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The Effects of Inductive and Deductive Instruction in a Flipped Classroom on English Grammar Ability of Undergraduate Students in Thailand

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Article information	
Abstract	This quasi-experimental research used a two-group pretest-posttest design to compare the grammar ability between one group of students taught with an inductive approach and another group taught with a deductive approach through a flipped classroom. The study participants were Thai university students majoring in English. After the implementation, the results of the comparison between the pretest and posttest mean scores indicated a significant difference in grammar ability between the students taught with the inductive and deductive approaches in a flipped classroom. Moreover, the findings from the survey questionnaire revealed that both groups of students had positive opinions toward flipped classrooms in terms of the flexible learning environment, learning efficiency, and learning enjoyment. However, some disadvantages were also revealed such as students' lack of confidence when learning on their own, lack of motivation in self-study, lack of discipline, and inconvenience caused by Internet access. Despite some disadvantages, teaching grammar with an inductive and deductive approach in a flipped classroom can be effective to promote grammar ability of students.

1. Introduction

1.1 Background of the Study

Grammar is one of the most crucial aspects of language learning and teaching for second language (L2) learners and teachers. Therefore, fostering grammar ability is deemed crucial for learners to master the target language. In fact, for language learners, developing a strong foundation in English grammar can enhance their academic achievements and open up career opportunities after graduation. English grammar is an essential part of language learning since it lays the groundwork for effective communication, both in spoken and written language. To communicate successfully, students need to have communicative competence, and grammatical competence is a part of it (Canale & Swain, 1980). Haussamen et al. (2003) state that most non-native English students should learn grammatical structures together with the meaning of a language in order to perform well.

In other words, EFL students need time and effort to foster their grammar ability since they need not only to understand the rules of grammar but also to apply them correctly for different communicative purposes. Even though there could be language learners who can acquire language and its grammar naturally without being taught, this does not work for everyone, especially in a country where English is used as a foreign language. The lack of authentic materials and exposure to the English language makes it difficult for students to acquire the language naturally. Previous studies have suggested that students who receive no instruction are likely to be at risk of fossilizing language errors sooner than those who receive instruction (Lip et al., 2014; Zhang, 2009). Thus, in order for students to be successful in communication, grammar should be emphasized and taught (Leech & Svartvik, 2002).

In the context of Thailand, the English language is considered a foreign language. English grammar is considered as an important aspect of language learning. However, Thailand is still in the very low proficiency group according to the World English Proficiency Index (EF English Proficiency Index, 2023). Due to

the regulations of Compulsory Education, Thai students must study English for 12 years. Nevertheless, Thai students ranked 89th in the English Proficiency Index based on the test results of 2.2 million adults in 100 countries. There are many factors influencing this very low rank. For instance, Pongpanich (2011) indicates that Thai students lack confidence when using the English language which is a result of their insufficient knowledge of the language as well as their lack of experience using it in real-world communication. Problems also come from the teacher as well. According to a study by Geringer (2003), an important factor in learning progress is how the teacher teaches in the class, and this is an even more important factor than motivation, funding, and class sizes. Moreover, a survey study undertaken by Noom-Ura (2013), in collaboration with the University of Cambridge, measuring the qualifications of 400 Thai teachers of English, has reported that 60% of the participants had knowledge of English and teaching methodologies below the required English language level at which they were teaching. Due to inadequate knowledge of teaching approaches, some Thai teachers still use outdated teaching styles such as rote learning, grammar translation using the Thai language as the medium of instruction, teacher-centered classroom activities, and a spoon-feeding approach in which teachers provide all the knowledge and students only listen to them and try to absorb what has been imparted by their teachers.

According to Nunan (2005), grammar can be taught in two primary ways: deductively and inductively. On the one hand, deductive teaching is rule-driven teaching; it applies the process of metalinguistic information presented by the teacher to students in any lesson (Mallia, 2014; Thornbury, 2000). To explain further, deductive teaching starts with a presentation of a rule, followed by examples in which that rule is applied (Rodríguez, 2017; Thornbury, 2000). After learning the rules, students practice them by doing language activities. Thornbury (2000) suggests that deductive teaching of grammar is a rule-driven approach, and the lessons should start with presentation of both the grammar rules and usage. Then, the teacher can illustrate grammar uses with multiple examples, preparing

students for independent practice after they have grasped the rules. Finally, the teacher offers students an opportunity to personalize the language points focusing on grammar forms and applications.

Students have to understand grammatical rules before they apply what they have learned in actual communication with others. The advantages of the deductive approach are that it saves time and it focuses directly on the points to be taught. Therefore, students can have more time to spend on the rules and their practice. However, it is not suitable for students who do not like grammar presentations in the classroom. Moreover, it may cause the perception that learning English simply means learning and memorizing only grammar rules.

On the other hand, an inductive approach refers to a type of teaching that starts by letting students work with examples without necessarily knowing the rules behind them. Simply put, students are asked to figure out grammar rules on their own. This discovery learning process is similar to how children acquire language naturally. According to Thornbury (2000), the inductive grammar teaching procedure should consist of the following steps: 1) introducing materials or situations that generate multiple examples of the targeted grammar item, 2) eliciting the content presentation of the grammar, actively involving students in the lesson, and then monitoring students' understanding and development of the target grammar, 3) letting students work on hypothesizing both grammar forms and applications, and 4) discussing and monitoring the grammar forms and applications proposed by students.

It is believed that since the grammar rules are discovered by students themselves, they are then more likely to understand and remember them better than when the rules are chosen and presented to them by their teacher. This inductive teaching process makes the learning of grammar rules more meaningful and memorable to students. It is believed that the discovery learning process that comes with inductive teaching engages students more effectively than deductive

teaching, and students tend to be better prepared for future lessons in the language classroom (Rodríguez, 2017; Thornbury, 2000).

Whether both teaching approaches will be effective or not depends on the objectives and classroom contexts. Deductive and inductive teaching approaches have their own characteristics and functions which may suit one type of students more than others, and they are performed differently by the teacher.

