

A closer look at writing errors in senior project theses: Insights from Thai computer engineering undergraduates

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Abstract

Academic writing, both in Thai and English, is a difficult problem that many Thai university students must deal with. Due to a lack of understanding of English grammar structures and Thai spelling, many errors were found in the senior project theses. This paper studied errors in senior project theses written by Thai computer engineering undergraduate students to obtain valuable information about the errors frequently appeared in their writings. The theses were entirely written in Thai, except for the English abstracts. Different types of errors, both in Thai and English, as well as their corresponding frequencies, were investigated. To investigate the errors, the types of errors were typed as words or texts representing the error types. AntConc was then used to find the word frequencies that corresponded to the error types. The ten most frequent errors found in the English abstracts were: 1) articles, 2) capital letters, 3) sentence structures, 4) singular and plural, 5) commas, 6) verb forms, 7) full stop, 8) prepositions, 9) adjectives, and 10) misspelling. As for the parts that were not English abstracts, the results revealed that English-Thai transliterated words such as ไบบรารี (lai-braa-ree, “library”), อัปโหลด (àp-lòht, “upload”), ฟังก์ชัน (fang-chan, “function”), and ดิจิทัล (di-ji-tan, “digital”) were often misspelled by the students. It was evident that Thai words were written incorrectly due to the following respects: 1) Thai final consonants (31.66%), 2) Thai tone markers (23.23%), 3) Thai initial consonants (19.57%), 4) Thai vowels (18.34%), and 5) Thai unpronounced consonants (7.20%). The present findings could have pedagogical implications for understanding the types of errors made by the engineering students. These results could be used to create a guidebook or manual to help the students master and achieve publishable quality in their senior project theses.

Keywords: computer engineering students, senior project thesis, writing errors

Introduction

Writing is a crucial means of communication for transmitting knowledge, exchanging ideas, and sharing experiences between a communicator and a receiver. Formal written works serve to record a variety of information, knowledge, experiences, or events. Good writing skills in English enable Thai students to communicate their ideas and exchange knowledge with global communities, contributing to both personal and professional growth. However, Thai engineering students face challenges not only with their English writing skills but also with their Thai writing skills when completing capstone projects before graduation. Therefore, it is important to study writing errors to identify the different types of errors made by the students. This information can be used as corrective feedback for current students and those who will be writing their senior projects in the next semester.

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Grammatical errors are major concerns for many teachers who teach English as a Foreign Language (EFL) students (Kampookaew, 2020; Phoophuangpairaj, & Pipattarasakul, 2022). Errors in English writing were studied by researchers. For instance, Khumphee, & Yodkamlue (2017) investigated common types of grammatical errors based on their frequency of occurrence in the English essay writing of Thai EFL undergraduate students. The five most frequent types of errors were the use of plural nouns, omission of punctuation, errors in the structures of complex sentences, omission of sentence elements, and sentence fragments. Similarly, Suraprajit (2021) reported that the most common errors were omission of articles, followed by the addition of a preposition, omission of a preposition, omission of a subject, and misformation of subject pronouns. Moreover, Promsupa, Varasarin, & Brudhiprabha (2017) investigated grammatical error types and analyzed sources of the errors in English writing. The three most frequently found errors were singular/plural errors (30.43%), article errors (21.51%), and preposition errors (5.23%). Watcharapunyawong, & Usaha (2013) studied the first-language interference errors and identified 16 categories: verb tense, word choice, sentence structure, articles, prepositions, modal/auxiliaries, singular/plural forms, fragments, verb forms, pronouns, run-on sentences, infinitive/gerunds, transitions, subject-verb agreement, parallel structure, and comparison structure.

Writing English words in Thai is not easy, and many Thai people cannot write them correctly. One reason is that each word can be spelled or written differently but pronounced the same, especially Thai written words derived from other languages such as English. For example, the word อัปเดต (àp-dèt, “update”) is often misspelled as อัปเดต, อัปเดต or อัปเดต. In this case, when p is an initial consonant, พ is used; when t is an initial consonant, ท is used. However, when p is a final consonant, ป is used, and when t is a final consonant, ต is used. Also, spelling errors can occur in any part of a syllable. A syllable is a unit of language that forms a whole word or parts of words. Thai syllable structure consists of four parts: initial consonant, vowel, final consonant, and tone. The parts of the Thai syllables where writing errors were found could be examined to highlight the problem. Hou (2019) studied spelling errors in Thai made by Chinese students learning Thai and found that 37.5% of the mistakes were in Thai vowels, followed by 20.7% in initial consonants, 20.4% in final consonants, 18.0% in unpronounced letters, 2.2% in tone markers, and 1.2% in other parts.

