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Development of a Conceptual Change Model to Overcome Grammar Misconceptions and Difficulty in Learning Grammar Concepts

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I. Introduction

Grammar knowledge is a solid foundation of grammar education content and a core entity that guarantees the specificity of grammar education. Accordingly, grammar education focuses on helping learners actively construct grammar knowledge. In particular, grammar concepts are positioned as the central axis of grammar education content, making the examination of learners' understanding process of target concepts a major task in grammar education research. It begins with an exploration of the learner's preconceptions.

Considering existing research results showing that the learner's grasp of preconceptions acts as a factor in determining the success or failure of learning, there is a need to promote multifaceted research on the process by which grammar misconceptions[1] or difficulties in learning grammar concepts[2] change into grammar concepts. In par-

1 Misconception is a term that generally refers to a learner's conception that is opposed to a concept established by consensus in each academic community, and is the term most commonly used today by most scholars in the field of conceptual change (Bahar, 2003).

2 In conceptual change research, 'conception' is signified as a concept constructed by an individual or a subjective concept, and 'concept' is signified as a public concept or objective concept. In the former case, it is considered to constitute meaning in rela-

ticular, it is worth noting that the learner's preconceptions are a major factor affecting learning and do not easily change through learning. Accordingly, research on conceptual change, which identifies incomplete or misunderstood personal conceptions formed during the conceptualization process and explores ways to change them into public concepts, has been active in science education. Recently, research results that sympathize with the value and necessity of research on misconceptions have been reported in grammar education. However, most studies explore the patterns and causes of grammatical misconceptions, and studies that suggest ways to overcome misconceptions or verify their effectiveness are still insufficient.

Nevertheless, the reason why we must continue to look into the process of changing grammatical misconceptions or difficult concepts into grammatical concepts is: First, as long as grammatical concept knowledge is the central axis of grammar education content, we should consider the process of learners' understanding of grammatical concepts. This is because this should be the core task of grammar education research. Second, the true value of research on grammatical misconceptions is maximized when applicability to educational settings is guaranteed. Therefore, based on the results of research on misconceptions, there is a need to predict difficulties in the grammar learning process and find ways to implement teaching and learning to overcome them. So far, studies on conceptual change have focused on the development of learning models using various strategies, and attempts have been made consistently to identify the effects of application and related variables. On the other hand, since it has not yet been attempted in grammar education, related research needs to be revitalized.

Of course, it is difficult to assume a single model that can en-

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tion to other concepts within an individual's cognitive structure and is influenced by the affective and sociocultural context, while the latter emphasizes that it is a concept as a recognized attribute (Choi, 2022b, p. 3975).

compass all grammar education contents. However, there has long been a demand in the educational field to present a practical form of grammar inquiry learning. In order to respond to this, it will be possible when research is accumulated that proposes and verifies teaching and learning practice plans that can practice grammar inquiry from various angles. Accordingly, the goal of this study is to develop a Conceptual Change Model (CCM) to overcome grammar learners' misconceptions and difficult concepts and to verify its effectiveness.

II. Background

1. Theoretical frameworks

1) Conceptual change theoretical models and conceptual change instructional strategies

The studies that defined conceptual change and laid the foundation for research are Posner et al. (1982) and Strike & Posner (1992). Posner et al. (1982) explained conceptual change as a process in which learners assimilate or adjust newly introduced concepts by relying on existing knowledge.[3] Additionally, by presenting four conditions[4] for the conceptual change process to occur, it provided a framework for developing various perspectives, theories, and strategies to promote understanding of scientific concepts and bring about conceptual change. Since then, as follow-up studies based on Posner et al. (1982) have continued, conceptual change theoretical models

3 Assimilation refers to "using existing concepts to deal with new phenomena," while accommodation involves "replacing or reorganizing the learner's central concepts" (Posner et al., 1982, p. 214). Posner et al. (1982) mainly focused on "accommodation".

4 (a) the learner being dissatisfied with his or her existing conceptions; (b) the new conception being considered intelligible; (c) the new conception appearing to be plausible, and (d) the new concept suggesting the possibility of fruitful results.

have been proposed to support conceptual change.