In Thailand, studies have been conducted to examine the effectiveness of deductive and inductive teaching approaches. For instance, Dankittikul and Laohawiriyanon (2018) carried out a study to compare the effects of the inductive and deductive teaching approaches to teach semantics in an English writing course. Their participants were 47 undergraduate students assigned to either a deductive group (the control group) or an inductive group (the experimental group). Both groups were taught logical connectors, but the inductive group was taught using paper-based concordance. The findings showed that there were no significant differences between both groups possibly due to the students' unfamiliarity with the inductive teaching approach. As such, further studies are needed to better determine the differences in effectiveness of both teaching approaches.

The English language has a complex set of rules that cannot be covered in just one class. When there are class time constraints, a flipped classroom can be one of the instructional strategies implemented as a solution. In a flipped classroom, the time is restructured (Bergmann & Sams, 2012). This means the places where the teacher gives lectures and where students do homework are switched, so there is more class time available for learning and getting feedback. Generally, content is learned outside class time through the instructional media that are provided by the teacher, such as online materials, videos, reading materials, and other sources of media. Once students have learned the content outside class time, the time in class can be spent engaging students in hands-on

activities to practice the target language skills (Sakulprasertsri, 2014). Advantages of the flipped teaching approach are that it promotes student interaction in class, and it also enhances students' communication. A flipped classroom can provide interactive tasks and encourage students to have more active participation, and it also offers an engaging learning environment to students (Bonwell & Eison, 1991; Bransford et al., 2000; Pudin, 2017).

Furthermore, a flipped classroom enables students to make the most out of the class time by asking questions and clearing up misconceptions before they practice and apply what they have studied doing class activities. In fact, the teacher can do more during valuable face-to-face class time by giving suggestions and feedback to students individually and paying more attention to students who might have lower abilities and need more assistance than others (Cockrum, 2014). In so doing, students become the center of the class while the teacher helps, guides, and gives feedback instead of simply delivering information.

It is worth noting that despite several studies related to the inductive and deductive teaching approaches, very few have examined differences between these approaches when they are used to teach grammar at a university level in the context of Thailand. Moreover, there are few studies on the use of both the inductive and deductive teaching approaches in a flipped classroom in the country. Therefore, to investigate ways to effectively improve grammar ability of students and mitigate time constraints, the inductive and deductive teaching approaches were implemented in a flipped classroom environment in the present study. In particular, this study aimed to provide insightful comparisons of the effects of the inductive grammar teaching approach and the deductive grammar teaching approach on improvement of grammar ability of students in a flipped classroom.

1.2 Research Objectives

The objectives of the present study were as follows:

(1) To compare grammar ability of the students learning with the inductive teaching approach in a flipped classroom and grammar ability of the students learning with the deductive teaching approach in a flipped classroom.

(2) To investigate the improvement in grammar ability of the students learning with the inductive teaching approach in a flipped classroom.

(3) To examine the improvement in grammar ability of the students learning with the deductive teaching approach in a flipped classroom.

(4) To explore the opinion of students toward the use of a flipped classroom for grammar instruction.

1.3 Research Questions

In this study, the following research questions were formulated:

(1) Is there a difference in grammar ability between the students learning with the inductive teaching approach in a flipped classroom and the students learning with the deductive teaching approach in a flipped classroom?

(2) Can the inductive teaching approach improve grammar ability of the students learning in a flipped classroom?

(3) Can the deductive teaching approach improve grammar ability of the students learning in a flipped classroom?

(4) What is the opinion of students toward the use of a flipped classroom for grammar instruction?

2. Literature Review

The related literature has been reviewed in the following topics: grammar and language skills, English grammar teaching, the inductive and deductive teaching approaches, and flipped classrooms.

2.1 Grammar and Language Skills

Grammar is defined by many educators in the English language teaching field. Grammar refers to how words are manipulated and combined into structures to produce sentences in the language. According to Celce-Murcia et al. (2014),

Nunan (2005), and Ur and Swan (2017), grammar is when words are grouped to formulate sentences consisting of many aspects such as singular and plural forms, negation, and word orders. Grammar, therefore, is a crucial element of language. Grammar ability is a part of language ability and is related to how English language proficiency is assessed and evaluated. The use of the Common European Framework of Reference for Languages (CEFR) comes into play with most standardized testing. The CEFR specifies the performance descriptors for language learning in the form of can-do statements. These descriptors are used to refer to the capabilities of language users at each level. The key language points (i.e. grammar, vocabulary, discourse markers, and functions) are categorized according to each level of competency. When planning their instruction, teachers can set the objectives in accordance with the CEFR descriptors, and they can use the aspects of competence (i.e. strategic, pragmatic, and linguistic) to enable students to accomplish these objectives. Apart from the British Council's collaboration with EAQUALS, TOEFL ITP® also suggests their own version of performance descriptors showing abilities for each level. When examining further into grammar ability for the CEFR levels, British Council and EAQUALS suggest the following core inventory.

Table 1

Core Inventory Representing the Core of English Language Taught at the CEFR Levels A1 to C1 in English—Grammar Descriptors of CEFR Levels by British Council and EAQUALS

Level	Grammar
A1	Adjectives: common and demonstrative / Adverbs of frequency / Comparatives and superlatives / Going to / How much / how many and very common uncountable nouns / I'd like / Imperatives (+,-) / Intensifiers - very basic / Modals: can, can't, could, couldn't / Past simple of "to be" / Past Simple / Possessive adjectives / Possessive 's / Prepositions, common / Prepositions of place / Prepositions of time, including in, on, at / Present continuous / Present simple /

