [7] Carlisle, J. F., & Stone, C. A. (2005). Exploring the role of morphemes in word reading. *Reading Research Quarterly*, 40(4), 428-449.
- [8] Cook, V. (1993). *Linguistics and Second Language Acquisition*. New York: St. Martin’s Press.
- [9] Critten, S., Connelly, V., Dockrell, J. E., & Walter, K. (2014). Inflectional and derivational morphological spelling abilities of children with specific language impairment. *Frontiers in Psychology*, 5, 948. <http://doi.org/10.3389/fpsyg.2014.00948>

- [10] Dangsaart, S., Naruedomkul, K., Cercone, N., & Sirinaovakul, B. (2008). Intelligent Thai text–Thai sign translation for language learning. *Computers & Education*, 51(3), 1125-1141.
- [11] Deacon, S. H., & Kirby, J. R. (2004). Morphological awareness: Just “more phonological”? The roles of morphological and phonological awareness in reading development. *Applied Psycholinguistics*, 25(2), 223-238.
- [12] Dulay, H. C., & Burt, M. K. (1973). Should we teach children syntax? *Language Learning*, 23, 245-258.
- [13] Dulay, H. C., & Burt, M. K. (1974a). Errors and strategies in child second language acquisition. *TESOL Quarterly*, 8, 129-136.
- [14] Dulay, H. C., & Burt, M. K. (1974b). Natural sequences in child second language acquisition. *Language Learning*, 24, 37-53.
- [15] Ehri, L.C., & Robbins, C. (1992). Beginners need some decoding skill to read words by analogy. *Reading Research Quarterly*, 27, 12-26.
- [16] Gaustad, M. G. (2000). Morphographic analysis as a word identification strategy for deaf readers. *Journal of Deaf Studies and Deaf Education*, 5(1), 60–80. <https://doi.org/10.1093/deafed/5.1.60>
- [17] Gaustad, M. G., Kelly, R. R., Payne, J. A., & Lylak, E. (2002). Deaf and hearing students' morphological knowledge applied to printed English. *American Annals of the Deaf*, 147(5), 5-21. <https://doi.org/10.1353/aad.2012.0264>.
- [18] Gaustad, M. G., & Kelly, R. R. (2004). The relationship between reading achievement and morphological word analysis in deaf and hearing students matched for reading level. *Journal of Deaf Studies and Deaf Education*, 9(3), 269-285. <https://doi.org/10.1093/deafed/enh030>
- [19] Goldscheider, J.M., & Dekeyser, R.M. (2001). Explaining the “Natural Order of L2 Morpheme Acquisition” in English: A meta-analysis of multiple determinants. *Language Learning*, 51(1), 1-50.
- [20] Krashen, S. D. (1981). *Second language acquisition and second language learning*. Oxford, England: Pergamon.
- [21] Krashen, S. D., Houck, N., Giunchi, P., Bode, S., Birnbaum, R., & Strei, G. (1977). Difficulty order for grammatical morphemes for adult second language performers using free speech. *TESOL Quarterly*, 11, 335-341. <https://doi.org/10.2307/3586032>
- [22] Krashen, S. D., Madden, C., & Bailey, N. (1975). Theoretical aspects of grammatical sequencing. *On TESOL '75: New directions in second language learning, teaching and bilingual education* (pp. 44-54). Washington, DC: TESOL.
- [23] Krashen, S. D., & Scarcella, R. (1978). *Issues in second language research*. Rowley, MA: Newbury House Publishers.
- [24] Krashen, S. D., Sferlazza, V., Feldman, L., & Fathman, A. K. (1976). Adult performance on the SLOPE test: More evidence for a natural sequence in adult second language acquisition. *Language Learning*, 26, 145-151.
- [25] Larsen-Freeman, D. E. (1975). The acquisition of grammatical morphemes by adult ESL students. *TESOL Quarterly*, 9, 409-419.
- [26] Larsen-Freeman, D. E. (1976). An explanation for the morpheme acquisition order of second language students. *Language Learning*, 26, 125-134.
- [27] Larsen-Freeman, D. E., & Long, M. H. (1991). *An introduction to second language acquisition research*. New York: Longman.
- [28] Lederberg, A. R., & Spencer, P. E. (2001). Vocabulary development of young deaf and hard of hearing children. *Context, Cognition, and Deafness* (pp. 73-92). Washington DC: Gallaudet University Press
- [29] Liddell, S. K. (1984). Think and believe: sequentiality in American Sign Language. *Language*, 60 (2), 372-399. <https://doi.org/10.2307/413645>
- [30] Lucas, C. (Ed.). (1990). *Sign language research: Theoretical issues*. Washington, USA: Gallaudet University Press.
- [31] Mayberry, R. I., & Fischer, S. D. (1989). Looking through phonological shape to lexical meaning: The bottleneck of non-native sign language processing. *Memory & Cognition*, 17(6), 740-754.
- [32] Nagy, W., Herman, P., & Anderson, R. (1985). Learning words from context. *Reading Research Quarterly*, 20, 233–253.
- [33] Newkirk, D., Klima, E. S., Pedersen, C. C., & Bellugi, U. (1980). Linguistic evidence from slips of the hand. In V. Fromkin (Ed.), *Errors in linguistic performance: Slips of the tongue, ear, pen, and hand* (pp. 165-197). New York: Academic Press.
- [34] Perfetti, C.A. (1992). The representation problem in reading acquisition. In P. Gough, L. Ehri, & R. Treiman (Eds.), *Reading acquisition* (pp. 107–143). Hillsdale, NJ: Erlbaum.
- [35] Peters, A.M. (1995). Strategies in the acquisition of syntax. In P. Fletcher and B. MacWhinney (Eds.), *The handbook of child language* (pp. 462-482). Oxford, England: Blackwell.
- [36] Plaewfueang, K., & Suksakulchai, S. (2012). A Framework for Promoting Reading Skills for Hearing-Impaired Persons Using the Sign Language Picture Story. In *Proceedings of the World Congress on Engineering and Computer Science, 1*, Retrieved from http://www.iaeng.org/publication/WCECS2012/WCECS2012_pp261-264.pdf
- [37] Powers, S., Gregory, S., & Thoutenhoofd, E. D. (1998). *The Educational Achievements of Deaf Children*. (Rep. No. DfEE Research Report RR65). London: Department for Education and Employment
- [38] Pratt, A. C., & Brady, S. (1988). Relation of phonological awareness to reading disability in children and adults. *Journal of Educational Psychology*, 80(3), 319-323.
- [39] Ravid, D.D. (1995). *Language change in children and adult Hebrew*. New York: Oxford University Press.
- [40] Reilly, S., Bavin, E. L., Bretherton, L., Conway, L., Eadie, P., Cini, E., ... & Wake, M. (2009). The Early Language in Victoria Study (ELVS): A prospective, longitudinal study of communication skills and expressive vocabulary development at 8, 12 and 24 months. *International Journal of Speech-Language Pathology*, 11(5), 344-357. <https://doi.org/10.1080/17549500903147560>
- [41] Saksiri, B., Ferrell, W. G., & Ruenwongsa, P. (2006). Virtual sign animated pedagogic agents to support computer education for deaf students. *ACM SIGACCESS Accessibility and Computing*, 86, 40-44.
- [42] Sterne, A., & Goswami, U. (2000). Phonological awareness of syllables, rhymes, and phonemes in deaf children. *The Journal of Child Psychology and Psychiatry and Allied Disciplines*, 41(5), 609-625.
- [43] Subin., N. & Chanyoo., N. (2018). A preliminary study on morphological development in English language of Thai deaf university students. In *Proceedings of The 2nd National Conference on Humanities and Social Science: Learning Diversity for Quality of Life*, 69-92. Nakhon Pathom, Thailand: Mahidol University.
- [44] Tumtavitikul, A., Niwatapant, C., & Dill, P. (2009). Classifiers in Thai Sign Language. *SKASE Journal of Theoretical Linguistics*, 6(1), 27-44.