Table 1. Conceptual change theoretical models (Dyer, 2018, p. 35)

Researcher	Subject	Theoretical models
Hewson & A'Becett Hewson(1984)	Epistemological model of learning	use of the diagnosis, integration, differentiation, and exchange instructional strategies
Strike & Posner (1992)	Revisionist conceptual change theory	Focus not only on the cognitive but also consider the impact that motives, goals, and social sources have on the conceptual ecology
Jonassen & Easter (2012)	Intentional conceptual change environments	Simulations, models, and dialectical argumentation

These research results led to changes in the epistemological interpretation of learner misconceptions. In addition, it was possible to add breadth and depth to the understanding of 'learning' and 'learners' through discussion of the various types of conceptual changes that occur as a result of teaching and learning.[5]

However, it has not gone so far as to specify teaching guidelines on how to implement it. This naturally led to the activation of research focusing on strategies to support the conceptual change process. Table 2 shows studies that proposed a conceptual change teaching and learning strategy based on Scott et al. (1991).[6]

5 Choi (2022b) confirmed changes in the epistemological interpretation of learner misconceptions by exploring the implications and premises of terms that have been discussed in conceptual change research. She also summarizes and presents the types and stages of conceptual change, teaching and learning models, etc. to confirm the assumptions of conceptual change research, so it is worth reference.

6 When determining the optimal instructional strategy, Scottet al. (1991) stated four factors that should be considered: (a) learner's prior conceptions and attitudes; (b) desired learning outcomes and assessment of those outcomes; (c) intellectual demands on the learner for conceptual change to occur; and (d) possible strategies that can assist with supporting the change process.

Table 2. Conceptual change instructional strategies

Researcher	Topic	Instructional Strategies
Stepans(2006)	Confront preconceptions	commit, expose beliefs, confront views, accommodate the concept, extend the concept, go beyond
Nussbaum & Sinatra(2003)	Argumentation	Involves constructing a rationale for a particular outcome, refuting opposing arguments, and weighing competing considerations
McComas(1995)	Diagnosis of conceptions	explore, diagnose, design, discuss, use phases
Driver(1987)	Alternative framework	elicitation, reconstruction, application, review phases
Cosgrove & Osborne(1985)	Generative learning model	preliminary, focus, challenge, and application phases
Nussbaum & Novick(1982)	Conceptual conflict	exposing alternative frameworks-creating conceptual conflict-encouraging cognitive accommodation
Erickson(1979)	Accommodation	experiential maneuvers, clarification maneuvers, anomaly maneuvers, restructuring maneuvers

These strategies had the potential to facilitate and support conceptual change processes and tasks. Although there are differences between strategies, they can generally be explained in terms of the stages of 'awareness -reconstruction-application'. In other words, conceptual change continues as the process of 'experience of dissatisfaction with the existing conception-understanding of the new concept–application of the new concept and problem solving' is cycled. Among them, what is especially emphasized is the 'reconstruction' stage, which shows the commonality of predicting situations of cognitive conflict and adopting a strategy of intentionally introducing them to be able to clearly construct concepts.

2) Learning strategies using cognitive conflict

Cognitive conflict is a state of psychological conflict that occurs when one becomes aware of a discrepancy between existing cognitive structures and external information. In other words, when learners encounter information or uncertainty that conflicts with their

current cognitive structure, they are placed in a state of cognitive disequilibrium and make intentional efforts to resolve this, leading to in-depth information processing (Baker et al., 2010; Craig et al., 2004; Graesser et al., 2005; VanLehn et al., 2003). Confusion caused by contradictions, conflicts, anomalies, erroneous information, and discrepant events becomes a useful resource for effective learning (D'Mello et al., 2014). Accordingly, one of the strategies that has received the most attention to promote conceptual change is cognitive conflict (Rowell et al., 1990). The mechanism by which cognitive conflict occurs can be understood through the schematic of Lee et al. (2003), which presented a cognitive conflict process model (Figure 1).