Level	Grammar
	Pronouns: simple, personal / Questions / There is, are / To be, including question + negatives / Verb + ing: like, hate, love
A2	Adjectives – comparative, – use of than and definite article / Adjectives – superlative – use of definite article / Adverbial phrases of time, place and frequency – including word order / Adverbs of frequency / Articles – with countable and uncountable nouns / Countables and Uncountables: much, many / Future Time (will and going to) / Gerunds / Going to / Imperatives / Modals – can, could / Modals – have to / Modals – should / Past continuous / Past simple / Phrasal verbs – common / Possessives – use of 's, s' / Prepositional phrases (place, time and movement) / Prepositions of time: on, in, at / Present continuous / Present continuous for future / Present perfect / Questions / Verb + ing / infinitive: like / want- would like / Wh-questions in past / Zero and 1st conditional
B1	Adverbs / Broader range of intensifiers such as too, enough / Comparatives and superlatives / Complex question tags / Conditionals, 2nd and 3rd / Connecting words expressing cause and effect, contrast etc. / Future continuous / Modals – must / can't deduction / Modals – might, may, will, probably / Modals – should have, might have, etc. / Modals: must, have to /Past continuous / Past perfect / Past simple / Past tense responses / Phrasal verbs, extended / Present perfect continuous / Present perfect / past simple / Reported speech (range of tenses) / Simple passive / Wh-questions in the past / Will and going to, for prediction
B2	Adjectives and adverbs / Future continuous / Future perfect / Future perfect continuous / Mixed conditionals / Modals – can't have, needn't have / Modals of deduction and speculation / Narrative tenses / Passives / Past perfect / Past perfect continuous / Phrasal verbs, extended / Relative clauses / Reported speech / Will and going to, for prediction / Wish, Would expressing habits, in the past
C1	Futures (revision) / Inversion with negative adverbials / Mixed conditionals in past, present, and future / Modals in the past / Narrative tenses for experience, incl. passive / Passive forms, all / Phrasal verbs, especially splitting / Wish, if only regrets

2.2 English Grammar Teaching

There are many different approaches to teaching English grammar with many changes over time from rote memorization (Larsen-Freeman, 2000) to grammar translation (Musigrungsi, 2001). Larsen-Freeman (2000, as cited in Mart, 2013) further elaborates that the purpose of the grammar translation method was to help learners read and understand literature written in a foreign language. It was believed that using this method to learn new vocabulary and grammatical structures was effective. Learning a language would be easier for learners as they could recognize the structures of the language when learning the rules of grammar. This is because the key role of this method was translation, and learners had to translate one language into another which required them to use vocabulary knowledge and grammatical rules. However, the grammar translation method had limitations in practice where learners were still dominated by their first language (Stern, 1983). Ellis (1992) and Ur (1996) also criticize this method for its limitation in exposing learners to the target language.

Another popular teaching approach in the past is known as the direct method, which was introduced in Europe in the late 1950s and early 1960s. This method was more systematic, and the focus was on communication. The direct method involved asking and answering questions, practicing pronunciation, imitation, and dictation. Learners learned the grammar rules by observing the texts they read and summarizing the rules from them (Musigrungsi, 2001). Richards and Rogers (2000, as cited in Musigrungsi, 2001) and Brown (2000, as cited in Musigrungsi, 2001) point out that one drawback of this method is that it could mislead learners to convey meaning without considering their first language.

The audio-lingual method was first introduced in the United States of America. It was the combination of behavioral language learning theory and structural linguistics. Speaking and listening without referring to the first language was given the priority in this method, whose aim was to speak like native speakers. As a result, learners had to practice the target language through dialogues,

repetition, and pattern drills. Krashen (1984) states that grammar was not explicitly taught in this method. It adopted the inductive approach as learners acquired the rules from observing dialogues or pattern practices. The problem with this method was that learners would encounter difficulty in real-life situations that were not the same as the situations in which they had practiced using the language before.

Structure-focused grammar teaching methods could effectively be used to develop learners' grammar accuracy, but with these methods, the communicative aspect of the language was neglected. This led to the emergence of the rise of communication-based approach, called communicative language teaching (CLT) in 1970s (Larsen-Freeman, 2000). The main objective of this method was to enhance learners' language use in a real-life context outside the classroom. CLT can also be categorized into strong/deep-end and weak/shallow-end forms. The strong approach suggests that languages can be acquired only by practicing and using them without direct grammar instruction, whereas the weak approach believes that there is a need for learning some language structures before transferring them to communicative tasks (Hall, 2011). Notably, the weak method has become the mainstream method (Allwright & Hanks, 2009; Thornbury, 2000).

2.3 Inductive and Deductive Teaching Approaches

As mentioned before, grammar can be taught using different approaches and methods. Among them, the two major teaching approaches are inductive and deductive grammar teaching.

Nunan (2003, as cited in Hmedan & Nafi, 2016) mentions that the inductive teaching approach shows students samples of language use through guidance. According to Mallia (2014), the inductive approach gives students a lot of responsibilities as they have to figure out the rules of grammar through their own experiences with language usage. The teacher's role is to provide some useful materials that enable students to use the target language until they can identify the rules. Gollin (1998, as cited in Mallia, 2014) states that students conclude the

language rules through practices and multiple examples of language use shown in different situations. Harmer (2007, as cited in Mallia, 2014) points out that students learn the language when trying to find out the rules. The purpose of implementing an inductive teaching approach is to activate students' observation skills. Moreover, the teacher may aim to provide students with the opportunity to evaluate the information they receive so that they will learn and formulate the rules on their own. Also, using the inductive teaching approach gives students an opportunity to use and develop their critical thinking skills.

Widodo (2006) has identified some advantages and disadvantages of the inductive teaching approach. The advantages of the inductive approach are that it promotes autonomy in learning since students have to discover the rules by themselves. Next, students tend to be more active in class and more motivated. Another advantage of the inductive approach is that students can enhance their problem-solving ability and learn how to recognize patterns. Lastly, the inductive approach enables students to collaborate in class which helps them develop skills necessary to communicate with others.

