Teaching English to Thai Students using an Artificial Intelligence Technology Algorithmic Model: A Prototype Analysis

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Abstract: In 2019**,** artificial intelligence (AI) use in education (AIEd) was a $500 million sector. However, by 2024 AI's use in education is estimated to increase to over $6 billion a year, with companies such as Grammarly currently valued at over $1 billion. Looking beyond writing assistants using AI technology, the 'Holy Grail' of AI use can do flawless, simultaneous translations between languages. As such, the authors developed and prototyped an AI technology (AIT) model for use in the English education of Thai students. The sample for the study consisted of one classroom of 40 upper secondary high-school students who were in their second semester of studies in the 2020 academic year. The tools used for data collection consisted of an AI technology algorithm to help teach English to Thai students. Knowledge measurement understanding of sentence structure and English vocabulary was determined to have an IOC consistency (IOC) from 0.60-1.00, a difficulty between 0.26-0.75, and a discriminant power of 0.74. A t-test additionally analyzed the data on the dependent sample. Results revealed that the students gained knowledge of English after studying using the AIT algorithm prototype to help teach English was higher than before. Also, the students were satisfied with the model at the highest level. Therefore, it can be concluded that the quality is suitable and acceptable.

Keywords: English, natural language processing, m-learning, New Normal, online education, Thailand

Introduction

English is considered a second language to many globally and plays an essential role in a broader level of communication at the international level. Moreover, being proficient in English can be crucial in studying abroad or an international institute in Thailand, with many of the belief that English proficiency can open employment opportunities in international sectors ranging from aviation to tourism to foreign trade. Furthermore, English language proficiency can open doors to scholarships and advanced studies for many students due to English being considered the language of business and academics.

However, language learning for many is complex, and for decades now, researchers have explored how to apply AIT to the process of language learning and speech recognition (SR). Growth within this sector is vast, with one report indicating that AI-enabled learning management tools have increased 47% since 2019 (Gautam, 2019).Also, the market value of AIEd is increasing quickly, rising from an estimated $500 million in 2019 to an estimated $6 billion by 2024 (Mwiti, 2019).

This is significant, as one of the essential aspects of online learning today has been the degree to which educators and students can 'personalize' their learning environments. Thus, from AIT, courses can be readily adapted to each student's knowledge level, learning speed, and goals. Additionally, AIT platforms can analyze students' learning histories, identify their weaknesses and offer courses best suited for improvement.

Concerning SR, Liaw (2013) examined its capability and use for Taiwanese elementary school children and demonstrated that the commercial software used was problematic in its over-correcting, even though the children were sure they were correct. This is consistent with Eskenazi (1999), who also stated that incorrect feedback avoidance remains challenging inapplying automatic SRsoftware.

Moreover, Baker et al. (2019) identified three AI education (AIEd) tools being used in UK schools. These were learner-facing (adaptive learning platforms), teacher-facing (automated assessment tools or advanced teacher dashboards) and system-facing (analyzing data from across schools to predict school inspection performance). In the US, Shroff (2020) discovered the effectiveness of games in learning a new language and noted how little research had been conducted on the use of AI in learning a language.

Also, Charniak (2019) has reported that in a sentence to sentence, translation systems from one language to another need tobe able to differentiate between sentences. This is consistent with Saini and Sahula (2020), who also noted the ease of translating a sentence from one language tothe other if the structure of the languages is similar. However, the Thai language is not similar in structure to Western languages and, therefore, requires software development and AIT use to develop an effective system.