Certain Thai language rules and writing system, such as the use of Thanthakhat and tone markers, can lead to written errors. Some Thais misunderstand the ‘ (thanthakhat) and karan. Thanthakhat indicates that the consonant character written below is silent, while the silenced consonant is called karan. In Thai, the use of a thanthakhat over the final consonant of a word indicates that the consonant is muted. To elaborate, a consonant with the thanthakhat on top is not pronounced. Unpronounced consonants make it difficult for Thais to convert English words to Thai. For instance, the words “output” and “browser” are actually spelled as เอาต์พุต (ao-pút) and เบราว์เซอร์ (brao-sêr, “browser”), respectively, with their final consonants of their first syllables unpronounced. Consequently, some Thai speakers misspell the word เอาต์พุต (ao-pút, “output”) as เอาพุท (ao-pút) and

the word เบราวเซอร์ (brao-sêr, “browser”) as เบราเซอร์ (brao-sêr). In addition, the use of tonal markers for the English-Thai transliteration is generally not required unless the word has the same pronunciation as an existing Thai word, for instance โค้ก (khók, “Coca Cola”) and โคก (khôk, “hump”) or โคมา (kho-mâa, “coma”) and โคมา (kho-maa, literally “cow comes”). Some English-Thai transliterated words are spelled incorrectly based on their pronunciation, such as ไลบรารี (lai-braa-rêe) and ฟังก์ชัน (fan-chân). The correct spellings are ไลบรารี (lai-braa-ree) for library and ฟังก์ชัน (fang-chan) for function. In addition, the use of a short vowel marker of Thai writing system represented by “๕” (mai tai khu) to distinguish mono-syllabic words such as เซ็น (sign) และ เซน (zen) can create confusion. A lot of Thais misspell เซต (sét) (set) to เซ็ต (sét) because the correct and incorrect words are pronounced nearly the same. As a result, the issue is that the students might not know if the right spelling words are written with or without “๕” (mai tai khu).

The starting point for this research was the observation that Thai computer engineering students made numerous grammatical errors, including spelling errors in English and Thai, even though the final versions had been reviewed by both the students and their senior project advisors. The error frequencies were used to provide a more comprehensive understanding of the extent of each type of the error found in the senior project theses. Hence, the present work aimed at identifying different types of errors made by Thai computer engineering undergraduate students by looking into these following aspects: 1) the frequency of errors in the English abstracts, 2) the frequency of words incorrectly written and 3) the frequency of Thai syllable parts that errors were found. The frequency of errors revealed improper English usage as well as Thai word misspellings. The results helped advisors and students focus on those frequent errors. The higher the frequency of the error category or spelling, the more attention both the advisors and the students should be paid. The results can also be used by advisors and students to rectify English errors and terms related to computers and technology in Thai.

The objectives of research

1. To examine different types of errors both in English and Thai committed by Thai computer engineering undergraduate students in their senior project theses.
2. To analyze where the spelling errors occurred in Thai words found in senior project theses written by Thai computer engineering undergraduate students.

Significance of research

1. The findings could reveal the different types of errors both in Thai and English committed by Thai computer engineering undergraduates in their theses. This valuable information can be used as corrective feedback to make students aware of their errors.
2. The findings could be compiled into a guidebook or manual on writing proficiency in both Thai and English to help achieve acceptable quality in senior project theses.
3. The findings provide a list of frequently misspelled Thai words related to computers and technology, along with their correct words, which advisors and students can use to fix their writing.

Methodology

The source of data collection was derived from the eighteen senior project theses written by Thai undergraduate students over 18 years old, majoring in computer engineering, enrolled in the Computer Engineering Project I and II courses. Writing theses is the outcome-based evidence as it is set forth in the course requirements. To graduate, students must submit printed theses, which were used as sources for error analysis in this study. One thesis consisted of five chapters: abstract, introduction, literature review, methodology, results, discussion and conclusion, with a total number of 2,520 pages and an average of 140 pages per thesis. Except for the English abstracts, the theses were written entirely in Thai. These senior project theses are made available to the public. Details of the titles and the number of pages are shown in (Table 1).

Table 1 Thesis titles and number of pages.

thesis title	number of pages
1) Employee Time Clocking Attendance and Location Tracking System	165
2) PM 2.5 Temperature, and Humidity Detector via Line	134
3) Adventures in the Mystery Land Game on Mobile	186
4) Indoor Environment	125
5) Electronic Door Control System for Dormitory	306
6) An Eye Tracking Application for Bedridden Patients	121
7) Southern Thailand Tour Website	92
8) An Electric Trian Schedule Checking Application	167
9) Chatbot System	65
10) System Control Hydroponics via Smartphone	107
11) A Current and Temperature Measurement Tool for Fishing	176
12) A Development of a Website for Student Internships of the College of Engineering	166
13) An Application to Prevent Drowsiness	93
14) Face Mask Detection	131
15) Smart Cat Litter	102
16) Papaya Classification Using Image Processing	140
17) Classification of Banana Colors Using Image Processing	111
18) Automatic Salt Farming System	133

To detect the errors in the English abstracts, two university lecturers—a computer engineering lecturer and an English lecturer—looked for errors in the abstracts and used QuillBot, a writing tool, to help them recognize the errors. Moreover, AntConc (Anthony, 2019) was applied to determine the frequency of each error type. The types of errors in the abstracts were typed as words or texts representing the error types such as “article” and “capital_letter” to indicate the different types of errors and were saved in a text file. The word frequencies, which correspond to the error types' frequencies, were then found using AntConc. The study also examined the errors in Thai written words

and analyzed the parts of those errors based on Hou (2019). For each senior project thesis, every misspelled word was typed and saved in a text file. Next, AntConc was used to determine the frequency of misspelled words across all text files. For counting the error parts in syllables that formed words, the researchers typed the words representing parts of errors such as vowels and tones and saved them in a text file. Then, AntConc was applied to determine the frequencies of each word. To create understanding for foreigners about how to pronounce Thai words, an online automatic Thai to English transliteration tool (Thai2English, n.d.) was utilized to map from Thai words to English based on phonetic similarity. In addition, the Royal Institute of Thailand's Transliterated Words Database System (n.d.) was used to identify the correctly written words. For those words that were not listed in the database system, the internet sources were used to identify the correctly written words. (Figure 1) shows the methodology for investigating the errors in senior project theses.