Some disadvantages of the inductive approach are also discussed by Widodo (2006, as cited in Hmedan & Nafi, 2016). First, this approach consumes a lot of time and energy before students recognize the rules. Second, it can cause misunderstanding because the concept is given implicitly. Another disadvantage is that it might not be suitable for students with particular learning style preferences, particularly passive learners who might prefer to be directly taught the language rules by the teacher rather than having to figure out the rules on their own.

In contrast to the inductive teaching approach, the deductive teaching approach is considered more explicit in nature. Thornbury (1999) defines deduction as giving students generalizations, then they are asked to deduce specific applications. According to Schmidt (1990), the deductive teaching approach involves explicit awareness, which means students learn with attention

to and awareness of the language rules (Hmedan & Nafi, 2016). Al-Kharrat (2000) points out that in this approach the teacher provides students with what language rules are, how they are formed, what their components are, and in which context they can be used. The teacher has to make sure that the rules provided to students are systematic and logical. After students learn the new rules of the target language, the teacher can ask them to create new sentences similar to the ones they have learned. The purpose of implementing the deductive approach in class is to teach students how to solve problems or answer questions by using the existing rules they have come to comprehend or the conclusions they have drawn. Moreover, students also learn to wait for accurate information before making any conclusion by themselves. It is also believed that the deductive teaching approach can delay students who tend to make any conclusions too soon.

There have been many studies investigating the effects of the deductive and inductive teaching of grammar rules, and the advantages and limitations of both approaches have been identified. For example, Erlam (2003) conducted a study with school-age learners using deductive language instruction in a teacher-centered class and found that it was effective for learners. In addition, a study by Negahdaripour and Amirghassemi (2016) examined the effectiveness of deductive and inductive grammar instruction on Iranian EFL spoken accuracy and fluency in terms of English tense usage. They found a significant difference regarding the accuracy of the use of the tenses, which suggested that a deductive approach towards grammar instruction could have a more positive impact on EFL learners' oral accuracy.

Also, in the EFL setting, a number of studies having been conducted on using inductive and deductive approaches in English language teaching. Retty et al. (2019), for example, explored the effectiveness of the inductive method in English grammar teaching when used with 56 junior high school students in Indonesia. Twenty-eight students were taught using the inductive method, and the remaining students were taught using the conventional deductive method. The

study reported that the inductive method was more effective with a significant difference in terms of students' grammar mastery when both groups were compared. Moreover, Benitez et al. (2019) carried out a similar study with 70 senior high school students in Ecuador. Confirming the findings of Retty et al. (2019), the study showed a significant difference in scores between the inductive and deductive groups.

The literature on inductive and deductive approaches also extends to the teaching of other foreign languages. Haight et al. (2007) conducted a study to compare the effectiveness of the inductive and deductive approaches on grammar teaching with French second language learners. Data regarding grammatical knowledge of each structure were gathered using the pretest and posttest, as well as quizzes after each grammatical unit, with the results showing that inductive teaching led to a significant increase in students' scores. Moreover, Vogel et al. (2011) carried out a similar study with the same research design and found that the participants had significantly higher gains with the inductive teaching method. Also, Osa-Melero (2017) studied the effectiveness of the inductive teaching approach when it was implemented to teach Spanish grammar usage to 27 students. The results showed that the frequency of grammatical errors decreased significantly after the inductive teaching approach was employed.

A number of studies have explored the inductive and deductive teaching approaches. However, there is an issue of the time limitation for grammar learning contents to cover in a semester. Therefore, teachers and students may encounter difficulty setting aside time for explicit grammar instruction. For this reason, the flipped learning approach is an interesting alternative that can be used to teach grammar.

2.4 Flipped Language Teaching

A flipped learning approach, coupled with Internet access, has made video and audio learning more easily accessible and more in line with current lifestyles

of learners (Herreid & Schiller, 2013). Two pioneers of the flipped learning approach, Bergmann and Sams (2012), found posting contents online for their chemistry students to be an effective teaching method. The main concept of a flipped classroom is considered simple—teachers create digital interactive content and make it available online for students to access at home (Tucker, 2012).

Bergmann and Sams (2012) state that a flipped classroom is a class where things which are normally done in class are changed to be done at home while homework is instead done in class. A flipped classroom or flipped learning by definition according to Flipped Learning Network (2014) is a pedagogical approach where the instruction phase moves from the group learning space in class to the individual learning space outside the class. As a result, the group space in class becomes a dynamic, interactive learning environment with the teacher giving guidance and engaging students creatively in learning the subject matter.

According to Bergmann and Sams (2012), when implementing a flipped classroom that allows students to work on a series of predetermined objectives at their own pace, the teacher should do the following: 1) set clear learning objectives, 2) determine which objectives are best achieved through inquiry or through direct instruction, 3) ensure student access to videos, 4) include engaging learning activities to be done in class, and 5) create multiple versions of summative assessment for each learning objective.

As for the implementation of a flipped classroom in English language teaching in the EFL context, several studies have shown various effects on students. Turan and Akdag-Cimen (2019) reviewed the main findings of 43 studies concerning the use of flipped classrooms in the field of English language teaching. Their analysis showed that the most commonly reported benefit was increased student engagement. Moreover, Hsieh et al. (2016) used flipped learning and Wen's Output-driven/Input-enabled model to design an oral training course for 48

sophomore English majors. The results of their study revealed that the students' motivation and idiomatic knowledge could be improved.

Kang (2015) implemented the flipped classroom method with EFL Korean adult learners to teach grammar and vocabulary. The participants were divided into two groups—one was taught with a traditional learning method and the other group studied in a flipped classroom environment. The results showed that the students who studied in a flipped classroom had higher posttest scores in grammar and vocabulary. Moreover, students had a positive attitude towards flipped classrooms, and they found the use of mobile applications or online resources to learn grammar and vocabulary interesting.

