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【研究論文】

The Analysis of Effectiveness for the Instruction of Reading Strategy (in EFL) based on Problem Solving by Collaborative Discussion
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要旨

本研究は、EFL 環境下の英語リーディング学習におけるリーディングストラテジー使用を目的とした指導において、読み手が英語リーディングを行う中で直面する困難さや疑問を仲間や教員も含めた話し合いにより解決する観点に基づく指導を行い、その効果の分析結果を報告する。第 1 言語だけでなく外国語におけるリーディングにおいても、熟達した読み手は自動化され潜在意識的なリーディング理解を進めるが、文中の困難さに直面する時、意識的で制御された形のストラテジーを用いたリーディング理解を行う点が指摘されている(Kintsch, 1998)。様々な困難さに対して熟達した読み手は多様なリーディングストラテジーを適確に使用する点が明らかになるにつれて、第 2 言語や外国語によるリーディングストラテジー使用を目的とした指導が研究されてきた。その中でも、本研究は、上記のリーディングストラテジーの定義に基づき、読み手自身が直面している困難さを(母語を用いる形式を含めて)仲間や教員との間で言語化し、話し合いにより解決する中でリーディングストラテジーの使用を意識し、習得する指導形式に着目し、実践を行った。結果、指導開始前と終了時におけるリーディングテストの結果は有意差を伴う上昇を示し、質問紙の探索的因子分析の結果、困難さや疑問点を話し合いにより解決する下位尺度が負荷量を持つ因子として示された。リーディングテスト結果を含めた共分散構造分析(パス図)の適合値は許容範囲の値を示し、上記の因子は間接的にリーディングストラテジーとリーディング力に影響を与える可能性が示された。

Keywords: reading strategy, difficulty of reading, problem solving, collaborative discussion
キーワード：リーディングストラテジー、リーディングの困難さ、問題解決、話し合い

For any student in university or college, successful reading comprehension is indispensable aspect, especially for expository passage. Kintsch defines the reding comprehension as “We comprehend a text, understand something, by building a mental model.” And to accomplish this, “… we must form connections between things that were previously disparate: the ideas expressed in the text and relevant prior knowledge” (Kintsch, 1998, p.93). Based on this definition, reading comprehension can be understood as the interaction between the information of short-term memory obtained from the passage and information of long-term memory accumulated in a reader (comprehension integration model, CI model; Kintsch, 1998).

For example, if someone reads such a sentence as, “There are some books on the table” or “I have to book my seat at the hotel”, it does not take so long time to see the different meanings of “book”. In the former sentence, “book” is a noun that refers to an implement for reading but in the latter sentence, “book” is verb that means to make a reservation. Readers can easily understand the different meaning of ‘book’ by their background knowledge based on the long-term memory of the meaning of “table” or “hotel”.

It must be emphasized that this model of reading comprehension proceeds automatically and unconsciously in a reader. Therefore, it does not take long time to grasp the meaning of a passage in daily life. However, when a reader faces difficulty or has question while reading, reading process becomes “… deliberate, conscious inferencing, reflected in the reader’s verbal protocol, unlike the automatic knowledge access that occurs in a familiar domain” (Kintsch, 1998, p.230). In other words, when facing difficulties or questions in a passage, reading process becomes conscious, controlled and strategic one.

For example, if someone reads the sentence “My boss asked me to cook the books,” some EFL readers may make deliberate inference of the meaning of the phrase “cook the books,” or may check a dictionary or ask someone else for the meaning. This is one example of strategic reading that is consciously done in a controlled way, not automatically or unconsciously.

Therefore, Grabe defines the reading strategy as “… processes that are consciously controlled by readers to solve reading problems” (Grabe, 2012, pp.221–222).

In addition, as Pressley and Afflerbach (1995) and Carell (1989) suggest, some surveys have reported a positive correlation between the use of reading strategy and reading comprehension. Instruction of reading strategy not only in reader’s first language (L1), but also in second language (L2) situation, including English as a foreign

language (EFL) and English as a second language (ESL), has been of interest to many researchers. In the following section, previous research concerning reading strategy instruction in EFL or ESL situation is reviewed. The focus is on research about reading strategy instruction, including problem solving by collaborative discussion.