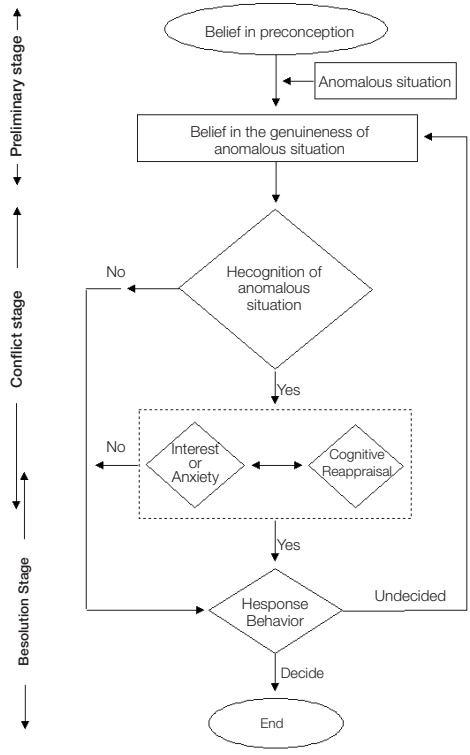

Figure 1. The model of cognitive conflict process (Lee & Kwon, 2001; Lee et al., 2003)

Limón (2001, p. 358) analyzed various strategies that promote concept change learning and categorized misconception reconstruction strategies into 'cognitive conflict using inconsistency cases,' 'use of analogy,' and 'collaborative learning or group discussion.' Among them, cognitive conflict is the minimum necessary condition for conceptual change (Chinn & Brewer, 1998; Kwon et al., 2003; Posner et al., 1982). Additionally, analogy and cooperative learning strategies can be understood in the context of cognitive conflict.[7]

Learning strategies using cognitive conflict have received more attention as results have been reported showing that they are significantly effective in correcting misconceptions. According to a meta-analysis by Guzzeti et al. (1993), the conclusions of studies conducted through various methods show that positive learning effects occur when students' misconceptions are compared with the target concept and cognitive conflict is induced (Kim, 2015, p. 2). The effects of the cognitive conflict learning strategy are shown in Table 3. Cognitive conflict learning strategies continue to evolve in connection with various discussions such as interest, motivation theory, and deep learning.

Table 3. The effects of the cognitive conflict learning strategy

cognitive level	• Positive impact on conceptual understanding and problem-solving • Functions as a premise for in-depth learning and a useful resource. • Representative discussions: VanLehn et al. (2003), Craig et al. (2004), Graesser et al. (2005), Baker et al. (2010), Lehman et al. (2012)
affective level	• Inducing learning motivation • Effect of arousing interest • Representative discussions: cognitive dissonance theory (Festinger, 1957)

7 According to a study by Limón (2001, p. 374), variables related to effective cognitive conflict learning include variables related to the social context in which learning occurs (roles of peers, relationships between teachers and individual learners, relationships between teachers and learners) and variables related to the teacher. This suggests that for meaningful conceptual change learning, it is necessary to consider not only variables related to the individual learner but also various variables external to the learner, especially the collaborative learning experience of the learning community.

With reference to the above discussions, we set the premises for constructing a CCM for grammar education as follows.

First, the process of making learners aware that their conceptions are incomplete and recognizing the need for learning to correct and supplement the incomplete conceptions must be established as important. Second, cognitive conflict strategies are used as a necessary condition for conceptual change learning. Third, based on cognitive constructivism and social constructivism, the learner's experience of knowledge reconstruction through individual learning as well as the experience of participating in the grammar inquiry process as a member of the grammar learning community should be highlighted as important factors. Fourth, it must necessarily include a process of examining and reflecting on what kind of conceptual reconstruction one has experienced.

2. Conceptual Change Model using cognitive conflict strategy

This study assumes that the central axis of developing a CCM for grammar education is cognitive conflict strategy and grammar inquiry.

The core of grammar inquiry is experiencing the process of discovering principles or rules by identifying problems with language phenomena and actively collecting and exploring related data. The grammar inquiry process has the structure of 'observation-analysis-judgment', and adjustment and inspection are involved in the entire process (Nam et al., 2009, p. 375). Based on this, studies have been presented that have modified the model appropriately according to the teaching and learning situation, but research on a model that comprehensively utilizes cognitive conflict strategies has not been conducted in earnest. However, some of the studies that explored the knowledge construction aspects of grammar learners have proposed the use of cognitive conflict strategies (Choi, 2018; Choi, 2022a; Kim, 2019; Gwak, 2020).[8]

This paper seeks to provide a framework for the cognitive control

process that supports changes in grammatical concepts based on the learner's reflection on preconceptions, grammar inquiry experience of accommodating the concept and understanding of target concepts. In other words, the purpose is to introduce a conceptual conflict strategy to arouse motivation and interest in learning and enhance the need for coordination, and to specify a learning activity procedure that supports the accommodation process through the creation of cognitive conflict. Therefore, the following activity guidelines (Nussbaum & Novick, 1982) were used as a basic framework.