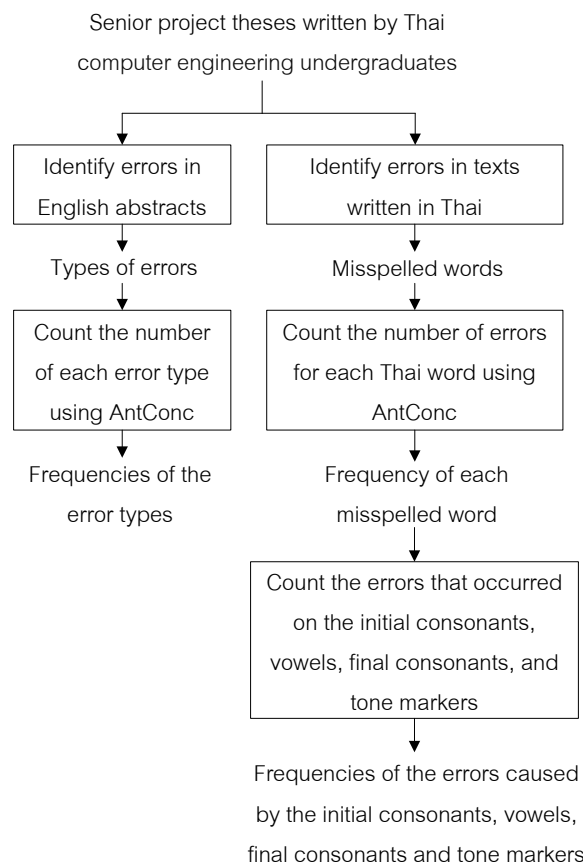


Figure 1 Methodology for investigating writing errors in senior project theses.

Results

Errors in the English abstracts

The results showed that many grammatical errors were found in the abstracts. Articles and capital letters were the most frequently found, followed by errors in sentence structures, verb forms, singular and plural forms, commas, full stops, auxiliary verbs, misspellings, and prepositions. Types of errors found in the abstracts and their frequency are shown in (Table 2).

Table 2 Types of errors in the abstracts and their frequencies.

No.	frequency	error type	No.	frequency	error type
1	23	article	15	2	gerund
2	23	capital letter	16	2	infinitive
3	17	sentence structure	17	2	participle
4	16	verb form	18	2	possessive
5	15	singular/plural	19	2	redundant word
6	13	comma	20	2	tense
7	9	full stop	21	2	typo
8	6	preposition	22	1	cause and effect
9	5	adjective	23	1	colon
10	5	misspelling	24	1	noun
11	4	auxiliary verb	25	1	pronoun
12	3	passive voice	26	1	space
13	2	conjunction	27	1	superlative/comparative
14	2	fragment	28	1	word choice

(Table 3) presents examples of flaws found in the English abstracts, along with the different types of errors made by the students.

Table 3 Examples of errors found in the English abstracts.

No.	errors	error type	correction
1	the event always move for selling in everywhere ...	verb form	the event always moves for selling in everywhere ...
2	Developer have found out these problems of this system and want to create the application ...	singular/plural, tense	developers have found out these problems of this system and wanted to create the application ...
3	the application has a GPS to confirm location when people signs in or out within the location that was set.	article, possessive, pronoun, verb form	when users sign in or out of the application, a GPS is used to confirm their location
4	to earn the salary more easier in this application	superlative/comparative adjective	to earn the salary more easily in this application
5	the result of system checking show that	verb form	the result of system checking shows that
6	everyone can work more efficient , can also get the exact data and easier to investigate it	adjective, sentence structure	Everyone can work more efficiently , obtain accurate data, and investigate it more easily

Table 3 Examples of errors found in the English abstracts (continue).