Literature Review and Reearch Question

While Finkbeiner and Erler (2007) suggest that the result of the instruction of EFL/ESL reading strategy is "less than conclusive", there are some features of instruction of reading strategy aimed at determining classification of the model of instruction. To focus on this aspect, it is worth reviewing research on the instruction of language learning strategy.

An example of a popular approach of language learning strategy instruction including four skills (LLSI) is "The Cognitive Academic Language Learning Approach" (CALLA) (O'Malley & Chamot, 1990). The basic phases of the instruction of CALLA are "preparation, presentation, practice, evaluation." The "presentation" phase is important for the following reason: "new information is presented and explained to students in English that is supported by contextual clues … Teachers make sure that students comprehend the new information so that they will be able to practice it meaningfully …" (O'Malley & Chamot, 1990, pp.201–202)

From this perspective, the typical language learning strategy instruction can be interpreted as teacher (or expert) driven. The teacher or expert presents strategies and those strategies are suggested to use for readers to practice.

However, as Rees-Miller suggests, this model of language learning strategy instruction is not always effective because it does not take "individual differences" into account; "[a]nother reason for potential failure of learner training schemes is the lack of fit between teachers' beliefs about how to learn a language and those of their students … In selecting techniques in which to train learners, the classroom teacher should take into account individual differences in students' cognitive styles and how effective a particular technique will be for different modes of language processing" (Rees-Miller, 1993, pp.685-686).

Following this argument about the individual differences for the strategy use for language learning, Harris (2019) and Gu (2019) suggest two models of language learning strategy instruction, namely, "top-down" and "bottom-up" models of instruction (Gu, 2019, pp.29–31; Harris, 2019, pp.45－49). Gu (2019) defines the top–down model as an "… instruction model [that] follows a clear top-down procedure; in other words,

researchers decide on both the strategies and the way of instruction." Meanwhile, following the concept of strategic content learning (SCL) by Butler (1995, 2002), bottom–up model is defined as "… the researcher or the teacher does not start by selecting the task, anticipating potential problems and identifying the strategies to be taught …" and "the teacher works with the students to do a content-based task analysis together to co-construct the potential strategies for assisting the completion of the task." (Gu. 2019, pp.28–29).

Harris suggests that importance of group discussion of a task for language learning strategy instruction: "Discussing task demands and criteria in mixed grouping also means that students themselves rather than the teacher can come into their own in terms of modelling … strategies" (Harris, 2019, p.47)

As Gu(2019) and Harris(2019) suggest, the bottom-up model includes discussion between the teacher and learners and among learners as a group, which aims to solve the difficulties or questions of the task and leads learners to find an appropriate strategy for each difficulty or question. It has the possibility to deal with individual differences for effective language learning instruction.

These two types of instructions can be applied to the instruction of reading strategy under EFL/ESL situation. As the start of specific application of bottom-up model of instruction, Cotterall (1990, pp.2–4) administers the instruction of reading strategies of "clarifying, identifying the main idea, summarizing, predicting" based on the design of instruction of "Reciprocal Teaching" (Palincsar & Brown, 1984). This emphasizes the phase of group discussion concerning participants' each question or difficulty in reading with peers and the teacher.

Following the idea of reciprocal teaching, Klingner and Vaughn (2000, p.73) administer the instruction of reading strategies of "Preview, Click and Clunk, Get the Gist, Wrap-up," allowing the students to use their L1 for the group discussion where the phase of "Click and Clunk" refers to clarifying the reader's difficulties and finding a solution. Salataci and Akyel (2002, p.5) also follow Cotterall's (1990) instruction design based on reciprocal teaching, and include the same phase of group discussion to instruct "(a) summarize and find the man ideas of in that paragraph, (b) predict what will come next, and (c) seek clarification of any comprehension difficulties". Fung et al. (2003) employ the same model of instruction for use in their design of a reciprocal teaching reading strategy for ESL students. They suggest that reader's use of L1 is essential for the effectiveness of instruction. (Fung. et al., 2003)

Later, using the same design of instruction of reading strategy, Finkbeiner et al. (2012) also include bottom-up model of instruction for reading strategy. Akkakoson (2013) also includes the same phase of instruction of reading strategies of generating questions, predicting, clarifying, summarization using applying group discussion for the instruction, following the design of instruction based on reciprocal teaching. Furthermore, Dabarera et al. (2014) include the same phase of instruction based on reciprocal teaching to instruct 30 metacognitive strategies.