In Thai contexts, Liu and Sukavatee (2019) examined the effects of a flipped classroom-based instructional model known as Debate Instruction through a Flipped Learning Environment or DIFLE on improvement of Thai learners' critical thinking ability. The pre-debate was conducted online out of class during which the introduction, lecture video, independent research, and a questionnaire were given to students online. Debate delivery and post-debate phases were launched in the classroom. The quantitative findings from the opinion questionnaire revealed positive effects of DIFLE on critical thinking skills of students, while qualitative data from the focus group interviews reflected students' general satisfaction with and positive opinion toward DIFLE.

Chonthamdee and Langprayoon (2022) developed learning activities in a flipped classroom to enhance the English speaking skill of 33 undergraduate Education students and the results indicated that the speaking skill of the students attending the flipped classroom was significantly higher compared to that of the students learning English in a conventional classroom. Furthermore, Panyajunsawang and Adipat (2022) used a flipped classroom to teach English vocabulary to 32 secondary students, and the results demonstrated a higher learning achievement and very high level of students' satisfaction with the flipped

classroom. Likewise, Dill (2012) experimented with the flipped classroom approach with students learning French at a middle school during which a two-week flipped classroom was implemented to compare homework completion rates. Students used class time for project-based assignments and workbooks, while they watched video lectures outside class. It was found that homework completion increased during that time, from 79.8% to 98.7%. Dill also compared quiz and written assignment scores between traditional and flipped classes and reported that the scores of the traditional class remained fairly constant, but the scores of the students in the flipped class increased on both the grammar quiz and written assignment. In addition, Dill noted fewer verbal warnings and detentions in the flipped class compared to the traditional class as well.

According to Yang (2017), a benefit of flipped classrooms is that they help students develop generic skills. Students have more opportunities to interact with teachers and classmates and such interactions can enhance their communication and collaboration skills. Musib (2014) states that flipped classrooms also increase students' learning engagement as students have to prepare themselves before the lesson, and Shaari et al. (2021) contend that flipped classrooms can have a favorable impact on students' perception and their English grammar when the use of appropriate interactive materials with proper cultural content are included.

Based on the analysis and synthesis of the aforementioned literature, the research framework was designed based on the theoretical concepts of Thornbury (2000) and Bergmann and Sam (2012) as follows:
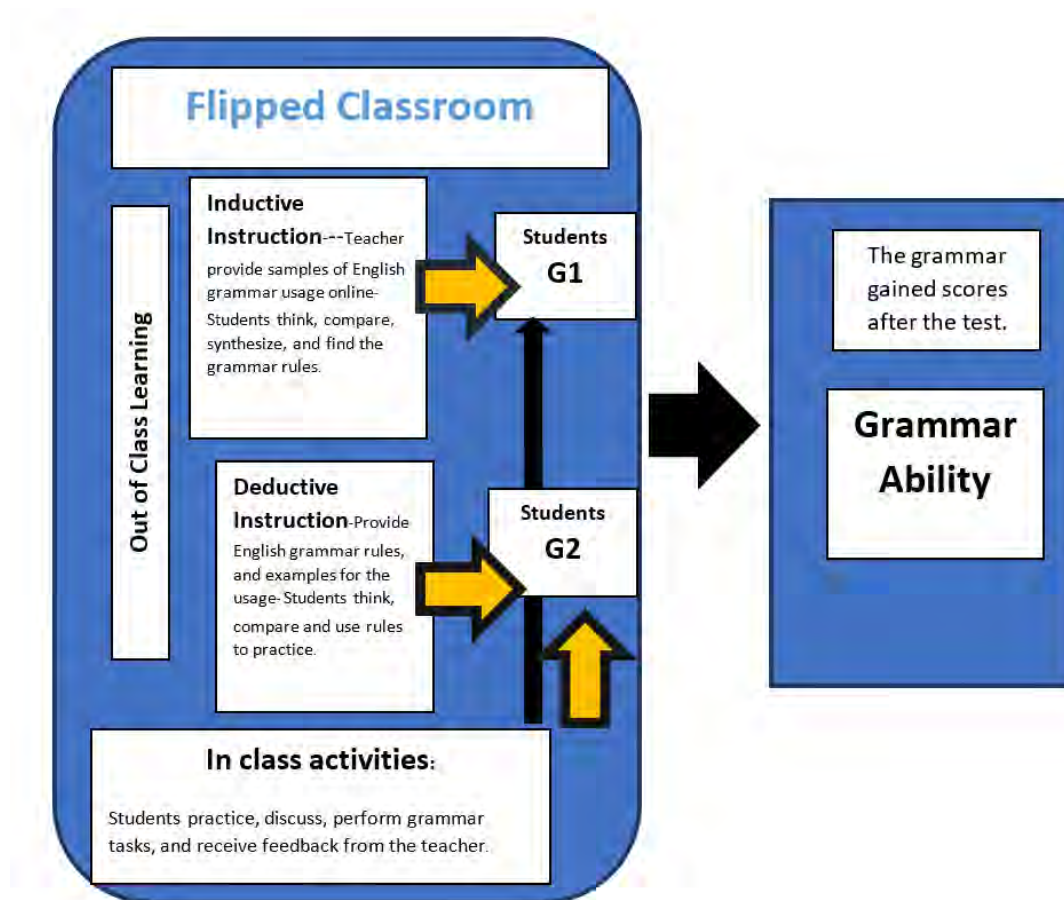
Figure 1

Research Framework

Figure 1 illustrates the framework of the study, detailing integration of grammar teaching with the deductive and inductive teaching approaches into flipped learning of two groups of students. For the inductive teaching approach group, the students heavily worked with grammar examples without necessarily knowing or being told the rules behind them, but they were asked to figure out the rules on their own. For the deductive teaching approach group, the teaching was rule-driven. The lesson started with a grammar presentation of both rules and usage. Then, multiple examples were given to illustrate the grammar rules. This stage of teaching was conducted online before students met in class. Both groups of students were told the learning objectives and got access to the videos via the Blackboard virtual learning platform. All students were required to complete a learning task to ensure that they watched the videos. In an on-site classroom

session, students in both groups worked and engaged in grammar activities and tasks. At the introduction stage of each class, what the students had watched from the videos was discussed and brought into light to ensure their understanding of the learning content from the videos. Various types of feedback were also provided in the classroom by the teacher and peers.