1. (a) Create an "exposing event" which requires students to invoke their preconceptions in order to interpret it.
   (b) Encourage students to describe their preconceptions verbally and pictorially.
   (c) Assist students in stating their ideas clearly and concisely, thereby making them aware of the elements in their own "alternative frameworks"(preconceptions).
   (d) Encourage confrontation in which students debate the pros and cons of their different preconceptions and increase their awareness and understanding of the differences between their own "frameworks".
2. Create a "discrepant event," one which creates conflict between exposed preconceptions and some observed phenomenon that they cannot explain.

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8 Kim (2019) proposed a learning model for categorizing concepts as 'voluntary awareness of conception–induction of cognitive conflict-reconstruction of conception–review of changes in conception.' Gwak (2020) presented a cognitive conflict learning instruction model as 'recognition of preconception-recognition of conflict-conflict resolution-recognition of changed conception'. Through analysis of actual data, Choi (2022a) confirmed that the factors that influence the construction of phonological concepts in grammar learners are encountering anomalous cases, mapping with concrete objects, grounds for epistemological confidence, epistemological beliefs, and past experiences. She then suggested using these factors as strategies to trigger and sustain spontaneous grammar inquiry. In particular, she emphasized helping students experience meaningful conceptual change by using cognitive conflict situations as drivers of conceptual change.

3. Support students' search for a solution and encourage emerging accommodation.

In this study, a 6-step model was constructed including argument and reflection activities in addition to the basic 3-step activities above. This is intended to emphasize the experience of participating in the grammar inquiry process as a member of the learning community and the experience of checking and reflecting on conceptual changes.

Table 4. CCM using cognitive conflict strategy

Phase	Teacher activities	Student activities
Check preconceptions	• motivating students to learn context • elicit students' beliefs and preconceptions	• exposing preconceptions and beliefs • expressing ideas and concept maps
⇩		
Cognitive conflict	• providing discrepant event • creating cognitive conflict	• focusing the preconceptions • recognizing the imperfection of preconceptions and beliefs
⇩		
Grammar inquiry Conversation	• providing exploratory materials • promoting exchange of opinions and checking the validity of ideas	• research data and share ideas • argumentation for rational explanation
⇩		
Accommodate the concept	• introducing grammatical concept • summary of key characteristics	• clarifying the concept • explaining the concept
⇩		
Extend the concept	• providing activities to apply concepts • reviewing concept usability	• elaborating the concept • applying the concept
⇩		
Inspection and reflection	• checking for conceptual changes • evaluating the level of conceptual changes	• examining conceptual changes • introspection and reflection

The first phase is to check the learner's preconceptions related to the main concepts of the target learning content. Activities are conducted to express the conceptions or ideas that the learner has internalized through concept maps or language. In the second phase, the learner experiences dissatisfaction with the preconceptions by creating a situation that causes cognitive conflict. To this end, teachers present descriptions of grammar in which there is a difference in perspective or interpretation or use intentionally constructed contradictions, conflicts, anomalies, erroneous information, and discrepant events. By presenting things like this, a cognitive conflict situation is created. The third phase is the experience of participating in the grammar inquiry process as a member of a learning community based on social constructivism. The experience of collaborative grammar inquiry through argumentation can contribute to independent understanding through interpretative meaning construction, enhancing the transferability of knowledge through integrated thinking activities, and securing the validity of understanding through internal and external communication. Phases 4 and 5 are the conceptual reconstruction stages, which are phases of change in existing conceptions and beliefs. Reconstruct existing knowledge based on experience in the elaboration, systematization, and contextualization of concepts focusing on linguistic units, category structures, and meaning-functions. The final phase is to check what conceptual changes have been experienced and reflect on the grammar learning process.

III. Research Methodology

In this chapter, we attempted to verify the impact of CCM on grammar learners' understanding of phonological concepts and how the various phases of CCM contribute to the conceptual change process.

1. Participants and setting

The participants in this study were 42 secondary school pre-service teachers (27 females, 15 males). The participants were students who had not learned grammar as an advanced elective subject in high school and had little or no knowledge of Korean phonology. Data from voluntary participants who agreed to data collection were analyzed.

2. Procedures

This study was designed based on a four-week course on the topic of phonological systems. Before the commencement of the course, the participants were given a pre-test to measure their knowledge of the phonological system.

