Development of Grammatical Knowledge: Using Mind Map or Inductive Instruction?

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Abstract
This experimental research aimed to 1) compare academic achievement in grammatical knowledge between an experimental group taught with the mind map concept and a control group taught with inductive concept and 2) compare the experimental and control group participants'satisfaction with the management of instructional activities to developgrammatical knowledge after being taught through the mind map concept.A total of 40 Grade 8 Thai students attending an English classin the second semester of the 2020 academic yearwere recruited through a simple random sampling approach.The sample was divided into two groups, with 20 students in the experimental group and 20 in thecontrol group. The research instruments consisted of 1) a mind map lesson plan; 2) an inductive lesson plan; 3) an academic achievement test; and 4) a satisfaction questionnaire. Descriptive statistics (mean scores and standard deviations) and inferential statistics (independent samples t-tests) were employed to analyze the quantitative data collected in this study.The findings demonstrate that the experimental group participants improved their academicachievement in grammatical knowledge more than the control group participants at the .01 significance level. In addition, the experimental group participants were significantly more satisfiedwith the management of the instructional activities to developgrammatical knowledge than the control group participants at the .01 significance level.

Keywords: Grammatical Knowledge, Mind Map, Inductive Concept

Introduction

The world is changing and progressing rapidly due to the use of technology to collectively connect information from all regions of the world. Technological advancement plays an important role in economic and social development and is also a tool to answer questions in general. People are able to effectively cross borders by communicating between each corner of the world. In addition, the influence of globalization continues to increase and its impact in doing business, trade, and commerce is consequently felt. Thailand is developing itself into an industrial hub, requiring personnel with knowledge in many areas, including language experts.

The 21st century and Thailand 4.0 policy requires learning a foreign language which is considered necessary for daily life and an important tool for communication, education, and to seek knowledge for an occupation. Thai people are now required to have international skills (internationalization skills), which is the knowledge and ability to compete in a global society that is interconnected, as well as to know and understand the differences between

individuals, cultures, and paradigms (cross-cultural understanding), and also involves the exchange of information and learning so the country can trade with other countries (Kotchasit et al., 2017).

Whankong (2016) stated that English plays a crucial role as an international language (English as global language) and is used to communicate in global society, whether through direct communication, internet usage, watching television, watching movies, computer programming, or various academic handbooks which constitute the main subjects that students learn. Those who are fluent in English can gain additional knowledge by accessing nearly unlimited sources of knowledge around the world with much convenience and ease. In addition, transacting in an era in which there are advancements in information and communication technology, those with effective command of English and the ability to use technology will develop faster and will be able to communicate more efficiently.

In addition, the Secretariat of the Education Council (2018) mentioned that the Thai government attaches importance to the development and elevation of teaching and learning the English language so that it is more consistent and suitable for current conditions. The Ministry of Education announced a reform policy for English language teaching in 2014, setting important policies on the promotion of English language proficiency through special management projects (Learn to teach English). The Common European Framework of Reference for Languages (CEFR) is an international standard for English language proficiency, which is the primary conceptual framework for teaching and learning English in Thailand, both in curriculum design teaching and learning development, including testing, assessment, teacher development, as well as setting learning goals so that students can communicate better in a world that is connected without borders and for individuals to seek knowledge for self-improvement.

However, Bunnag (2018) argued that although the Thai government and the Ministry of Education have made efforts to increase the capacity to develop English language teaching and learning, Thai people are not sufficiently competent in their use of the English language. This is because English teaching faces many challenges,namely teachers who lack the required skills and teaching techniques that are suitable for activities in addition to limited quality teaching materials, learning management skills, as well as teachers who instruct using textbooks and select only certain activities that suit them, and students who lack the motivation to study. As a result, students' English learning capacity is compromised which results in poor attitudes towards learning English.