3. Methodology

3.1 Research Design

This study was quasi-experimental research with a two-group pretest-posttest design. The participants who were students enrolled in the course constituted intact groups in the study. One group was taught using the inductive teaching approach, while the other group of students learned with the deductive teaching approach. Both quantitative and qualitative methodologies were used to answer the research questions to determine the effects of both teaching approaches. The data collection instruments in the study were the following: 1) a pretest and posttest and 2) an opinion questionnaire. The quantitative findings were analyzed using descriptive and inferential statistics, while content analysis was employed for qualitative data analysis.

3.2 Participants

The participants of the study were 40 first-year students majoring in English who were enrolled in a compulsory English grammar course. Their English proficiency was considered homogeneous since they all passed a screening test conducted in the previous semester. At the beginning, there were 24 students in section 1 and 16 students in section 2. However, one student in Section 1 quit the program, so there were 23 students left in that section. Both sections were flipped classrooms, but Section 1 was taught using the inductive teaching approach, whereas Section 2 was taught using the deductive teaching approach.

3.3 Research Procedure

The research was developed in two phases. The first phase was the preparation of the intervention of the study as well as the data collection instruments, and the second phase was data collection and data analysis.

3.3.1 Phase I: Preparation of the Study

Stage 1: Reviewing related literature

The researcher explored principles and concepts in grammar teaching, inductive and deductive teaching approaches, approaches related to flipped classrooms, and flipped classrooms in grammar teaching. Then, the framework of flipped classrooms proposed by Bergmann and Sams (2012) was selected. The research framework of this study, involving the use of the flipped classroom principles to support grammar instruction, was then constructed.

Stage 2: Constructing lesson plans

The lesson plans designed for each unit were parallel. For each unit and for each topic, two plans were made for both the inductive and deductive teaching approaches. The content of the teaching was based on the course syllabus, and the teaching procedures were based on the frameworks of Bergmann and Sam (2012) and Thornbury (2000). However, due to the time spent on the preparation stage of the research procedure and on preparation of learning materials, the experimental phase began in week 6 of the semester. Each lesson plan covered online out-of-class learning and in-class activities.

Stage 3: Validating and revising the lesson plan

The sample lesson plan was validated by three experts in English language teaching. The item-objective congruence index was used, and the experts were given the evaluation form to rate the appropriateness of the sequence of the teaching using the inductive approach, the teaching sequence using the deductive approach, the level of content parallel of both approaches, the out-of-class activities, the in-class activities, the time allocation, and the materials used in the

study including the selected videos. The overall unit plan was given the score of 1.0, meaning it was valid. However, it is worth noting that there were some minor revisions suggested by the experts, and the lesson plan was revised accordingly.

3.3.2 Phase II: Data Collection and Data Analysis

Stage 1: Design and administering the pretest and posttest

The pretest and posttest used to assess students' grammar ability were developed based on the CEFR criteria and included items that were specifically related to evaluation of grammar ability as specified by the British Council and EAQUALS Core Inventory for General English. There were 60 test items in the pretest and posttest. The tests were validated by a panel of experts before they were administered. The Kuder-Richardson Formula 20 (KR-20) yielded a coefficient of .728, thus indicating a high level of internal consistency. In addition, the test item difficulty was equal to .71, reflecting a moderate level of challenge for student test-takers.

Stage 2: Design and administration of the opinion questionnaire

The questionnaire was designed to elicit students' opinion toward advantages and disadvantages of using a flipped classroom for grammar instruction. It consisted of a total of 19 questions, 15 of which were arranged in a five-point Likert scale, ranging from strongly disagree to strongly agree. Of these, four items were designed with the reverse technique to make sure that the students paid attention to the questionnaire items when responding to them. In addition, there were four open-ended questions for the students to provide detailed answers. The questionnaire identified which group students were in (inductive or deductive) without asking for their names. The questionnaire was validated by three experts in English language teaching. The item-Objective Congruence Index was equal to .96, meaning the overall questionnaire items were valid.

The opinion questionnaire was administered at the end of the implementation of the flipped classroom instruction.

In this study, the intervention was carried out for nine weeks, with the first and the last weeks reserved for administration of the pretest and posttest. The pretest was administered in the first week, and the remaining seven weeks focused on delivery of grammar instruction via online materials and online activities before class. The online activities were different for the inductive and deductive approaches when the students studied the lessons by themselves outside the class. As for the in-class sessions, the students had more time to do further practices, receive the teacher's guidance and clarification when needed, and get feedback from the teacher. After the posttest, the questionnaire was administered to students in the final week to elicit their opinion.

Stage 3: Data analysis

Due to the small number of students participating in this study, non-parametric tests were used as descriptive methods to investigate the significance of the intervention. Two types of non-parametric analyses were used: the Mann-Whitney U Test, which did not assume a normal distribution and increased the robustness of the results even with unbalanced group sizes, and the Wilcoxon Signed-Rank Test, which was used to compare pretest and posttest scores within each group of students. These tests were chosen to ensure that the results were as generalizable as possible given the limited sample size.

Content analysis was also employed to analyze qualitative data obtained from the open-ended items in the opinion questionnaire.

4. Results

The results of this study are reported in two parts: the effects of the two types of teaching approaches—inductive and deductive—in flipped classroom instruction on students' grammar ability and students' opinion toward the use of a

flipped classroom for grammar instruction using the inductive and deductive teaching approaches.

4.1 Grammar Ability

The results showed that students in the inductive group had significantly higher mean ranks on the posttest compared to those in the deductive group, reflecting better performance (see Table 2).