The phonological system instruction commenced with a phenomenon-based learning approach where a "phonological phenomena, Korean Orthography of Loanwords, and Romanization" plugs into their language life. This approach encourages participants to explore a variety of phonological phenomena based on phonological concepts. Participants were asked to explore the characteristics of Korean phonemes using materials presented by the instructor. Participants wrote their ideas and explanations according to the CCM teaching phases and had group discussions about their ideas and explanations before, during, and after each activity.

A post-test and post-questionnaire were administered regarding the relationship between CCM and conceptual understanding. Additionally, a questionnaire was completed regarding the effect of each phase of CCM on participants' conceptual change.

The questions on the test and items in the questionnaire also include well-known misconceptions such as wrong answer choices so that they can be used for analysis and data interpretation. Using this approach had the advantage of directing participants' attention to the

particular misconceptions that needed to be addressed (Addido et al., 2022, p. 503).

3. Data collection

In this study, data were collected using tests and questionnaires designed with reference to Addido et al. (2022).

The first data collection was conducted using a pre- and post-test consisting of 10 questions about participants' knowledge of the phonological system (Table 5). The test was designed with reference to previous studies on grammatical misconceptions. The test questions were intended to help participants demonstrate accurate knowledge of the phonological system, and analyze the reasons why a claim might be true or not. The reliability of the test (Cronbach-α) was .83.

Table 5. Sample question from pre- and post-test

4. '손:산', '빛:빗' are minimal pairs. □True □False • Reason: • Are you sure of your answer? □Sure □Not Sure

The second data collection was conducted using a 5-point Likert scale questionnaire(from strongly disagree to strongly agree) to measure participants' linkage between the CCM and their conceptual understanding (Table 6). Numbers 1 to 4 in Table 6 are statements about CCM, and numbers 5 to 8 are statements about conceptual understanding.

Table 6. Questionnaire on CCM and conceptual understanding

items	Strongly Disagree				Strongly Agree
1. The teaching approach helped me understand the concept of the phonological system.					
2. Recording the reasons for my ideas dispelled some misconceptions I had.					
3. The group discussions convinced me to abandon some preconceptions I had.					
4. I was able to see applications of the concept of phonological system beyond the lesson for the day.					
5. Phonemes are the same as written letters.					
6. The initial consonant 'ㅇ' is a phoneme.					
7. A double consonant (e.g. ㄲ, ㄸ, ㅃ, ㅆ, ㅉ) is composed of two phonemes.					
8. A diphthong is a combination of two simple vowels.					

In addition, data were collected using pre- and post-questionnaires on participants' phonological system conceptions (Table 7) and a questionnaire on the effects of CCM phases on conceptual change (Table 8). Both questionnaires are based on a 5-point Likert scale.

Table 7. Questionnaire on the effects of the phases of CCM on conceptual change

items	Strongly Disagree				Strongly Agree
Writing down my ideas(predictions and explanations) and concept map helped build my understanding of the phonological system.					
Experiencing anomalies and different perspectives on grammar descriptions helped me change my initial ideas.					
The discussions, debates, and arguments using collected data had a positive effect on my understanding of the concept of phonological system.					
Sharing my ideas, predictions, and explanations with group members enhanced my understanding of the phonological system.					
The experience of linking concepts of the phonological system to related phenomena helped clarify the concepts.					
Reflecting on how my understanding has changed has led to a positive perception of grammar learning.					

Table 8. Pre and post questionnaire on conceptions of phonological system

items	Strongly Disagree				Strongly Agree
Voice is sound, and phoneme is letter.					
'오리' and '고리' are examples of minimal pairs.					
The number of phonemes for '있다' and 없다' is 4 and 5, respectively.					
[ㅖ] and [ㅟ] are diphthongs.					

4. Data analysis

Participant responses to pre- and post-tests as well as the questionnaires were analyzed using the SPSS statistical program. For pre- and post-tests, tier 1 (T/F) was scored based on a total of 10 points. The test scores were analyzed using a paired-samples t-test statistical model to check if there was a statistically significant difference between the means of the pre-and post-tests. Additionally, tier 1 (T/F), Tier 2 (the reason) and tier 3 (sure/unsure) responses were divided into five categories based on level of understanding (Table 9).