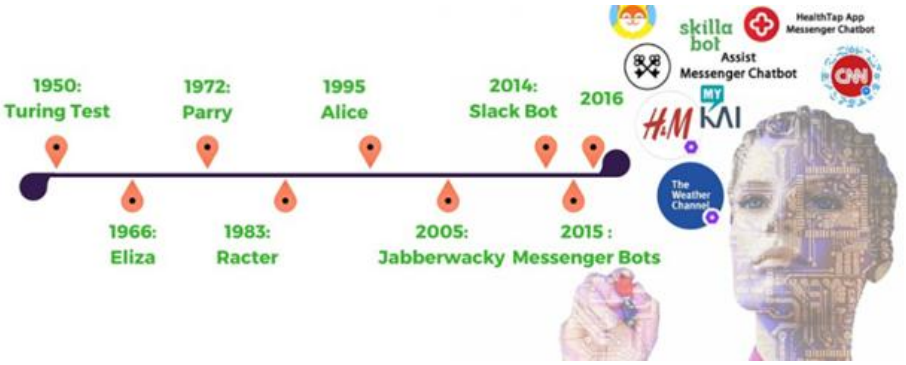
Fortunately, the development of English language AI tools, although unreliable in the past, are making great strides in their accuracy due to advances in natural language processing (NLP) (Madi & Al-Khalifa, 2018) and the related subfield convergences of AI, linguistics, and computer science as pertains to human-machine natural language interaction. Witnessing this revolution in AIT use in the English language use authentication within the commercial and academic sectors isthe English writing assistant '*Grammarly*' (Fitria, 2021).

Researchers such as Mammadova (2019) point out the growing influence and importance of online language checkers and have stated they are now playing a crucial role in teaching English and learning. Joseph et al. (2016) has also added thatNLP is effective in the computer analysis of text, which involves gathering knowledge on how human beings understand and use language. These studies are consistent with Tonic (2020), who also stated that AI's recent advances in machine learning deep neural networks had engendered a revolutionary way for individuals to write in which they can craft compositions that are augmented by algorithmic grammar checkers correcting writing in real-time (such as with Grammarly).

As stated, Thais have difficulties in finding native-speaker teachers due to cost, availability, and now teacher foreign teacher 'lockouts' due to the global Covid-19 pandemic travel restrictions. As such, some have turned to '*chatbots*' to fill in these native speaker gaps in *English Learning* (FLL) (Fryer & Carpenter, 2006). Once again, with the personalized education movement, chatbots could be an AIT tool from which students can be provided English practice anytime and virtually anywhere.

Chatbot technology is not new, with the first widely recognized *ELIZA*chatbot entering the space in 1966 with the ability to conduct conversations with text-to-speech interaction (Figure 1). However, there have been great leaps in this technology, with Amazon's *ALEXA*in 2021 now able to understand and process a human's voice which can also talk back and answer the questions being asked. Furthermore, recently, Huang et al. (2021) examined 25 language learning empirical studies in which chatbots were used and stated that they effectively communicate with users in their target languages. Also, chatbot use has a positive outcome on a student's behavioral outcome, which can be used to perform as an external learning partner.

Figure 1. A chatbot history timeline



Source: https://web.njit.edu/~ronkowit/eliza.html

However, despite its worldwide fame as a tourist destination and the requirement for English language education from the first grade through the twelfth grade (Ministry of Education, 2008; Prasongporn, n/d), Thai English language test scores reveal questionable teaching methods (Noom-ura, 2013). Although many factors have been identified from both Thai scholar studies and international agency reports, the outcome is a continuing decrease in student English language test scores.

An example of this was the most recent 2020 report from *EF Education*, in which English language scores were reported to have dropped for a third consecutive year to 419 (very low) out of a possible 800 ("English skills drop again," 2020). There is also a consistent complaint from students to parents that the focus on grammar, translation, and memorization does not meet the real-life communications' needs of the students in a real-world environment for employment, education, or international travel (Kaur et al., 2016; Thadphoothon, 2017).

Furthermore, it has been found that English language teaching and learning has not yet been integrated into all four required skill sets. Once again, theheavy emphasis on teaching grammar and vocabulary precludes learners from the opportunity to use English effectively. Also, even when the expense and effort are undertaken to hire foreign English teachers, many Thai families cannot afford the extra expense of these special programs. Additionally, more often than not, the teaching and learning methods are not diverse and do not correspond to the needs of the students. Also, unfortunately, Thai English class sizes are notoriously large and challenging to manage, with the assignment of English language teachers who have little to no training in their assigned discipline(Thadphoothon, 2017).

Moreover, in researchers' deeper examinations of Thai English-language classes, several problematic themes keep re-occurring. These include poorly-trained and unqualified teachers, poor student motivation, mixed-ability learners in overly large classes, and infrequent opportunities for student exposure to English outside of class time (Dhanasobhon, 2006; Noom-ura, 2013; ONEC, 2003).