Table 2

The Result of the Pretest and Posttest Examining Grammar Ability

	N	Mean Rank	Sum of Ranks	Z	Sig. (2-tailed)
Inductive	23	23.96	551.00	-2.607	.009**
Deductive	16	14.31	229.00		

Note: p < .01

Table 3 below shows the results of a comparison between the pretest and posttest scores of the inductive and deductive groups, as well as the overall scores of students. It was found that the pretest mean score for the inductive group was 43.74, which was higher than the deductive group's pretest mean score of 36.56. Posttest scores of both groups increased, with the inductive group achieving a mean score of 45.26 and the deductive group 40.50. However, the Wilcoxon signed-rank test indicated that neither group showed a statistically significant improvement, as evidenced by p-values greater than .05. For the total sample of 39 participants, the mean pretest score was 40.79 (SD = 6.94), which increased to a mean posttest score of 43.31 (SD = 5.38). The overall test results yielded a Z-score of -1.791 with a p-value of .078, indicating that the overall increase in scores for all participants was also not statistically significant.

Table 3

Descriptive Statistics of the Pretest and Posttest

	N	Pretest		Posttest		Z	Sig. (2-tailed)
		M	SD	*M*	SD		
Inductive	23	43.74	5.15	45.26	4.54	-1.062	.294
Deductive	16	36.56	7.13	40.50	5.38	-1.765	.089
Total	39	40.79	6.94	43.31	5.38	-1.791	.078

Furthermore, the posttest scores of the two groups were compared to determine the effects of the two approaches. It was found that the mean score of the students who were taught using the inductive approach ($M = 45.26$, SD = 4.54) was higher than that of the students who were taught with the deductive approach ($M = 40.50$, SD = 5.38), hence a statistically significant difference in the mean scores of the two groups ($p < .01$), as displayed in Table 4.

Table 4

The Comparison of the Posttest Score between the Inductive and Deductive Approach Groups

	Posttest			Z	Sig. (2-tailed)
	N	*M*	SD		
Inductive	23	45.26	4.54	2.895	.006**
Deductive	16	40.50	5.38		

Note: $p < .01$

The students who were taught using the inductive approach ($M = 45.26$, SD = 4.54) were compared to the group taught by the deductive approach ($M = 40.50$, SD = 5.38). The findings yielded a statistically significant difference in the mean scores of the posttest ($p < .05$).

4.2 Opinions Toward the Use of a Flipped Classroom with the Inductive and Deductive Teaching Approaches

4.2.1 Quantitative Results

Students' opinion toward the use of a flipped classroom with the inductive and deductive teaching approaches to teach grammar was at the "agree level." This meant that students have a positive feeling toward the use of a flipped classroom for grammar instruction, both inductively and deductively. They preferred out-of-class videos, online activities, and full-time in-class activities. The students in both groups had a rather similar opinion (see Table 5).

Table 5

Students' Opinion toward Inductive and Deductive Grammar Instruction in a Flipped Classroom

Questionnaire Items	Inductive English Grammar Instruction n = 23		Deductive English Grammar Instruction n = 16		*t*	*p*
	M	SD	*M*	SD		
1. A flipped classroom is more engaging than a traditional classroom.	**3.61**	0.58	**3.44**	0.63	0.855	.398
*2. I would (not) recommend a flipped classroom to a friend.	**4.00**	0.43	**4.19**	0.66	1.020	.314
3. A flipped classroom gives me great opportunities to learn grammar online.	**4.00**	0.52	**4.06**	0.68	0.297	.768
4. A flipped classroom helps me understand the grammar lesson better before coming to learn in class.	**3.83**	0.49	**3.93**	0.70	0.491	.626

Questionnaire Items	Inductive English Grammar Instruction n = 23		Deductive English Grammar Instruction n = 16		t	p
	M	SD	M	SD		
5. I like learning lessons from the videos before the class time.	3.61	0.89	3.44	1.21	0.479	.635
6. The videos help us understand English grammar more.	3.74	0.75	3.75	0.86	0.038	.970
7. The questions I answered online after watching the videos were appropriate for the activity.	3.91	0.58	3.56	0.51	1.983*	.055
8. The amount of time given to do the online task after watching the videos was appropriate.	3.65	0.57	3.75	0.58	0.535	.596
*9. I (dis)like that I can take online quizzes at my own pace.	3.83	0.87	4.06	0.99	0.746	.461
*10. I would rather be taught by a teacher in-person than by an instructional video.	3.43	0.85	3.63	0.89	0.704	.486
11. A flipped classroom gives us more time to practice English grammar use in class.	3.87	0.68	3.75	0.86	0.467	.643
12. A flipped classroom allows us to have support from the teacher in class.	3.83	0.70	3.94	0.85	0.426	.672
*13. I (dis)like having more practice time in class.	3.57	0.83	3.88	0.72	1.241	.222

Questionnaire Items	Inductive English Grammar Instruction n = 23		Deductive English Grammar Instruction n = 16		t	p
	M	SD	*M*	SD		
14. I am more motivated to learn grammar in a flipped classroom.	**3.26**	0.66	**2.94**	0.68	1.467	.151
15. A flipped classroom allows us to have more practice with feedback in the class.	**3.78**	0.64	**4.06**	0.77	1.193	.241
Sum	**3.73**	0.64	**3.76**	0.77	0.128	.899

Note: *Reverse questionnaire items

The mean score of each questionnaire item was also calculated to confirm similarity of the responses. All items received a p-value greater than .05. In sum, there was no significant difference between the responses of the two groups. However, for item 7, "The questions I answered online after watching the videos were appropriate for the activity," the inductive group had a mean of 3.91 (SD = 0.58), while the deductive group had a mean of 3.56 (SD = 0.51), resulting in a p-value of .055, which was slightly above the threshold for statistical significance.

4.2.2 Qualitative Findings

The qualitative data were categorized into three major themes: the advantages of a flipped classroom for grammar instruction, the disadvantages of a flipped classroom for grammar instruction, and the factors affecting grammar instruction.