Table 9. Understanding level category

Category	Tier 1	Tier 2	Tier 3
Sound understanding (SU)	True	True	Sure
Misconception (M)	False	False	Sure
Not understanding the concept (NU)	False	False	Unsure
Partial understanding (PS)	True	False	Sure
	True	False	Unsure
	False	True	Sure
	False	True	Unsure
Not being encoded (UC)	if one, two, or all are not filled		

The data from the questionnaire was also analyzed using a Pearson bivariate correlation in SPSS to find out if there was a relationship between participants' conceptual understanding of the phonological system and the CCM. In addition, another paired-sample t-test was conducted on the pre- and post questionnaire data.

IV. Results and Discussions

1. CCM and conceptual understanding

A bivariate correlation analysis was run to determine whether there is a statistically significant correlation between CCM and conceptual understanding. As can be seen in the table below, the analysis indicated that there was a positive correlation between participants' conceptual understanding of the phonological system and the CCM.

Table 10. Correlation results for CCM and conceptual understanding

		CCM	Conceptual understanding
CCM	Pearson's *r*	1	.503**
	p-value(2-tailed)		.001
	N	42	42
Conceptual understanding	Pearson's *r*	.503**	1
	p-value(2-tailed)	.001	
	N	42	42

**Correlation is significant at the .01 level (2-tailed)

In order to obtain more information, the mean difference be-

tween pre- and post-tests on phonological system knowledge was additionally analyzed. A paired-sample t-test was conducted to compare pre-test and post-test scores on participants' understanding of some concepts of phonological systems. Table 11 shows growth in phonological system knowledge from the pre-test to the post-test. Results point to a statistically significant difference between pre-test scores (M=3.95, SD=1.847) and post-test scores (M=6.50, SD=1.877); t=-12.424, df(41), p<.001. We can infer that the CCM instructional approach did have an effect on the participants' understanding of the phonological system concepts.

Table 11. Descriptive statistics of phonological system knowledge from pre-test and post-test scores

	N	M	SD
Pre_test	42	3.95	1.847
Post_test	42	6.50	1.877

Table 12. Paired samples statistics of pre- and post-tests on conceptions of phonological system

	M	SD	t	p
Pre_test - Post_test	-2.55	1.329	-12.424	.000

In addition, the results of analyzing the pre- and post-test results according to the level of conceptual understanding are shown in Figure 2.

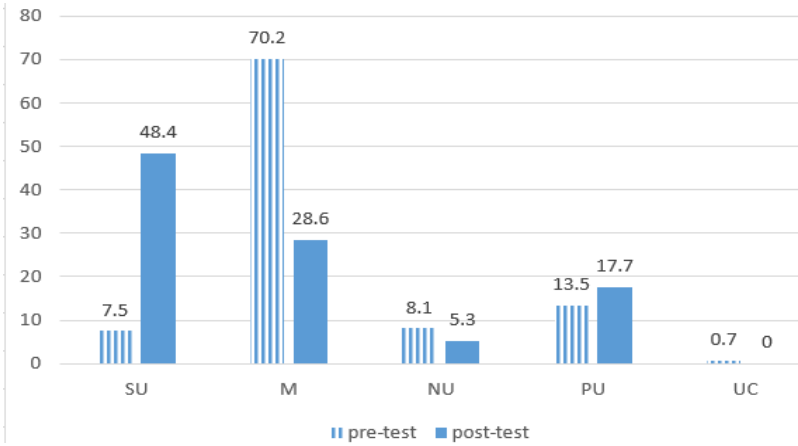

Figure 2. The result of the pre-test and post-test from understanding level

Of the total 42 students, 40.9% experienced positive conceptual change. The number of students with misconceptions decreased by 41.6%. The number of students who did not understand the concept decreased by 2.8%. On the other hand, the number of students who understood some concepts increased by 4.2%.

These results support previous studies that confirmed the positive effects of CCM in overcoming misconceptions and improving conceptual understanding (Addido et al., 2022; Hadjiachilleos et al., 2013; Lee & Byun, 2012; Nadelson et al., 2018; Potvin et al., 2020). It also confirms the need to implement teaching and learning using CCM for successful conceptual change.