Certainly, there are other studies that do not use the concept of the bottom-up model (which is based on the top-down model). Barnett (1988) administers instruction of 17 reading strategies including both bottom–up and top－down types, while Carell et al. (1989) administer the instruction of the semantic mapping and experience-text-relationship method for ESL reading. Kern (1989, pp.137–138) reports the result of the instruction of reading strategies as "Word Analysis, Sentence Analysis, Discourse Analysis, Questioning Strategies and Reading for Specific Purposes".

Raymond (1993, p.61) administers the instruction of reading strategy of "Top Level Structures (TLS): description, collection, causation, problem solution, and comparison." Kitajima (1997) reports the result of referential strategy training. Auerbach and Paxton (1997, pp.240–241) apply instruction to lead participants to "research their own reading as part of the pedagogical process ... apply what they discovered to their reading." As an interesting design of instruction, Janzen and Stroller (1998, p.256) administer the instruction following the idea of strategy instruction by "Cognitive Academic Language Leaning Approach" (O'Malley & Chamot, 1990) to instruct ten reading strategies ("1. Identifying a purpose for reading, 2. Previewing, 3. Predicting, 4. Asking questions, 5. Checking predictions and finding an answer to a question, 6. Connecting text to background knowledge, 7. Summarizing, 8. Connecting one part of the text to another, 9. Paying attention to text structure, 10. Rereading"). Janzen (2003, p.30) also reports the result of the instruction of reading strategies of "predicting, previewing, asking questions, identifying a purpose for a reading, and thinking about what the reader already knows."

Dreyer and Nel (2003) include computer software to instruct personally required reading strategies for each participant. For Japanese learners of English, Ikeda and Takeuchi (2003, p.51) instruct the seven reading strategies ("Parse the sentences into phrasal groups, Guess unfamiliar words from context, Identify the topic sentence in each paragraph to understand the outline of a passage, Use the key words in a title and attached questions to understand the outline of a passage, Use visual aids to understand

the outline of a passage, Use discourse markers to comprehend a passage more, Summarize each paragraph after reading"). Aghaie and Zhang (2012, p.1066) administer instruction of eleven "Cognitive reading strategies" and nine "Meta reading strategies". Schwartz et al. (2013, p.6) apply instruction of "text structure reading strategy", and Manoli, Papadopoulou and Metallidou (2016, pp.56–57) administer the instruction for reading strategies of "predicting text content, using semantic mapping before text reading, getting the gist (skimming), identifying specific information (scanning), and guessing the meaning of unfamiliar words from context."

Following this review, the present research reconfirms the definition of reading strategy. Strategy is conscious and controlled process for solving difficulties and questions in reading, and acknowledges that there is reasonable relationship between this definition and the model of instruction, including the concept of the bottom–up model, which includes the phase of engaging groups of readers in discussion about the difficulties faced by and questions of each reader while reading the passage, to encourage the use of L2 reading strategies.

Hence, this research focuses on the effectiveness of the bottom-up model of instruction, which has rarely been applied to learners of English in Japan. Using the top–down model, some researchers have reported a positive effect for the effectiveness of the instruction of reading strategy for Japanese learners of English, whereas other researchers report no significant effect (e.g. Kimura, et al., 1993; Kimura, 1999). This research aims to grasp the effectiveness of instruction of EFL reading strategy from the viewpoint of bottom–up model of instruction for Japanese learners of English.

In addition, as the method of research, structural equation model is selected to clarify the cause-and-effect relationships among the instruction, use of reading strategy and reading test, which can be another new aspect in this research area. Therefore, in this study, following two research questions are set.