No.	errors	error type	correction
7	if you do not use a PM 2.5 dust mask, we inhale dust into the body and ...	article, pronoun, possessive	if you do not use a PM 2.5 dust mask, you inhale dust into your body and ...
8	there is an automatic notification system when the PM 2.5 dust levels were dangerous to health the system notify through the Line application. a user can also check the PM 2.5 dust ...	capital letter, comma, verb form	there is an automatic notification system. When the PM 2.5 dust levels were dangerous to health, the system notifies a user through the Line application. the user can also check the PM 2.5 dust ...
9	the system can work well, but it too big and heavy weight still inconvenient to carry	auxiliary verb, noun, sentence structure	The system can work well, but it is too big and heavy to carry ...
10	and displayed they're through a LCD screen...	sentence structure	and displayed them through a LCD screen ...
11	Currently, there are many an game applications available on mobile phones.	article	Currently, there are many game applications available on mobile phones
12	under stand	misspelling	understand
13	the pH of the seawater shouldn't be too much or too low ...	word choice	the pH of the seawater should not be too high or too low
14	in the future, it can connect to devices such as pumps for increased or reduce ...	gerund passive voice	in the future, it can be connected to devices such as pumps for increasing or reducing ...
15	receive data from the environmental sensor. and send the data to server To analyze ...	article, full stop	receive data from the environmental sensor and send the data to the server. To analyze ...
16	adjust the environment to meet the needs of users The user can ...	full stop, singular/plural	adjust the environment to meet the needs of users the users can ...
17	as a result, planting is more convenient the project has 3 main components	full stop	as a result, planting is more convenient. The project has 3 main components
18	... water flow rate (Water Flow Sensor), part 2 is the processing and recording Data Use the Raspberry Pi 4 ...	comma, capital letter, preposition, sentence structure	... water flow rate (Water Flow Sensor). Part 2 is the processing and recording of data using the Raspberry Pi 4 ...
19	by using a mobile application and key cards to control the door lock of the dormitory	fragment	a mobile application and key cards are used to control the door lock of the dormitory
20	the application can verify the user, and view usage history, and battery status	conjunction, sentence structure	the application can verify the user, view usage history, and battery status.
21	an eye tracking application for bedridden Patients is designed to help patients to communicate their needs ...	capital letter, infinitive	an eye tracking application for bedridden patients is designed to help patients communicate their needs ...
22	it works by detecting an eye movements ...	article	It works by detecting eye movements ...
23	The designed program is able to detects eye movements ...	verb form	the designed program is able to detect eye movements ...
24	moreover, there still problems in the detection precision	auxiliary verb, preposition, sentence structure	moreover, there are still problems with the detection precision
25	92 page	singular/plural	92 pages
26	however, the system still lacks of the parts of deleting add packaging information of the admin user	participle preposition	however, the system still lacks the parts of deleting added packaging information from the admin user

Table 3 Examples of errors found in the English abstracts (continue).

No.	errors	error type	correction
27	however, it is preferable to know the data in advance for the journey such as the density of people on the station and the train schedule, Therefore, this application has been developed on an android operating system ...	comma, capital letter, preposition	however, it is preferable to know the data in advance for the journey, such as the density of people at the station and the train schedule. Therefore, this application has been developed on an Android operating system ...
28	the density of people on the stations the density of people at the station .	preposition, singular/plural	the density of people at the stations. the density of people at the stations .
29	the train positions on the map which does not match the actual positions	comma, verb form	the train positions on the map, which do not match the actual positions
30	therefore, there are suggestions for further development in the future	redundant word	therefore, there are suggestions for development in the future
31	then ESP8266 board will send all informations through WIFI via smartphone ...	article, singular/plural, misspelling	then the ESP8266 board will send all information through WiFi via smartphone ...
32	the smartphone is the receiver by using application blynk .	capital letter, sentence structure	using the Blynk application, the smartphone serves as the receiver
33	the EC meter gets connect to floating foam and uses AI camera ...	article, sentence structure, verb form	the EC meter gets connected to floating foam and uses an AI camera ...
34	reducing pH and increasing EC has pH tank and EC tank to get controlled ...	verb form, article, sentence structure	to reduce the pH and EC levels, a pH tank and an EC tank are used ...
35	by Sonoff connects with solenoid valve to turn on and turn off with eWeLink application	sentence structure, article, capital letter	by connecting Sonoff with a solenoid valve to turn on and off with the eWeLink application
36	AI camera uses for testing the system runs ...	article, gerund, passive voice	the AI camera is used for testing the system running ...
37	has weak point	article	has a weak point
38	Because it will not have too many nutrients in the water	fragment	this is because it will not have too many nutrients in the water
39	when the water contain so many nutrient ...	verb form, singular/plural,	when the water contains so many nutrients
40	the project has divided into 2 parts: The first part placed on boat	article, colon, passive voice	the project is divided into 2 parts. The first part is placed on a boat
41	the second part placed underwater ...	passive voice	the second part is placed underwater ...
42	... comparing the results with the standard equipmens ...	misspelling, singular/plural	... comparing the results with the standard equipment ...
43	in the future, the flow Meter should be improved ...	capital letter	in the future, the flow meter should be improved ...
44	in addition, there are several procedures for the internship while there is only on clerk ...	misspelling	in addition, there are several procedures for the internship while there is only one clerk ...
45	the results showed that the system was function and in accordance with the design	adjective, conjunction	the results showed that the system was functional in accordance with the design
46	from the results of the test, it was concluded that the area where the digital camera is installed to detect yawning ...	sentence structure	from the results of the test, it was concluded that the area where the digital camera is installed can detect yawning ...
47	from different angles in the driver's room and On the hardware ...	capital letter	from different angles in the driver's room and on the hardware ...

Table 3 Examples of errors found in the English abstracts (continue).