However, fortunately, technology is opening up many new possibilities for language learning, and the Internet has tremendous potential (Fryer & Carpenter, 2006). This is consistent with Benson (2001) also pointed out that the Internet is a powerful tool for self-directed learning in which learners can study whenever they want using a potentially unlimited range of authentic materials.

Therefore, the authors feel that other methods and solutions must be found with these significant and continuing limitations with English language learning in Thailand and the stated objective of online learning under the Covid-19 pandemic education '*New Normal*.' Given the long and rich history of natural language processing (NLP) use in AIT for chatbots and language learning systems, the authors developed an AIT algorithm model in Thai English development.

Research Objectives

Research objectives

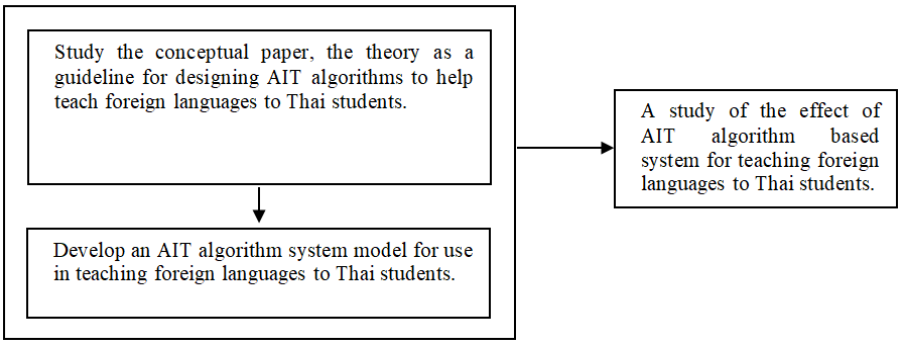
1. To develop an AIT algorithm model in teaching aids for English to Thai students.

2. To certify the AIT algorithm to help teach English to Thai students.

Conceptual Framework

Figure 2 shows the study's conceptual framework.

Figure 2. The English training program development process



Research Methods

Sample

The sample obtained for the research consisted of 40 high school students studying in the second semester of the academic year 2020. Simple random sampling was used to identify the sample group further. The tools used for data collection in the AIT algorithm model prototype to teach English to Thai students used four aspects in the assessment and measurement process. These included:

1) Speech identification,
2)Vocabulary correctness,
3) Sentence patterns and grammar aspects, and
4) Pronunciation fluency.

Student Knowledge Assessment

The student knowledge assessment exercise used a measurement instrument and process developed by five experts in English, language measurement, and evaluation. The 40 item quiz used a response mechanism in which a score of '1' indicated a correct response, while the value of '0' was used to indicate an incorrect response. The 40 items covered multiple topics, including sentence structure, speech identification, vocabulary correctness, grammar aspects, and pronunciation fluency (Al Mukhallafi, 2020).Subsequently, it was determined

that the assessment instrument had a reliability of 0.60-1.00 as determined by using the IOC consistency value scale.

After successfully developing the assessment instrument, a tryout was undertaken in which 30 tenth grade (Mathayomsuksa 4) students were asked to participate in the form's assessment. After their scores were analyzed, the quality of the knowledge scale and difficulty value was between 0.26-0.75, with a discriminant power of 0.74.

After that, a questionnaire was developed in which another group of experts consisting of information communication technology (ICT) specialists, English teachers, and language measurement and evaluation experts analyzed the authors' AI algorithm technology system's four aspects in teaching English. It is characterized as a 5-level Likert scale depicted in Table 1.

Table 1. Satisfaction levels of students

Scale Level	Level	Scale Range	Interpretation
5	Very high	4.51 – 5.00	highest agreement
4	High	3.51 – 4.50	high agreement
3	Medium	2.51 – 3.50	moderate agreement
2	Low	1.51 – 2.50	somewhat agree
1	Very low	1.00 – 1.50	minimal agreement

Sampling and collection process

The researchers used an AIT algorithm model to help teach Englishto a sample group of Grade 10 students in Bangkok. The sample group was obtained using random cluster sampling by drawing lots in one classroom of 40 students. After that, an assessment was performed on each student's English comprehension before participating in the study using the AIT algorithm system model to help them learn English. After the sample group had participated and completed all the system's functions, each student was asked to take an English language comprehension test and a student satisfaction questionnaire. After that, the researchers took the model and related output and assessment data and had three additional experts certify the model.