2. CCM and conceptual change

A pre- and post-questionnaire was conducted to directly confirm whether there was a change in the participants' conceptions. On participants' conceptions of the concept of phonological system, there was a statistically significant difference between the pre- and post-questionnaire responses on all items. The result indicates that using the CCM had a positive effect on participants' misconceptions

about the target concept. There was no significant difference between the items in the mean difference and t value of the pre- and post-questionnaire. However, the mean difference and t value of the third item are relatively low compared to other items. These results mean that changes in misconceptions about double consonants and double final consonants (eg. ㄳ, ㄶ, ㅙ, ㅄ, ㄺ, ㅀ) occurred slowly. Therefore, we must teach students to clearly understand that double consonants are one phoneme.

In addition, looking at the reasons for choosing the answers described in the pre- and post-test, it was confirmed that the difficulties or misconceptions commonly experienced by participants were due to constructing conceptions based on notation types. The concept of phonology and phonological system, constructed through discrimination at the level of sound and notation, is a concept that is continuously investigated to understand the principles of phonological variation and the characteristics of each type. Therefore, educational treatment to change misconceptions into target concepts is very important. From this perspective, the results of this study, which showed positive conceptual changes in all items of the questionnaire, show that continuous inspection is necessary during the learning process to avoid forming conceptions based on notation types. It also shows that CCM can be an effective learning method. Two tables below provide a summary of the descriptive statistics and paired sample t-test results.

Table 13. Descriptive statistics of pre- and post questionnaire on conceptions of phonological system

items	N	pre-test		post-test	
		M	SD	M	SD
Voice is sound, and phoneme is letter.	42	1.70	.917	3.36	1.084
'오리' and '고리' are examples of minimal pairs.	42	2.05	1.035	3.37	1.036
The number of phonemes for '있다' and 없다' is 4 and 5, respectively.	42	2.20	1.030	3.47	1.110
[ㅐ] and [ㅔ] are diphthongs.	42	2.76	1.072	4.19	0.917

Table 14. Paired samples statistics of items on phonological system

items	M	SD	*t*	p
Voice is sound, and phoneme is letter.	-1.655	.985	-10.892	.000
'오리' and '고리' are examples of minimal pairs.	-1.321	.679	-12.610	.000
The number of phonemes for '있다' and 없다' is 4 and 5, respectively.	-1.274	.964	-8.564	.000
[ㅐ] and [ㅔ] are diphthongs.	-1.429	.852	-10.862	.000

3. Phases of the CCM and their effect on conceptual change

Participants' responses were counted to determine how the various phases of CCM affect conceptual change. As a result of the analysis, participants responded that the "Check Preconceptions" and "Cognitive Conflict" phases had the most positive effect on their conceptual change. This suggests that the starting phase before entering into full-fledged grammar inquiry activities is important for conceptual change. Therefore, it is necessary to provide opportunities to objectify and express one's preconceptions about the content to be learned, and to create an environment in which students can question their existing conceptions by facing situations of cognitive conflict.

Another point to note is that discussions and collaborative inquiry experiences among fellow learners during the grammar inquiry activities had a positive impact on leading to conceptual change and understanding of concepts. Therefore, in order to lead successful grammar inquiry learning, creating a student-centered cooperative learning environment can be an important factor.

However, the result of relatively higher negative reactions toward the later phases leaves something to think about. These results may be due to several factors, but it is possible that learning was difficult or failed during the "Extend the concept the concept" phase, which attempts to generalize concepts through various materials. Additionally, the "Inspection and Reflection" phase may have been felt to have

a relatively low direct relationship with conceptual change compared to the remaining phases. Most of these responses were confirmed to be those of learners who were not successful in conceptual change. In addition, given that the negative and positive responses to the two phases were almost equal, it seems difficult to view this as simply a problem with the CCM phase setting. For a detailed analysis, a study using a research method that sufficiently collects and analyzes the thoughts of participants must be followed up.

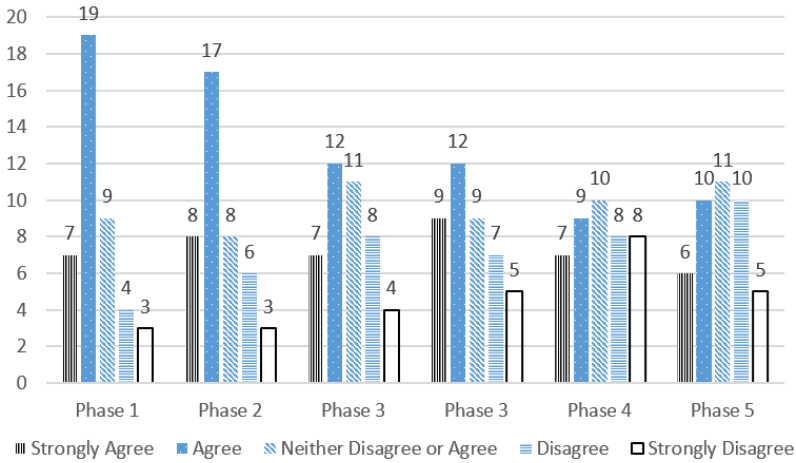

Figure 3. The result of the phases of the CCM and their effect on participants' conceptual change