No.	errors	error type	correction
48	the project trains computer program by building CNN ...	article	the project trains the computer program by building CNN ...
49	face mask detection project uses dataset which contains ...	article	face mask detection project uses a dataset which contains ...
50	USB Webcam which is connected to computer	article, article, capital letter	A USB webcam which is connected to the computer ...
51	the computer training uses epochs = 5, batch size = 64, train 91% and test accuracy 93%	cause and effect, sentence structure, comma	the computer training uses 5 epochs and a batch size of 64. 91% train accuracy and 93% test accuracy are achieved
52	without-mask face detection in distance 50-100 centimeters is able to ...	article, preposition, sentence structure	without-mask face detection at a distance of 50-100 centimeters is able to ...
53	which equivalent to 4%	auxiliary verb	which is equivalent to 4%
54	detect average time is 1.35 minutes ...	adjective, sentence structure	average detection time is 1.35 minutes ...
55	however, face mask detection program is unable to detect	article	however, the face mask detection program is unable to detect ...
56	112 page	singular/plural	112 pages
57	from the problem of using a cat little box. cat owners encounter ...	full stop, capital letter	from the problem of using a cat little box, cat owners encounter
58	... make the weight sensor measure more accurate	adjective	... make the weight sensor measure more accurately
59	... a model for classify ing the colors ...	typo	... a model for classifying the colors ...
60	the average classification accuracy of 86.86% were achieved	auxiliary verb	the average classification accuracy of 86.86% was achieved

Errors in other parts of the senior project theses

(Table 4) shows a list of correct words that were frequently misspelled and their frequencies. The top three words that the students wrote wrongly were ไบรารี (lai-braa-ree, “library”), อัปโหลด (àp-lòht, “upload”), and ฟังก์ชัน (fang-chan, “function”).

Table 4 A list of correct words frequently misspelled and their frequencies.

No.	frequency	correct word	No.	frequency	correct word
1	111	ไลบรารี (lai-braa-ree) library	21	8	รีเลชัน (ree lay chan) relation
2	68	อัปโหลด (àp-lòht) upload	22	8	เบราว์เซอร์ (brao-sêr) browser
3	43	ฟังก์ชัน (fang-chan) function	23	8	เวอร์ชัน (wer-chan) version
4	41	ดิจิทัล (di-ji-tan) digital	24	7	กราฟิก (graa-fik) graphic
5	21	อินเทอร์เน็ต (in-têr-nét) internet	25	7	อัปเกรด (àp-grèt) upgrade
6	21	°C°	26	5	ลิงก์ (ling) link
7	20	เซต (sét) set	27	5	อีเมล (ee-men) email
8	19	อัปเดต (àp-dèt) update	28	5	เอาต์พุต (ao-pút) output
9	19	โปรเจกต์ (poh rá-jèk) project	29	5	พริ้นต์ (prin) print
10	18	สมาร์ทโฟน (sà-màat fohn) smartphone	30	4	บล็อก (blòk) blog
11	17	แอปพลิเคชัน (àep-pli-kay-chan) application	31	4	อัลกอริทึม (an-gor-ri-teum) algorithm

Table 4 A list of correct words frequently misspelled and their frequencies (continue).

No.	frequency	correct word	No.	frequency	correct word
12	15	วิดีโอ (wi-dee-oh) video	32	4	โซนาร์ (soh-naa) sonar
13	15	แอนะล็อก (ae nâ lók) analog	33	3	ดีบั๊ก (dee bàk) debug
14	14	แอตทริบิวต์ (àet-tri-biw) attribute	34	3	สเปก (sà-bpék), สเป็ก (sà-bpék) specification
15	13	ล็อก (lók) log	35	3	เรคคอร์ด (ray kòt) record
16	12	WiFi*	36	3	แบตเตอรี่ (bàet-dter-rée) battery
17	9	อินเตอร์เฟซ (in-dtêr-fèt) interface	37	3	แอป, แอปป์ (àep) app
18	9	อ็อบเจกต์ (òp-jèk) object	38	2	ประสิทธิภาพ (bprà-sit-ti-pâap) efficiency
19	9	เว็บไซต์ (wèp sai) website	39	2	คอมเมนต์ (kom men) comment
20	9	เอนทิตี (en-ti-dtee) entity	40	2	คอมโพเนนต์ (kom poh nen) component

* English words found in other parts of the theses

After obtaining the words listed in (Table 4), the frequencies of errors in each syllable part of the words were counted. (Table 5) displays the number of errors found in each syllable part along with their percentages.

Table 5 Syllable parts with errors and their percentages.

parts of errors	number of errors	percentage
initial consonants	144	19.57
vowels	135	18.34
final consonants	233	31.66
unpronounced consonants	53	7.20
tone markers	171	23.23

To provide more specific information, the frequencies of incorrect words and the syllable parts where errors occurred were also presented. As indicated in (Table 6), a Thai word may be incorrectly written in different ways. For example, the word ไ้บรารี (lai-braa-ree, “library”) was incorrectly written as ไ้บรารี (lai-braa-rée), ไ้บารี (lai-baa-ree), ไ้บารี (lai-baa rée), and ไ้บลารี (lai-blaa-ree) with frequencies of 74, 21, 15, and 1, respectively. It became clear that the misspelled word ไ้บรารี (lai-braa-rée) occurred due to the incorrect tone marker on the third syllable. Both words, ไ้บารี (lai-baa-ree) and ไ้บารี (lai-baa rée), were incorrect because the flaws were created by the wrong initial consonant part of the second syllable for the former, and for the latter, the errors occurred on the initial consonant part of the second syllable together with the incorrect tone marker on the third syllable. In a similar vein, the word ไ้บลารี (lai-blaa-ree) was found incorrect due to the wrong initial

consonant part of the second syllable. In addition, 21 and 12 errors were found in the words °C and WiFi, which appeared in other sections of the theses but not in the abstract.

Table 6 The frequency of incorrect words and parts of errors.