Data analysis

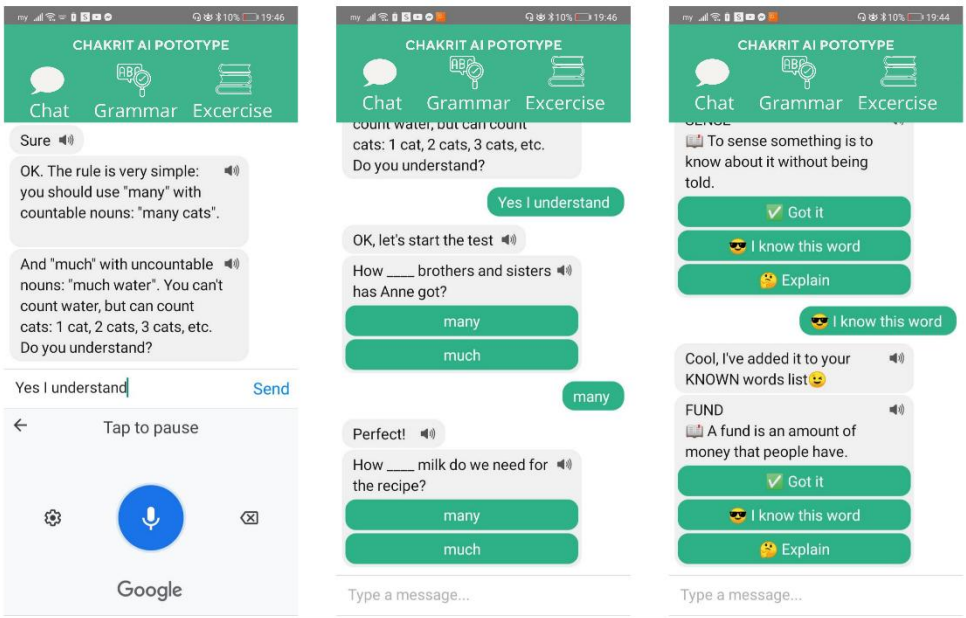
The researchers compared the students' English comprehension before and after studying with the AIT algorithmic model in teaching English. The two groups of t-test for dependent samples were statistically analyzed, and the students' satisfaction level and experts' opinions on the cognitive technology's algorithmic system model were analyzed using descriptive statistics, including mean statistics, standard deviation (SD), and use the mean interpretation criteria as in Table 1.

Results

Language learning AIT interface

Before starting the course, students create an avatar-type character, their account profiles, and scheduling. In the development phase, the researchers used 100 English items with vocabulary related to daily, adapted from the student's Grade 10 English language lesson books (Figure 3). This assured familiarity with the course material and correct sentence structure and grammar. Then the researchers created anAI technology-based algorithm to assure speech separation accuracy and the accuracy of vocabulary and dialogue. Additionally, there is grammar explanation, with an emphasis on speaking English clearly and fluently.

Figure 3. Sample system language items



The system's design allows for speech interaction between the student and the AIT system. However, the system developed by the researchers is divided into levels of difficulty, using a set of vocabulary from simple to uncommon. The intelligence of the AI system can learn new words, but because this research is limited due to budgetary constraints, initial system interaction must be led by the teacher. The system is used to enhance the addition of real teachers by co-reviewing teachers, as the design of this research, AI, is an essential part of creating English teaching intelligence for Thai students. Algorithms, or step-by-step sets of commands or conditions, allow computers to learn manually by using big data created by the researchers to process them into data sets.

The system can learn and predict results by automatically classifying, distinguishing, and creating patterns from the information received. Initially, the system is programmed to have an initial set of instructions using a pool of 100 query and response sets.The practical use of an AIT algorithm used to teach English to Thai students resulted in the following:

The 40 students who participated in the initial tryout and not the subsequent sample group were determined to have achieved a reliability coefficient of 0.97, showing the quality was suitable and acceptable. Also, students'knowledge gain from through the AIT algorithmic model English development system was higher than before they started, both overall and in every aspect (Table 2).