An English proficiency survey conducted by Education First (EF), which aimed to measure levels of English language proficiency around the world, revealed that Thailand was ranked at 64thin 2018 but dropped to 74th in 2019. Thailand's English language rating has slipped from a low group ranking to very low in terms of English proficiency. Thailand was also ranked 6th out of 8 countries in the ASEAN region when surveyed by EF, where it ranks at the bottom of the group for very low English proficiency. This implies that Thai workers working abroad are likely still unable to use English for effective communication. In concurrence with the above, the results of the National Educational Test of the Basic Education (Ordinary National Education Test or O-NET) showed that the English scores of Grade 9 students at a school wherethe researchers were teachingwere evaluated to have average scores (from 2017-2019) of 41.09, 40.18, and 49.36 percent, respectively, which is lower than the assessment criteria set by the National Institute of Educational Testing Service (NET). This shows that many students are unable to speak at all or communicate in English but cannot speak fluently,while most students express themselves in broken words and incomplete sentences which results in limited confidence when leading English for communication.

From the a fore mentioned problems, Kajornkiatsakuland Ngamnil (2018) suggested that learning English for efficiency and success requires learners to have basic knowledge in grammar. This is because having a good knowledge in English grammar leads to the ability to effectively develop skills in listening, speaking, reading, and writing. It is like a house with a strong structural foundation that can make other components of the house stable. Learning English with a good foundation in grammar

is equally rewarding as an effective teaching and learning structure that results in quick learning. Teachers also must choose appropriate teaching methods, especially methods that will make learners learn and have high learning achievement.

In order to achieve the goal of education management, teachers must organize quality teaching and learning activities that are consistent with the learning content in question (Pornthadawit, 2016). A variety of processes and methods are available to teachers, so learning activities selected must take into account the development of physical, emotional, social, intellectual, learning methods, interests, and abilities of learners at regular intervals. Moreover, teachers should also strengthen skills in data analysis and synthesis as well. Regarding the learner-centered teaching style, it was found that active learning encourages learning through practice or doing. In active learning, knowledge is gained directly from the learning experience whereby learners have the opportunity to act rather than just listening. Learners learn by reading, writing, interacting, and analyzing problems. Furthermore, students engage in advanced thinking processes such as analysis, synthesis, and valuation. This enables learners to store information in their long-term memory system, enhancing learners to gain powerful learning skills as well as permanent life skills.

For this reason, the researchers proposed a mind mapto develop Grade 8 students' English grammar knowledge.The two primary objectives of this study were to 1) compare academic achievement between the experimental group of students who received the mind map instruction and the control group of students who received the inductive instruction and 2) compare the experimental and control group participants'satisfaction withthe mind map instruction.

Methodology

Participants

A total of 40 students attending an English class at a school in Thailand in the second semester of academic year 2020 were recruited through simple random sampling using the lottery method. The sample was divided into two groups, with 20 students in experimental group and 20 in the control group.

Research Instruments

The research instruments used in the experiment included inductive lesson plans, mind map lesson plans, a multiple-choice achievement test, and a student satisfaction questionnaire.

Inductive Lesson Plans

To create inductive lesson plans, the researchers studied the Basic Education Core Curriculum 2008 and a manual for teaching English in Grade 8. They were designed based on Khamanee's (2017) principles and instructional management of the inductive methodin five steps: 1) Preparation; 2) Sample presentation; 3) Comparison; 4) Rules summary; and 5) Implementation. To assess the content validity of the lesson plans, the index of item-object congruence was evaluated. Three experts determined the degree to which the plans corresponded to the composites of skills they were intended to assess. With an item-objective congruence rating of 0.62, the results indicated that the content was valid. In addition, the same three experts were requested, using the rating scales, to respond to what extent they agreed or disagreed with the statements concerning the appropriateness, relevance, and accuracyof aspects included in the lesson plans. The lesson plans were modified according to the experts' advice which was to employ student-centered teaching and learning activities.