No.	frequency	correct word	incorrect word	parts of errors
1	74	ไลบรารี (lai-braa-ree) library	ไลบรารี (lai-braa-rée)	วรรณยุกต์ (tones)
2	67	อัปโหลด (áp-lóht) upload	อัปโหลด (áp lóht)	พยัญชนะท้าย (final consonants)
3	41	ดิจิทัล (di-ji-tan) digital	ดิจิตอล (di-ji-dton)	พยัญชนะต้น (initial consonants)
				สระ (vowels)
4	38	ฟังก์ชัน (fang-chan) function	ฟังก์ชัน (fang-chân)	วรรณยุกต์ (tones)
5	21	°C	C°	พิมพ์ผิด (typo)
6	21	ไลบรารี (lai-braa-ree) library	ไลบารี (lai-baa-ree)	พยัญชนะต้น (initial consonants)
7	18	สมาร์ทโฟน (sà-màat fohn) smartphone	สมาาร์ทโฟน (sà-màat fohn)	พยัญชนะท้าย (final consonants)
8	18	อินเทอร์เน็ต (in-tér-nét) internet	อินเตอร์เน็ต (in-dtér-nét)	พยัญชนะต้น (initial consonants)
9	17	เซต (sét) set	เซ็ต (sét)	สระ (vowels)
10	15	วิดีโอ (wi-dee-oh) video	วีดีโอ (wee-dee-oh)	สระ (vowels)
11	15	ไลบรารี (lai-braa-ree) library	ไลบารี (lai-baa rée)	พยัญชนะต้น (initial consonants)
				วรรณยุกต์ (tones)
12	14	แอนะล็อก (ae ná lók) analog	อนาล็อก (à-naa-lók)	พยัญชนะท้าย (final consonants)
				สระ (vowels) สระ (vowels)
13	13	ล็อก (lók) log	ล็อก (lók)	พยัญชนะท้าย (final consonants)
14	12	WiFi	Wifi หรือ wifi	ตัวอักษรตัวใหญ่/เล็ก
15	12	อัปเดต (áp-dèt) update	อัปเดต (áp-dèt)	พยัญชนะท้าย (final consonants)
				พยัญชนะท้าย (final consonants)
16	12	โปรเจกต์ (poh-rá-jèk) project	โปรเจค (bpoh-rá-jèk)	พยัญชนะต้น (initial consonants)
				พยัญชนะท้าย (final consonants)
				พยัญชนะท้ายที่ไม่ออกเสียง (unpronounced final consonants)
17	9	อินเตอร์เฟซ (in-dtér-fèt) interface	อินเตอร์เฟซ (in-tér-fèt)	พยัญชนะต้น (initial consonants)
				พยัญชนะท้าย (final consonants)
18	9	เว็บไซต์ (wép sai) website	เว็บไซต์ (wép-sai)	พยัญชนะท้าย (final consonants)
19	8	รีเลชัน (ree-lay-chan) relation	รีเลชัน (ree-lay-chân)	วรรณยุกต์ (tones)
20	8	เวอร์ชัน (wer-chan) version	เวอร์ชัน (wer-chân)	วรรณยุกต์ (tones)
21	8	แอตทริบิวต์ (àet-tri-biw) attribute	แอททริบิวต์ (ae-tót-ri-biw)	พยัญชนะท้าย (final consonants)
22	7	เบราว์เซอร์ (brao-sér) browser	บราวเซอร์ (bà-räao-sér)	สระ (vowels)
				พยัญชนะท้ายที่ไม่ออกเสียง (unpronounced final consonants)
23	7	อัปเดต (áp-dèt) update	อัปเดต (áp-dèt)	พยัญชนะท้าย (final consonants)
24	7	แอปพลิเคชัน (àep-pli-kay-chan) application	แอปพลิเคชัน (ae-bpà-pli kay chân)	วรรณยุกต์ (tones)
25	6	กราฟิก (graa-fik) graphic	กราฟฟิก (gráaf-fik)	พยัญชนะท้าย (final consonants)
26	6	แอตทริบิวต์ (àet-tri-biw) attribute	แอททริบิวต์ (ae-tót-ri-biw)	พยัญชนะท้าย (final consonants)
27	6	แอปพลิเคชัน (àep-pli-kay-chan) application	แอปพลิเคชัน (àep-pli-kay-chan)	พยัญชนะท้าย (final consonants)
28	6	โปรเจกต์ (poh-rá-jèk) project	โปรเจกต์ (bproh-jèk)	พยัญชนะต้น (initial consonants)

Table 6 The frequency of incorrect words and parts of errors (continue).