RQ1: Does the instruction based on the group discussion of readers concerning questions while reading passage give any effect to the use of reading strategy by Japanese learners of English?

RQ2: When the instruction proposed in RQ1 is administered, can any effect for the score of reading comprehension be found by structural equation model?

Method

To answer the two research questions of this study, research design including participants, materials, procedure, and research instruments, is presented in this section.

Participants

Participants are 73 university students from 2nd to 4th year students in a private university of Aichi prefecture, and include 70 males and 3 female students. Their majors are mechanical systems engineering, electronic robot engineering, and media informatics. Thus, participants' majors are within scientific areas. They have experience of English learning in junior and senior high school and no participants has lived in an English-speaking country more than 6 months.

Participants' English proficiency is presented based on the Computerized Assessment System of English Communication (Casec, https://casec.evidus.com/). At the beginning of the research, participants' average score was 376.7 (Full score is 1,000). From the formal data by Casec, a score range of 350–400 is equivalent to 275–315 of the TOEIC® test and to A2 level of CEFR (Common European Framework of Reference for Languages). Hence, it is possible to say participants' English proficiency was at the rudimentary level.

They were divided into 3 classes not by the English proficiency level. Dividing classes based on English proficiency was impossible, because their time schedule for other lessons involving their major was quite tight. They took an English reading lesson once a week for 90 minutes, 15 times in a term. Reading passages in the textbook were related to basic mathematics and physics (mentioned in the next subsection). The study started from April 15 and ended on August 2, 2022. The researcher obtained the written consent of all participants and it was formally approved by the ethical review board of the university.

Reading Tasks

In the reading class, a textbook named *Fundamental Science in English I* (Kameyama, T & Aoyama, A. (eds.) 2017) was used. The explanation was written in bilingual form (i.e. Japanese and English). It included one expository English passage for each topic, and was about basic mathematics and physics, considering the participants' major. Specific topics were as follows; "addition, subtraction, division, multiplication, polygon, area, circle, space figure, volume, electric charge, electric circuit, conductors and insulators, Ohm's law, coordinates, graphs and linear function." The

average length of each passage was about 130 words. Based on the Flesch Kincaid grade level, the average readability was 7.3 (from Word 2019 version).

In addition, grammatical explanation and questions were attached for each unit. The contents were as follows; "noun (countable and uncountable), to infinitive, present and past participles, relative pronoun, expression of fraction, present perfect, causative verb, indefinite pronoun, relative adverb, passive voice."

Procedure

Specific procedure of reading lesson is as follows:

(1) Preparation is done by the participant (reading one unit of textbook for each lesson in advance) During this preparation, participants are required to summarize questions/difficulties in each feedback sheet.

→ In the Lesson …

(2) Group Discussion by 4~5 members to clarify questions and difficulties by each participant (Use of L1 is allowed)

(3) The teacher walks around each group and picks up unsolved questions

(4) The teacher gives an explanation to unsolved questions to the whole class

(phases of (2)(3)(4) are based on the bottom–up model of instruction.)

(5) Participants read English passage loud to check whether they can read smoothly.

(6) Participants self-reflect on each question (written in the phase (1)) by providing comments on the feedback sheet about whether those questions have been answered. Participants' feedback sheets are submitted to teacher at the end of the lesson.

Feedback sheets are returned to participants by teacher to let them review and remember the content of the question and problem solving by each participant. Comments are written on the returned feedback sheet by teacher.

Then, the teacher manages reflection or review of the previous lesson at the beginning of the next lesson. In particular, if unanswered questions are left on the feedback sheet, they are clarified by the teacher in the next lesson using the screen and print sheet delivered to each participant.

Research Instruments

In this research, two research instruments are utilized, namely, the questionnaire and reading test. They are as follows.

Questionnaire with Multiple Questions.

This research used a questionnaire designed for reading strategies for a foreign language presented by Carell (1989), which is composed of five multiple-choice subscales.