Mind Map Lesson Plans

To create mind maplesson plans, the researchers studied the Basic Education Core Curriculum 2008 and a manual for teaching English in Grade 8. They were designed based onan active learning model. To assess the content validity of the lesson plans, the index of item-object congruence was evaluated. Three experts determined the degree to which the plans corresponded to the composites of skills they were intended to assess. With an item-objective congruence rating of 0.62, the results indicated that the content was valid.Experts recommended adapting student-centered teaching and learning activities with a brainstorming activity along with creating a mind map template on worksheets.

Achievement Test

An achievement test was designed and developed to measurethe participants'academic achievement. The test consisted of 40 four-option multiple-choice questions, with only one correct answer each. Three experts determined the degree to which the test corresponded to the composites of skills that were intended to assess. With an item-objective congruence rating of 1.00, the results indicated that the content was valid. In addition, the difficulty index (p) and discrimination index (r) were calculated, and reliability was evaluated by conducting a pilot study in which tests were given to students who shared characteristics with those students participating in the main study. The results showed a difficulty level (p = 0.341) and good discrimination (r = 0.963). Cronbach's alpha was0.79, indicating acceptable reliability.

Student Satisfaction Questionnaire

The questionnaire consisted of 20 items organized into three main sections, ateacher's learning management effectiveness, teaching, and outcomes. The five-point scoring scales, which were extremely satisfied(5), very satisfied (4), moderately satisfied (3), slightly satisfied (2), and least satisfied (1), were applied for each of the items. Score ranges for data interpretation wereextremely satisfied (4.51-5.00), very satisfied (3.51-4.50), moderately satisfied (2.51-3.50), slightly satisfied (1.51-2.50), least satisfied (1.00-1.50) (Wongratana, 2010). Three experts determined the degree to which the questionnaire corresponded to the composites of skills that were intended to measure. With an item-objective congruence rating of 0.75, the results indicated that the content was valid. In addition, the experts suggested that the item "the teacher's performance" be changed to "the teacher's characteristics"and that each item should be a single question rather than asking multiple questions in one item.

Data Collection

The study was conducted for four weeks startingin the beginning of July 2020at a school in Thailand in order to reach the two objectives of this study to: 1) compare academicachievement between the experimental group of students who received the mind map instruction and the control group of students who received the inductive instruction; and 2) compare the experimental and control group participants' satisfaction withthe mind map instruction.

Before conducting the study, the researchers informed students of the objectives of the study and practical procedures. Students were given an opportunity to ask questions and refuse to participate in the study without any negative consequences.

Data Analysis

Descriptive statistics including mean scores and standard deviations were employed to analyze academic achievement and satisfaction of the experimental group and the control group.In addition, the researcher performed inferential statistics using independent samples t-test to compare learning achievement and satisfaction among the control group students who received inductive instruction with the experimental group students receiving mind map instruction.

Findings

This section presents the experimental results from the test. Data is presented in two primary sections on: 1) a comparison of the experimental group participants' and the control group participants' academic achievement; and 2) a comparison of satisfaction among the experimental group and the control group participants.

A Comparison of the Experimental Group Participants'and the Control Group Participants' Academic Achievement

The learning achievement of the experimental group participantstaught withthe mind map instruction was higher than that ofthe control group participants taught with inductive instruction as shown in Table 1.

The data presented in Table 1reveal thatthe experimental group's mean scores of academic achievements were higher than the control group's (M=28.70, and M=17.50, respectively) at the 0.01 significance level.

Table 1 Comparison of Learning Achievement Between the Experimental Group Students and the Control Group Students

Group	M	SD	t
Experimental (n=20)	28.70	3.02	7.27*
Control (n=20)	17.50	6.18	

*p < 0.01

A Comparison of the Experimental Group Participants'and the Control Group Participants' Satisfaction with Instruction

The experimental group participants' satisfactionwith the mind map instruction was higher than the control group participants taught with inductive instruction as shown in Table 2.

Table 2 Comparison of Satisfaction with the Instruction Between the Experimental Group Students and the Control Group Students

Group	M	SD	t
Experimental (n=20)	4.46	0.35	7.84*
Control (n=20)	3.17	0.64	

*p < 0.01

The data presented in Table 2 reveal thatthe experimental group's mean scores of satisfaction with instruction were higher than the control group's (M = 4.46, and M = 3.17, respectively) at the 0.01 significance level.