No.	frequency	correct word	incorrect word	parts of errors
29	5	พริ้นต์ (prin) print	บรื้น (bprin)	พยัญชนะต้น (initial consonants) พยัญชนะท้ายที่ไม่ออกเสียง (unpronounced final consonants)
30	5	อัปเกรด (àp-grèt) upgrade	อัพเกรด (àp-grèt)	พยัญชนะท้าย (final consonants)
31	5	อีเมล (ee-men) email	อีเมลล์ (ee-men)	พยัญชนะท้ายที่ไม่ออกเสียง (unpronounced final consonants)
32	4	บล็อก (blòk) blog	บล็อก (blòk)	พยัญชนะท้าย (final consonants)
33	4	ฟังก์ชัน (fang-chan) function	ฟังก์ชั่น (fang-gà-chàn)	พยัญชนะท้ายที่ไม่ออกเสียง (unpronounced final consonants) วรรณยุกต์ (tones)
34	4	อ็อบเจกต์ (òp-jèk) object	อ็อบเจ็กต์ (òp-jèk)	สระ (vowels)
35	4	เอนทิตี (en-ti-dtee) entity	เอนทิที (en-ti-tee)	พยัญชนะต้น (initial consonants)
36	4	แอปพลิเคชัน (àep-pli-kay-chan) application	แอปพลิเคชัน (ae-pá-pli-kay-chàn)	พยัญชนะท้าย (final consonants) วรรณยุกต์ (tones)
37	4	โซนาร์ (soh-naa) sonar	โซน่า (soh-nàa)	วรรณยุกต์ (tones) พยัญชนะท้ายที่ไม่ออกเสียง (unpronounced final consonants)
38	3	เอนทิตี (en-ti-dtee) entity	เอนทิตี้ (en ti-dtée)	วรรณยุกต์ (tones)
39	3	ดีบั๊ก (dee bàk) debug	ดีบัค (dee-bàk)	พยัญชนะท้าย (final consonants)
40	3	ลิงก์ (ling) link	ลิงค์ (ling)	พยัญชนะท้ายที่ไม่ออกเสียง (unpronounced final consonants)
41	3	อินเทอร์เน็ต (in-tèr-nét) internet	อินเอร์เน็ต (in-ay-nét)	พยัญชนะต้น (initial consonants)
42	3	เซต (sèt) set	เซ็ท (sèt)	พยัญชนะท้าย (final consonants) สระ (vowels)
43	3	อัลกอริทึม (an-gor-ri-teum) algorithm	อัลกอรีทึม (an gor réu teum)	สระ (vowels)
44	3	สเปก (sà-bpèk), สเป็ก (sà-bpèk) specification	สเปค (sà-bpèk)	พยัญชนะท้าย (final consonants)
45	3	เรคอร์ด (ray kòt) record	เรคคอร์ด (rèk-kòt)	พยัญชนะท้าย (final consonants)
46	3	แบตเตอรี่ (bàet-dter-rée) battery	แบเตอรี (bae-dter-rée)	พยัญชนะท้าย (final consonants)
47	3	แอป, แอป (àep) app	แอป (àep)	พยัญชนะท้าย (final consonants)
48	2	อ็อบเจกต์ (òp-jèk) object	ออปเจ็ค (or-bpà-jèk)	พยัญชนะท้าย (final consonants) พยัญชนะท้าย (final consonants) สระ (vowels) สระ (vowels) พยัญชนะท้ายที่ไม่ออกเสียง (unpronounced final consonants)
49	2	อ็อบเจกต์ (òp-jèk) object	อ็อบเจ็กต์ (òp-jèk)	พยัญชนะท้าย (final consonants) สระ (vowels)
50	2	เอนทิตี (en-ti-dtee) entity	เอ็นทิตี้ (en ti-dtée)	สระ (vowels) วรรณยุกต์ (tones)
51	2	อัปเกรด (àp-grèt) upgrade	อัปเกรด (àp-grèt)	พยัญชนะท้าย (final consonants)
52	2	เอาต์พุต (ao-pút) output	เอาท์พุท (ao-pút)	พยัญชนะท้าย (final consonants) พยัญชนะท้ายที่ไม่ออกเสียง (unpronounced final consonants)
53	2	เอาต์พุต (ao-pút) output	เอาท์พุท (ao-pút)	พยัญชนะท้าย (final consonants)

Table 6 The frequency of incorrect words and parts of errors (continue).

No.	frequency	correct word	incorrect word	parts of errors
54	2	ประสิทธิภาพ (bprà-sit-ti-páap) efficiency	ประสิทธิภาพ (bprà-sit páap)	พยัญชนะท้ายที่ไม่ออกเสียง (unpronounced final consonants)
55	2	คอมเมนต์ (kom men) comment	คอมเม้นต์ (kom mén)	วรรณยุกต์ (tones)
56	2	คอมโพเนนต์ (kom poh nen) component	คอมโพเนนต์ (kom-pai-nen)	สระ (vowels)
57	1	ไลบรารี (lai-braa-ree) library	ไลบลารี (lai-blaa-ree)	พยัญชนะต้น (initial consonants)
58	1	เอาต์พุต (ao-pút) output	เอาพุท (ao-pút)	พยัญชนะท้าย (final consonants) พยัญชนะท้ายที่ไม่ออกเสียง (unpronounced final consonants)
59	1	อ็อบเจกต์ (òp-jèk) object	ออบเจ็ค (or-bà-jèk)	พยัญชนะท้าย (final consonants) สระ (vowels) สระ (vowels) พยัญชนะท้ายที่ไม่ออกเสียง (unpronounced final consonants)
60	1	อัปโหลด (áp-lòht) upload	อัปโหลด (áp-lòht)	พยัญชนะท้าย (final consonants)
61	1	ฟังก์ชัน (fang-chan) function	ฟังก์ชัน (fang-chan)	พยัญชนะท้ายที่ไม่ออกเสียง (unpronounced final consonants)
62	1	โปรเจกต์ (poh-rà-jèk) project	โปรเจ็กต์ (bpoh-rà-jèk)	พยัญชนะต้น (initial consonants) สระ (vowels)
63	1	แอนะล็อก (ae-ná lók) analog	อะนาลอก (à-naa-lók)	สระ (vowels) สระ (vowels) สระ (vowels)
64	1	เบราว์เซอร์ (brao-sêr) browser	เบราเซอร์ (brao-sêr)	พยัญชนะท้ายที่ไม่ออกเสียง (unpronounced final consonants)
65	1	กราฟิก (graa-fik) graphic	กราฟิกส์ (graa-fik)	พยัญชนะท้ายที่ไม่ออกเสียง (unpronounced final consonants)
66	1	ลิงก์ (ling) link	ลิ่ง (ling)	พยัญชนะท้ายที่ไม่ออกเสียง (unpronounced final consonants) วรรณยุกต์ (tones)
67	1	ลิงก์ (ling) link	ลิงค์ (ling)	พยัญชนะท้ายที่ไม่ออกเสียง (unpronounced final consonants)
68	1	อัลกอริทึม (an-gor-ri-teum) algorithm	อัลกอรีทึม (an gor réu tèum)	สระ (vowels) วรรณยุกต์ (tones)