Table 2. Results of using the AITalgorithmin Englisheducation by Thai students.

Aspects	Total Score	Pretest		Posttest		t	Sig.
		$\bar{x}$	SD	$\bar{x}$	SD		
Speech identification (before studying)/(after studying)	10	0.900	0.810	9.225	1.561	-27.518**	.000
Vocabulary correctness (before studying)/(after studying)	10	1.550	1.467	9.300	1.522	-24.391**	.000
Grammar aspects (before studying)/(after studying)	10	2.750	1.750	9.275	1.320	-17.456**	.000
Pronunciation fluency (before studying)/(after studying)	10	1.900	1.236	9.300	1.159	-25.674	.000
Average	40	7.100	3.087	37.100	4.706	-31.850**	.000

**Sig.<.01

Table 3details the results of the student satisfaction assessment. It was found that the average for the 40 students who participated in the project was at the highest level ($\bar{x}$ = 4.631, SD = 0.573). Moreover, from the four primary aspects questioned, the students felt that AIT's use in helping to identify correct word and grammar was most helpful ($\bar{x}$ = 4.775, SD = 0.479). This was followed equally by AIT's use in distinguishing words ($\bar{x}$ = 4.600, SD = 0.590) and AIT's accurate use in words and dialogue ($\bar{x}$ =4.600, SD = 0.671). Finally, according to the students, the least effective aspect of AIT's use in language education was pronunciation fluency ($\bar{x}$ =4.550, SD = 0.552).

Table3. Assessment results of student satisfaction using AIT algorithms to help teach English (*n*=40).

Aspect	*n*	$\bar{x}$	SD	Level
AIT is accurate in distinguishing words.	40	4.600	.590	highest
AIT is accurate in words and dialogue.	40	4.600	.671	highest
AIT can be used to help identify correct word and grammar use.	40	4.775	.479	highest
AIT must focus on the pronunciation of spoken English clearly and fluently.	40	4.550	.552	highest
Average	40	4.631	0.573	highest

Table 4shows the input from the three expert assessments of the AIT algorithm system model used to teach English to Thai students, with the calculated values divided into five appropriateness levels. There were represented by the use of '5' at the 'highest level (4.21 – 5.00), '4' at the'high' level (3.41 – 4.20), '3' at the'moderate' level (2.61 – 3.40), '2' at a 'low' level (1.81 - 2.60), and finally '1' representing an opinion score of 'very low' (1.00 - 1.80).

Therefore, from this scale, the experts' assessments of the overall model were at a 'high' level as $\bar{x}$ =4.249 and SD = 0.538. Moreover, from the four primary aspects questioned, the experts felt that AIT's use in helping in assuring accurate word and dialogue use was most useful ($\bar{x}$ = 4.666, SD = 0.577). This was followed equally by AIT's use in pronunciation fluency ($\bar{x}$ = 4.333, SD = 0.577).Additionally, according to the experts, both AIT's inaccuracy in distinguishing words ($\bar{x}$ =4.000, SD = 1.000) and helping identify correct word and grammar use ($\bar{x}$ =4.000, SD = 1.000) were ranked the same in importance. Finally, the experts commented that the working model was clear and useful.

Table 4. Experts' assessment of the AIT algorithm model to help teach English to Thai students.

Aspect	*n*	$\bar{x}$	SD	Level
AIT is accurate in distinguishing words.	3	4.000	1.000	high
AIT is accurate in words and dialogue.	3	4.666	0.577	highest
AIT can be used to help identify correct word and grammar use.	3	4.000	1.000	high
AIT must focus on the pronunciation of spoken English clearly and fluently.	3	4.333	0.577	highest
Average	3	4.249	0.538	high

Discussion

AI's use in teaching content and grammar is excellent compared to the average Thai English language teacher. The AI system also allows students to participate from anywhere, as seen from millions of online users with AI-developed systems such as Grammarly. Thus, AIT use in English language writing is a highly effective tutoring tool (Fitria, 2021).