The above research results support previous research results that have emphasized the positive effect of the CCM in overcoming misconceptions and helping to understand concepts. Furthermore, it provides evidence showing that using CCM for conceptual change can be effective.

The CCM proposed in this study is an attempt to specify a model for realizing student-centered voluntary grammar inquiry learning. This approach emphasizes 'self-direction' in which students construct their own knowledge and experience 'open learning' where they can

objectify their own ideas and share them with peers and teachers. This can encourage them to take responsibility for their learning. Through this experience of grammatical inquiry activities, learners will be reborn as voluntary investigators who can accept grammatically accurate concepts instead of holding on to misconceptions.

V. Conclusion

This study was planned to explore specific ways to practice grammar inquiry learning, which has been continuously emphasized in the field of grammar education.

To this end, based on the results of analyzing the conceptual change theory model and teaching and learning strategies, the central axis of developing the CCM was assumed to be cognitive conflict strategy and grammar inquiry. It is considered that the core of grammar inquiry learning is experiencing the process of discovering principles or rules by capturing problems targeting linguistic phenomena and actively collecting and exploring related data. In addition, the aim was to introduce a cognitive conflict strategy to arouse motivation and interest to initiate voluntary exploration and to enhance the need for accommodation. Accordingly, in order to provide a framework for the cognitive control process that supports conceptual change, a CCM using cognitive conflict strategies' was proposed. Afterward, we attempted to verify whether the proposed CCM actually contributed to conceptual change. For this purpose, response data collected through four types of tests and questionnaires were analyzed.

The results showed a statistically significant, positive correlation between CCM and building conceptual understanding. Additionally, the results of analyzing pre- and post tests and questionnaires showed an increase in knowledge and a decrease in misconceptions. Among the various phases of CCM, it was confirmed that "Check Preconceptions" and "Cognitive Conflict" phases had the most positive effect on

their conceptual change.

The results of this study provided empirical evidence supporting the knowledge assimilation and misconceptions minimization attributes of CCM by showing that target learning concepts are better understood when students focus on their preconceptions before entering into full-fledged grammar inquiry activities. This research also assesses the effect a misconceptions-based instructional approach has on students' conceptual change to help inform practitioners in the field of grammar education to make informed decisions about using the CCM for future instruction and research.

However, since the results of this study were limited to the phonological system, research on various grammar inquiry topics and concepts by grammar education content should be followed up. In addition, we attempted to use descriptive responses from pre-post tests and informal interviews to supplement the quantitative research results, but there were limitations. so, qualitative research should be followed up to closely check learner responses.

Lastly, CCM using cognitive conflict strategies does not guarantee learning effects in itself, but can be effective only when it is induced in an appropriate context and scaffolding is properly supported. Therefore, we expect to continue to conduct more research on strategies to appropriately utilize cognitive conflict to advance effective learning.

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ABSTRACT

Development of a Conceptual Change Model to Overcome Grammar Misconceptions and Difficulty in Learning Grammar Concepts

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This study was planned to explore specific ways to practice grammar inquiry learning, which has been continuously emphasized in the field of grammar education. Based on the results of analyzing the conceptual change theory model and teaching and learning strategies, a 'conceptual change model using cognitive conflict strategies' was proposed. To verify the model, response data collected through four types of tests and questionnaires were analyzed. The results showed a statistically significant, positive linear correlation between Conceptual Change Model and building conceptual understanding. And the results of analyzing pre- and post tests and questionnaires showed an increase in knowledge and a decrease in misconceptions. Among the various phases of Conceptual Change Model, it was confirmed that "Check Preconceptions" and "Cognitive Conflict" phases had the most positive effect on their conceptual change.

KEYWORDS Conceptual change model, Conceptual change, Cognitive conflict, Misconception, Preconception, Grammar inquiry, Grammar education