Discussion

This study aimed to ascertain whether the experimental group participants'academic achievement and satisfaction toward instruction they received were higher than the control group participants'.The results demonstrate higher mean scores for both academic achievement and satisfaction, suggesting that mind map instruction benefits Grade 8 students.

In particular, the learning achievement of the experimental group participantstaught with the mind map instruction was higher than the control group participants taught with the inductive instruction at .01 level of significance because the mind map method of teaching and learning is consistent with the nature of both the left and right hemispheres of the brain. For instance, the first step of teaching comparative adjectives begins with seeking knowledge using the left side of the brain because the left brain is the learning part or considered as the academic activity part. The detailed sequence of activities is as follows:

Stage 1: Introduction

The teacher showed pictures of small, medium, and large sized fruits (oranges) and asked students to compare the sizes. Students were asked to take turn asking the following questions with friends. Who is the tallest? Who is taller, Yaya and Porch? Who is as tall as Mark? In addition, comparative chain game activities were organized as a team competition. If the first sentence was "Elephants are bigger than cats," then the next sentence must start with "cats" (e.g., "Cats are smarter than pigs."), and the next sentence must start with 'pigs' (e.g., "Pigs are fatter than dogs."), and so on to draw the attention of students to the lesson. This activity prepared students to pay close attention to the primary lesson that the teacher was going to teach. In addition, students were able to anticipatethe topics they were going to study next and appliedrelevant prior knowledge and skills to new lessons. This facilitates the development of alternate learning strategies and a clearer grasp of new lessons.

Stage 2: Presentation

The teacher explained to the students that there arethree degrees of comparison: positive degree, comparative degree,and superlative degree. Activities were as follows:

1. Do you know which of the following sentences are correct? Check your grammar: true or false – positives, comparatives, and superlatives. Are these statements true or false? To enhance positive interaction, students studiedthe usage principles of the three degrees of comparison together.
2. Countdown minutes. Solve the problem quickly "Where does it go?". Write the adjectives in the correct category. Can you write the comparative and superlative form too? Students learned about the principles of transforming adjectives into comparative degrees and superlative degrees. These two activities reinforced investigation, critical thinking, information gathering,and interaction. Each pair was given10 minutes to

complete the task, and the teacher awarded points to the pairs that answered the most questions correctly.

3. Problem solving competition. Students earn points from solving problems provided on a worksheet. In this activity, the teacher distributes worksheets without letting the students know the score for each item. Each question requires the use of either the comparison of the normal adjective (positive degree), the comparison of the comparative adjective (comparative degree), or the comparison of the superlative adjective (superlative degree) (superlative degree). Students study the principles of employing and transforming adjectives from the normal (positive degree) to the comparative degree (comparative degree) and the superlative degree (superlative degree).

Stage 3: Conclusions

Students helped summarize the content of the topic. They were required to compare adjectives (comparison of adjectives) and apply the content to practice by completing tasks from the teaching materials, as well as practice speaking about comparisons of adjectives as directed by the teacher. Students were divided into groups to brainstorm ideas for a comparison of adjectivesby separating major and minor elements and creating a mind map to summarize all learnt material, involving the use of the right hemisphere of the brain, referred to the hemisphere of happiness to create work pieces according to their own ideas.