Concerning speech implementations, ALEXA is a proven conversational device and highly effective in question/response format. However, as Lotze (2018) has pointed out, although AI-based learning language systems are helpful, but are best suited for beginning language learners to supplement classroom learning with a human teacher as it may be difficult for students to attend language classes (e.g., such as in Covid-19 situations).

Along these lines, Haristiani (2019) feels that Chatbots are an excellent tool in language learning and have great potential, both as a tutor in language practicing and as an independent learning medium. Once again, learner approval for chatbots is also their ability to be used anywhere at any time, thus also avoiding classroom 'shyness' and 'face' issues. This is consistent with Huang et al. (2021), who also feel that chatbots effectively communicate with users in their target languages while positively impacting the student's behavioral outcome.

Our study also determined that our AIT algorithmic English language learning system was highly effective from the pretest and post-test assessments. This is also consistent with research from China, in which 'adaptive learning systems(ALS) were stated as standing apart from traditional English language learning systems by offering a personalized learning experience to students according to their different knowledge states (Cui et al., 2018). Results also suggested that students achieved better performance using the Yixue ALS over traditional classroom instruction and other ALSs.

Whether hosted in the cloud or on local networks, Digital AIT systems can also step over problems such as shyness and cultural issues such as 'saving face. Moreover, AIT language learning systems can also step over other uncommon problems where multiple genders are not allowed in the same classroom (e.g., Afghanistan), Internet connectivity is limited or non-existent, or finally, as in the case in China in 2021, foreign teachers and

tutor schools have been outlawed ("How China's tightening rules," 2021). Thus, multitudes, if not millions, of students now can get help in language learning.

These ideas are also consistent with Kamuka (2015), who pointed out that AI-based tutoring systems have programs that provide guidance automatically and enable learners to use self-study skills, thus cutting down on instructor needs. Also, as Al Mukhallafi (2020) has pointed out, the nature of learning the English language requires strategies suitable for listening skills,speaking, reading, and writing. Therefore, AIT, intelligent tools, and expert systems based on interaction and studentsharing are highly appropriate. Finally, AIT use in English language learning is more student-centered, leading to learner empowerment (Ali, 2020).

Setup, implementation, and features

1. Learners must have a digital device such as a smartphone or tablet to download the application. After that, students then register as a member of a group and then complete the settings. The learners can then choose to communicate at their own pace or use a set of exercises and questions previously programmed into the system by the study's developers. As there are no time or location constraints, students can study when and where it is most convenient.
2. The system has features that allow students to participate in assessment tests, which currently are limited to 100 items prepared by the developers from the experts' input concerning English language learning.
3. Although there is currently rudimentary speech synthesis capability with the digital device's microphone, this feature is still in preliminary development with some limitations due to budget development constraints. However, the study's developers have shown that current phone microphones are reasonably stable enough to work wellwith the system itself.
4. In subsequent development versions, vocabulary will be added to cover a wide range of everyday situations, including tourism, health care, and medical professions, which require good pronunciation and understanding of grammar. These modules will also be divided into multiple levels, including beginner, intermediate and advanced. Accounts will use personalized avatars with future versions adding more video to create a character simulation from real-life encounters.
5. The system allows expansion into other language modules such as Chinese, Spanish, Japanese, or Lao.

Conclusion

The researchers developed the AIT algorithm English language learning model to bring more accessible, consistent, and online English learning to Thai students. From the prototype's development, various experts and student sample groups confirmed the validity of the design and usefulness in English language teaching. Also, the AIT system fits nicely into a significant gap in language learning left open due to the ongoing Covid-19 pandemic in traditional classroom learning. Furthermore, personalization and high degrees of flexibility as to the system's use is possible, with students who have Android or iOS-enabled smartphones to participate from anywhere at any time. Additionally, an AIT system can help students organize their learning materials while allowing instructors to monitor better and evaluate learning activities.

Finally, although limited to actual real-world scenarios, the initial version is easy to cost-effective to upgrade and will be an even better digital AI tool to help in the analysis of student pronunciation accuracy. Finally, as this study and others have confirmed, AI-enabled language learning systems and chatbots make learning more fun and less dull and create student motivation to learn.

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