The findings revealed that students in both the inductive teaching approach group and the deductive teaching approach group reported similar positive experiences. The flipped classroom provided them with flexibility when accessing

grammar content. Additionally, students had more opportunity to practice in class, ask questions, and receive timely feedback, and the flipped classroom made their learning more efficient and enjoyable. The excerpts shown below reflect the opinions of the students towards both inductive and deductive approaches:

> "*I can learn grammar before discussing and practicing it in class. Every student can understand the grammar point before discussing in class.*"
> (Deductive Group)

> "*We have a chance to prepare the lesson before the class, so we can come up with the questions. It does not waste time learning in the class.*"
> (Inductive Group)

Disadvantages perceived by students were reported as well. The inability to confirm understanding when learning online and out-of-class led to low confidence. Students also reported feeling lost, unsure, and not motivated or disciplined enough to work online by themselves. The inconvenience of out-of-class sessions where they needed a strong, and stable Internet connection was indeed an inevitable problem experienced by students. The following statements reflect students' unfavorable opinion toward a flipped classroom:

> "*I can't ask questions when using the flipped classroom. I have to ask the teacher that question in the class. It's quite frustrating sometimes.*"
> (Deductive Group)

> "*It may cause some confusion about the content we will study in the class. Moreover, if we are not interested in what we learn online, it's quite boring.*"
> (Inductive Group)

Lastly, students shared their opinion on how to further improve flipped classroom grammar instruction. They gave suggestion on the number of days to do

online assignments, stating that there should be more time to work online before the class met. In terms of online materials, such as videos, students stated that the teacher should pick a wider variety of videos that suited the types of the activities, as they described:

> "*I think it's okay already, but it will be better if the videos are more fun. It will be more attractive to the students.*" (Deductive Group)

> "*I think we should add more songs, or games, in the online lessons because it will make us more interested.*" (Inductive Group)

5. Discussion and Pedagogical Implications

Improvement of grammar ability in both groups of students was investigated, and a significant change in students learning with both the inductive teaching approach and deductive teaching approach in a flipped classroom was detected. Previous studies have shown that the inductive and deductive teaching approaches were effective, but the inductive teaching approach resulted in higher improvement in students' language skills (Haight et al., 2007; Judy Shih & Huang, 2020; Kang, 2015; Vogel et al., 2011). The findings of this study yielded support to the inductive teaching approach in a flipped classroom as it was found to have a positive effect on grammar ability of students. Many educators also support the benefits of inductive grammar teaching, pointing out that students are better able to discover grammar rules and take charge of their own learning or become autonomous and self-reliant language learners (Bergmann & Sams, 2012; Nunan, 2005). The inductive approach can also help students use language without being held back by grammatical terminology and rules that can be an obstacle to fluency development. The inductive approach used in this study also favored students who preferred the challenge of pattern recognition and problem-solving skills. This kind of mental effort made during learning ensures cognitive depth and memorization as well.

As shown in this study, the inductive and deductive teaching approaches are not equally effective. Gower et al. (1995) have pointed out that the deductive teaching approach could be more effective when it is applied with higher-level students, and it is less suitable for lower-level students. Even though the participants in this study were English majors who were qualified as higher-level students, those in the deductive approach group did not improve as much as those in the inductive approach group.

The improvement of the students in the two groups, however, could not have been achieved without a flipped classroom which was one of the key components of the instruction in this study. A flexible learning environment created by online learning platforms allowed students to study at their own pace. They were able to manage their preferred time to learn grammar and to explore the content prepared for them in advance by the teacher. This concurs with Chen Hsieh et al. (2017) who point out that one of the advantages of flipped classrooms is students' ability to control the pace of video lessons when learning online. Repeated exposure to learning materials and resources also strengthens and deepens students' understanding of the instructional content. Furthermore, flipped classrooms let students acquire grammar knowledge at home where they have more time to practice their language skills. According to Cockrum (2014), flipped learning yields advantages to students with different levels of proficiency. The teacher has more time available in class to pay attention to students individually and provide useful feedback to students who may need different amounts of assistance on an individual basis. Moreover, when there is time for hands-on tasks in class, students have more chances to interact with the teacher and their peers. Johnson (2013) explored the perceptions of students toward flipped classrooms and found that they enjoyed the time they had more for in-class activities and interpersonal interaction.

As regards implications of the study findings, teachers who want to apply the inductive and deductive teaching approaches in a flipped classroom need to

prepare their lessons sufficiently. To teach with the deductive approach, teachers need to carefully choose the videos they want to use from a large number of videos that are already available online. They need to make sure that the content as well as the presentation of the videos is interesting and engaging, in addition to being accurate. Also, they should keep in mind that the videos do not have to be long. Besides this, time is another factor that teachers need to take into careful consideration. To capture the interests of students, videos should average three minutes in length to sustain student attention. Finally, teachers need to carefully consider their audience. When selecting teaching materials to use, teachers need to make sure that the materials chosen are suitable for students' interests, age, learning styles, and levels of language proficiency.

6. Recommendations for Future Research

Future research should explore the use of inductive and deductive grammar teaching approaches in flipped classrooms with other target learners such as non-English majors, young learners, and even adult learners so as to shed more light on the effectiveness of inductive and deductive approaches to develop grammar ability of students in a flipped classroom. Moreover, future research should be conducted to investigate the use of inductive and deductive approaches in flipped classrooms to promote other aspects of language skill development of students such as speaking, listening, reading, and writing.

7. Conclusion

This study integrated the inductive and deductive grammar teaching approaches into a flipped classroom. The results confirmed that both the inductive and deductive approaches can improve the grammar ability of students learning in a flipped classroom. However, language teachers who want to use a flipped classroom in the Thai educational context need to keep in mind that it can be challenging, and there are several things they need to take into consideration. Instructional design, material preparation, students' motivation, Internet access, and the availability of personal electronic devices can influence learning outcomes.

Nevertheless, when implemented with careful preparation, a flipped classroom can effectively help improve English grammar ability of students learning English in Thailand.

8. About the Author

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