Students started the main topic from the middle of the paper by emphasizing the use of positive cartoon characters such as Batman and Superman. The students' pictures reflected their learning and preferences. For instance,they were fond of painting dog pictures because they enjoy dogs (this student may have experience raising dogs). Another student drew a picture of a book because it contained a wealth of beneficial information for him/her. Another student drew a picture of a boy to simulate his idea. A simple sketch is sufficient if a student is unable to draw. In addition to writing the topic in letters, students utilized a three-dimensional letter shading styleto make the letters stand out. The images and texts generated by the students demonstrated that different students may have diverse ideas and perspectives. They designed and created their own work based on their preferences, making it as interesting as possible. The use of images/symbols will enable the brain to store more information. In addition, the use of prior knowledge to connect the primary idea, major sub-topics, and small sub-topics, along with the use of colors to increase one's creativity and make the mind map more engaging.Both the left and right brains should be trained to simultaneously act and be creative. Creating a mind map could assist students in practicing "free thought." The ability to generate ideas can facilitate categorization and summarization of content. The combination of knowledge gleaned from listening and reading with the effect of mind mapping aids students in comprehending and memorizing pertinent information with clarity and efficiency. In addition, studentscould reflect on knowledge that had been summarized in a mind map for subsequent study purposes.

In summary, the development of students' lesson summarization skills using mind maps is a systematic approach and helpswith more effective teaching and learning. This is consistent with research on the development of English reading comprehension activities utilizing mind mapping for Grade 5 students. Laolapa (2012) proposed the mind mapping approach to develop English reading comprehension with three steps of teaching reading: pre-reading, while reading,and post-reading in which the reader improves with each step by an average rating of 68, 79, and 81 percent, respectively. In addition, achievement English reading comprehension by 25 students, had an average score of 21.33 out of 30 on an achievement test, which surpassed the criteria set according to the objectives for learning. Reading the long passages at the high school level is quite difficult. Therefore, mind mapping has come to assist students in analyzing a story, organizing thoughts by summarizing the primary and secondary themes, and connecting with their artistic side through the use of color, imagery, and symbols that make remembering easier and clearer. Thipboonmee (2015) conducted research on the use of mind maps to improvethe English listening and reading comprehension of Prathom Suksa 6 (Grade 6) students at Ban Pang

Moo Community School. The results demonstrated that the average score on the post tests was higher after participating in the study. Students possessed a high degree of English ability and interest.Most of the behaviors that students expressed during teaching and learning activities showed theircreativity in planning. Designing mind maps in a variety of ways resulted in studentsbeing happier, more interested, more focused, and assertive. In addition, mind maps helped students to understand content studied in a broader and more comprehensive dimension to cover the issues studied, as well as working systematically to improve writing and presentation skills. They will also become more independent and self-disciplined, with a desire to seek out additional knowledge independently. In addition, students will be able to apply the lesson's content to real-world events, such as personal planning, problem-solving, and goal setting.

The findings of this study are in line with Kampuang's (2016) comparison between learning outcomes and satisfaction with learning English for Mathayomsuksa 1 (Grade 7) students using concept map technique and traditional teaching. The results proved that students who utilized mind mapping had a greater English learning outcome than those who did not. This was likely becausemind map learning activities helped these students better comprehend the course material and learning objectives. Viewing visuals and making connections between them is a method of learning that motivates students to engage in independent thought and action.As previously mentioned, the use of mind mapping can facilitatethe acquisition of all abilities and skills, as Buzan and Buzan (1997) pointed out that humans can develop one part of the brain and the discovery of the left and right hemispheres of the brain enables us to modify the amount of note-taking memory. Communication becomes a mind map, which is the need for the brain to link information as efficiently as possible. Collecting information with mind mapping is simple and it is much easier to rearrange the recording instead of writing lines and writing sentences. Adopting the mind mapping technique is advantageous due to its ability to begin at the core of the main idea and then branch out into sub-ideas while moving between words, pictures, and symbols.