There are 35 subscales in this questionnaire. They are divided by five small titles. (see Appendix A for more detailed content of each subscale);

(1) When reading silently in English (6 subscales)

(2) When reading silently in English, if I don't understand something (5 subscales)

(3) When reading silently in English, the things I do to read effectively are to focus on (9 subscales)

(4) When reading silently in English, things that make the reading difficult are (8 subscales)

(5) The best reader I know in English is a good reader because of his/her ability to (6 subscales)

The original section of (5) ('The best reader…") has seven subscales. However, the subscale of "grasp the organization of the text" was excluded because of the similarity to another subscale of "understand the overall meaning of a text" (Carell, 1989).

This questionnaire was selected because it was introduced to Japan and translated into Japanese by a reading research group (Institute for Research in Language and Culture in Tsuda University, 1993) and has already been applied to research for Japanese learners of English, with being modified. (e.g. Isaji, 2003)

In the questionnaire, the present study newly added the following four subscales to the section of "(2): When reading silently in English, if I don't understand something", based on the aims of this research. Overall, 39 subscales in the questionnaire were applied in this research. Newly added subscales are as follows;

Q 12. When reading English passage and if I don't understand something, I verbalize that part in Japanese.

Q 13. When reading English passage and if I don't understand something, I ask questions and discuss with peers in Japanese.

Q 14. When reading English passage and if I don't understand something, I ask questions and discuss with teacher in Japanese.

Q 15. I review and remember the part of question and answer about what I don't understand.

To design these newly added subscales, the aspect of the instruction based on forming groups of readers to discuss questions while reading the passage was deliberately considered.

Evaluating Scores.

In addition to questionnaire, a passage (*Finding Their Way,* see the Appendix B for details) was selected from EIKEN pre-2 grade level (managed on October 10th in 2021) to confirm the English reading comprehension level of participants.

The passage is selected because the story is about the use of map navigation and how to deal with technological trouble. Hence, it includes a scientific perspective, taking account the aim of the reading class based on students' majors. The passage consists of 161 words with Flesch and Kincaid readability of 5.2. To determine the participants' reading comprehension level, this reading test is slightly more difficult than passages in the textbook.

The following question types are set for the passage: (1) two fill-in-the-blank questions (each worth 1 point) and two vocabulary questions (each worth 1 point); (2) One translation question (into Japanese) (meaning of conjunctive: 2 points, meaning of the first sentence: 1 point, meaning of the second sentence: two points); (3) One question for understanding content (1. aim of travel: 4 points, 2. explanation of process: 3 points); (4) one question for the double meaning of the title (the double meaning of the "way" (i.e. the meaning of real route and the method to tackle the problem): 2 points for each meaning) are set.

In sum, the total marks comprise 20 points.

Results

As outcomes of the study, the result of the reading test and the questionnaire analysis are presented in this section.

The reading test is applied at the 1st lesson and the final lesson (15th), as the pre- and post-test to confirm the improvement of participants' English reading comprehension level. Each test takes about 20 minutes to be finished. However, if all students finished earlier, the duration could be shortened,

The average score of the pre-test is 13.48, and the average score of the post-test is 17.22. The analysis of t-test shows that $t = 7.9$, $p < .01$, Cohen's $d = 0.98$, which means the result can be interpreted as the improvement with significance.

The questionnaire survey was administered in the 15th lesson, after the post-test was finished. For the analysis of the questionnaire, JASP (ver.0.11.1) is used. To begin the exploratory factor analysis, the alpha coefficient is confirmed for 39 subscales and the result is 0.87. Considering that there is correlation among the factors, oblique rotation (promax rotation) is selected. The maximum likelihood method is used for the

factor analysis. Factor loading is set as 0.4. Based on the result of exploratory factor analysis, five factors are recognized. The result of the exploratory factor analysis is presented in Table 1.

Table 1

Result of Exploratory Factor Analysis.