- [45] Wicha, S., Sharp, B., Sureephong, P., Chakpitak, N., & Atkins, A. (2012). An animated dictionary for hearing-impaired students in Thailand. *Journal of Research in Special Educational Needs*, 12(4), 234-244.
- [46] Wilbur, R. B. (1987). *American Sign Language: linguistic and applied dimensions*. Washington, USA: Little, Brown and Co.
- [47] Woodward, J. (1996). Modern Standard Thai Sign Language, influence from ASL, and its relationship to original Thai sign varieties. *Sign Language Studies*, 92, 227-252.
- [48] Zobl, H. & Liceras, J. (1994). Functional categories and acquisition orders. *Language Learning*, 44, 159-180.



Natdanai Subin (first author) is currently a doctoral student in the International Graduate Program in Applied Linguistics at the Faculty of Liberal Arts, Mahidol University. He received a BSc. in Biological Sciences from Mahidol University International College in 2016 and an M.A. in Applied Linguistics from Mahidol University's Faculty of Liberal Arts in 2020. His research interests include second language acquisition, language acquisition for people with special needs, and clinical linguistics. He may be reached at [natdanai.subin\[at\]gmail.com](mailto:natdanai.subin[at]gmail.com).



Krisna Lertsukprasert (second author) is associate professor of Communication Sciences and Disorders at the Faculty of Medicine Ramathibodi Hospital, Mahidol University. She received BSc. in Nursing from Mahidol University in 1976 and an M.A. in Communication Disorders from Mahidol University in 1979. Her research interests include audiology, and communication sciences and disorders. She may be reached at [krisna44\[at\]hotmail.com](mailto:krisna44[at]hotmail.com).



Natthapong Chanyoo (corresponding author) is assistant professor in the International Graduate Program in Applied Linguistics at the Faculty of Liberal Arts, Mahidol University in Thailand. He received a PhD in Instruction and Learning with concentrations in English Education and Applied Linguistics from the University of Pittsburgh, USA in 2013. His research interests include teaching English as a foreign language, second language acquisition, and the psychology of language learning. He may be reached at [natthapong.cha\[at\]mahidol.edu](mailto:natthapong.cha[at]mahidol.edu).