Discussion

Theses for senior projects are the results-based outcomes of research projects. Not only could the students conduct experiments relating to their disciplines, but they could also disseminate their findings in the form of both written theses and oral presentations, contributing significantly to the industry. However, the present study indicated that the theses contained numerous Thai and English errors, including article errors, capitalization errors, and punctuation errors (full stops). The study postulated that these errors stemmed from inadequate knowledge of grammatical rules based on the empirical results. Previous research also suggested that another important cause of errors resulted from the first language interference in the sense that the students were unaware of using nouns as singular or plural (Dechvijankit, & Puangsing, 2021). Apparently, singularity and plurality in English differs

from the Thai language in a way that Thai people add separate words called collective nouns to indicate a large number of objects. On the contrary, the singular or plural nouns in English could be exhibited by adding one free or bound morpheme “s” or “es”. For this reason, undoubtedly Thai students were more likely to commit this type of error repetitively. The current results agreed well with the research of Promsupa, Varasarin, & Brudhiprabha (2017), expounding that singular/plural errors and article errors were often found. Although these grammatical errors may not completely obscure the meanings of students’ writing, the worrying point is that their presence or prevalence can significantly undermine its quality and prevent it from reaching publishable quality (Kampookaew, 2020). Senior project advisors should enlighten students about the writing errors documented in this study, as well as explain common English mistakes. They can also provide guidance on the utilization of grammar-checking tools. Students can then leverage solutions such as QuillBot grammar checker and Ref-n-Write to polish their English language.

Based on the current findings, Thai computer engineering undergraduates often misspelled Thai words borrowed from other languages, such as ไบรารี (lai-braa-rêe), ฟังก์ชัน (fang-chân), ดิจิตอล (di-ji-dton), เวอร์ชัน (wer-chân), แอปพลิเคชัน (ae bpà-pli kay chôn), กราฟฟิก (gráaf fik), วีดีโอ (wee-dee-oh), โซน่า (soh-nâa). The students misspelled the words because they were accustomed to the way people pronounce them. In addition, words such as อัฟโหลด (àp lòht), สมาร์ทโฟน (sà-màat fohn), อัปเดต (àp-dèt), บล็อก (blòk), ลิงค์ (ling), were incorrectly spelled because some Thai words have multiple written forms but the same pronunciation. For example, words using the short vowel marker “ั” (mai tai khu) such as เซ็ต (sét) and เซต (sét), อีอบเจ็กต์ (òp-jèk) and อีอบเจกต์ (òp-jèk) were pronounced nearly identically or exactly the same. The use of a thanthakhat over the final consonant of a word in Thai language indicates that the sound of the consonant is muted. For example, both words อีเมล (ee-men) and อีเมลล์ are pronounced the same. Consequently, the students were confused about whether the words had a thanthakhat over the final consonant. Although the total number of theses may be limited, the study offered insightful data reflecting on common errors made by Thai undergraduates studying computer engineering. To gain a comprehensive understanding, further studies with larger data are recommended. For pedagogical implications, the current findings could allow the students to learn from other students’ mistakes to enhance their writing quality as well as to raise students’ and advisors’ awareness of their roles in preventing writing errors. Therefore, it is suggested that senior project advisors or English teachers compile the most frequent grammatical and spelling errors and produce guidebooks that illustrate these common mistakes and highlight the correct patterns with a list of correctly spelled words.

Conclusion

The present study investigated the types of grammatical errors in senior project theses written by Thai computer engineering undergraduate students. The results revealed writing errors in both

English and Thai. Grammatical knowledge, including the use of articles and possessives, pronouns, capital letters, commas, and full stops, should be taught comprehensively. To achieve this, senior project advisors should point out some examples of errors to the students and encourage them to practice writing accurately. Moreover, most errors found in Thai writing were the result of the misspelling of the final consonants, tone markers, initial consonants, vowels, and silent consonants. These errors diminish the work quality and reputation of academic programs, undermining the credibility of the institutions. The findings provide pedagogical implications for both senior project advisors and computer engineering undergraduate students. These guidelines can help students enhance their writing skills, enabling them to achieve publishable quality. Despite its immense benefits for academic writing, this research has some limitations, particularly the need for more data to be collected and analyzed. Further studies should expand to other disciplines, including social science and the humanities, medicine, and pharmaceutical studies.

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