2. The level of satisfaction of the group of students receiving the mind map instruction was higher than the group of students receiving the inductive method of instruction at the statistical significance level of 0.01. Students are able to reason, compare, and establish the relationship between variables as a result of learning activities (left brain) that encourage learners to always use their thinking abilities by asking questions or providing opinions about simple problems.In addition, it encourages students to gain as much direct experience as possible through learning-by-doing and to collaborate through group discussions. They can share or divide tasks among team members in order to collaborate and assess.The way in which learning is structured in the classroom could always be altered to make learning management more adaptable, engaging, and interesting.Students should be given the opportunity to express their opinions freely and reflect on both right and wrong ideas as well as listen to others'opinions. Motivation during learning arrangements such as rewards, compliments, advice, scoring, exams, competitions, and applause are key. There are numerous activities that students can engage in to pique their interest in learning and to help them enjoy it in a child-centered manner. Moreover, creativity (right brain) is the method through which the learner's brain may think and conceive, allowing them to generate new objects, mind maps, and creative ideas. It is a tool that facilitates free, creative, and efficient writing by condensing knowledge. Mind maps, whether used in education, work, or management, use text or short words and a range of colors to develop imagination and boost memory through the usage of images. A mind map is a tool that combines words, images, figures, and colors to make information more memorable.

Learners can have fun by creating a mind map in their own way. In addition, they can use words and pictures to help them remember six times better than using only letters because mind maps are a natural tool to connect groups of ideas together. Moreover, it allows learners to find deeper meanings of the desired topic under review including the discovery of information they might have missed. It helps to visualize big data while organizing large amounts of information. It also facilitates the organization of new thoughts and ideas because it has the ability to break

down information in a manner that corresponds to a brain cell, hence facilitating the rapid generation of new concepts.It also encourages the learner to think outside the box. This is consistent with Yiamsaeng's (2013) findingson the use of mind maps to develop English reading comprehension of Mathayomsuksa 2 (Grade 8) students at Kham Kaen Nakhon School. This study revealed that students were satisfied with English learning activities using concept maps at a high level in all aspects. They were of the view that mind-mapping English learning activity helped students do better in their test. It also made students enjoy learning and they had better attitudes towards learning. Students learn to relate and summarize content as well as categorize readable content which helps them to better understand and recollect content. Students participated in several activities with their peers and participated in teaching and learning activities. They were also able to apply mind mapping reading strategies to other subjects, such as history. Students were able to summarize events from the past to the present using mind maps to help them effectively remember the lesson. Nuankaew's (2017) study on the effect of reading instruction using mind mapping on English reading comprehension and the learning satisfaction of PrathomSuksa 5 (Grade 5)students at Ban Klong Wang School, Nakhon Si Thammarat Provincerevealedthat students were very satisfied with the instruction using mind map, as evidencedby their enthusiasm, determination, and neat and accurate work of the students. This was because writing a mind map by summarizing what they were reading and using imagination and the use of color to create a beautiful work made the learners more easily understand the subject being taught. The research of Silawatkul et al. (2017) also emphasized on the use of mind maps in teaching French grammar (les pronomsrelatifs). The students in the experimental group were satisfied with learning using the concept map in summarizing the lessons at a high level. Students were able to write mind maps to clearly relate importance to various details, and some students decorated their mind maps more beautifully, adding various symbols to increase interest and make them easy to remember.

Implications of the Study

Management of teaching and learning can be used to develop our thinking process and teachers play an important role in enhancing students' thinking ability. The element that develops students' thinking abilities lies in the teaching techniques and methods of the teachers. To help stimulate, promote, and develop the ideas of learners to flourish, teachers should organize activities in accordance with the appropriateness of student needs by finding new and creative teaching techniques, aiming for learners to be able to practice on their own. Follow up, encouragement, and giving learners the opportunity to have the freedom to express themselves by speaking or acting according to their imagination will lead to satisfaction among learners. This will help develop the students' thinking ability more effectively and allow them to apply thinking process skills to benefit their learning, daily life,and when pursuing a career in the future. Learning activities should describe the type of mind map to build, how to do it, and which style to adopt. It is possible to explore the various types of mind maps, their distinctions, and the relevant applications for each type.

Suggestions for Future Research

1. The use of mind maps in teaching grammar is a summary of the lesson delivered, with students constructing the graphic autonomously based on their comprehension. Teachers can also use it to teach other English aspects or topics such as vocabulary, expressions, etc.
2. Mind maps should be studied in relation to cognitive skills other than academic accomplishment.

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