	1	2	3	4	5
F1 (α = 0.85) Ideal Reader based on Vocabulary Learning					
10 (When reading silently in English, if I don't understand something,) I look up unknown words in a dictionary.	.79				
33 (The best reader I know in English is a good reader because of his/her ability to) recognize words	.77				
22 (When reading silently in English, the things I do to read effectively are to focus on) looking up words in the dictionary.	.71				
37 (The best reader I know in English is a good reader because of his/her ability to) guess at word meanings.	.60				
35 (The best reader I know in English is a good reader because of his/her ability to) understand the overall meaning of a text.	.59				
38 (The best reader I know in English is a good reader because of his/her ability to) integrate the information in the text with what he/she already knows.	.58				
36 (The best reader I know in English is a good reader because of his/her ability to) use a dictionary.	.56				
39 (The best reader I know in English is a good reader because of his/her ability to) focus on the details of the content.	.41				
F2 (α = 0.82) Top Down Reading Strategy based on Background Knowledge					
5 (When reading silently in English) I am able to use my prior knowledge and experience to understand the content of the text I am reading.		.79			
21 (When reading silently in English, the things I do to read effectively are to focus on) relating the text to what I already know about the topic.		.67			
8 (When reading silently in English, if I don't understand something,) I reread the problematic part.		.66			
3 (When reading silently in English) I am able to relate information which comes next in the text to previous information in the text.		.63			
2 (When reading silently in English) I am able to recognize the difference between main points and supporting details.		.50			
4 (When reading silently in English) I am able to question the significance or truthfulness of what the author says.		.46			
7 (When reading silently in English, if I don't understand something) I keep on reading and hope for clarification further on.		.45			
F3 (α = 0.73) Interactive Reading Strategy between Bottom-up and Top-down					
20 (When reading silently in English, the things I do to read effectively are to focus on) the grammatical structures.			.89		
24 (When reading silently in English, the things I do to read effectively are to focus on) the organization of the text.			.62		
23 (When reading silently in English, the things I do to read effectively are to focus on) the details of the content.			.54		
19 (When reading silently in English, the things I do to read effectively are to focus on) being able to pronounce each whole word.			.52		
F4 (α = 0.77) Reading Difficulties					
32 (When reading silently in English, things that make the reading difficult are) the organization of the text.				.87	
28 (When reading silently in English, things that make the reading difficult are) the grammatical structures.				.69	
31 (When reading silently in English, things that make the reading difficult are) getting the overall meaning of the text.				.69	

F5 (α = 0.77) Strategy of Solving Difficulties of English Reading by Collaborative Discussion	
14 When reading English passage and if I don't understand something, I ask questions and discuss with teacher in Japanese.	.79
15 I review and remember the part of question and answer about what I don't understand.	.65
13 When reading English passage and if I don't understand something, I ask questions and discuss with peers in Japanese.	.59

Each factor is named following the content of the subscales. In particular, newly added subscales appear as the factor 5. Based on the result of exploratory factor analysis, correlation among five factors and the post-test score are presented in Table 2.

Table 2

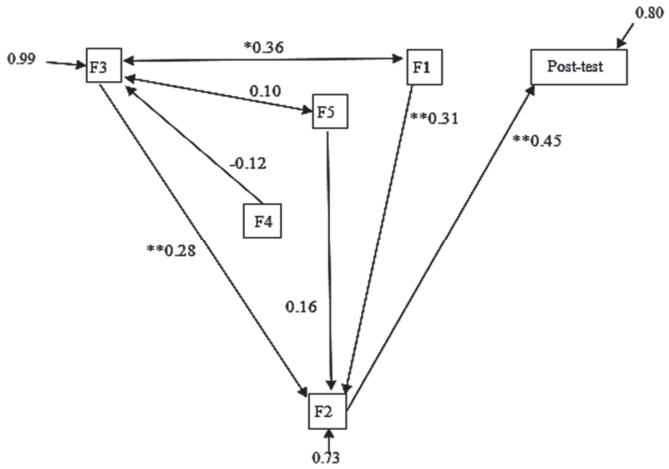
Correlation among Five Factors and Post-test Score

		Post-test	F1	F2	F3	F4
F1	Pearson's r	0.19	—			
	p value	0.11	—			
F2	Pearson's r	0.45	0.42	—		
	p value	< .001	< .001	—		
F3	Pearson's r	0.17	0.35	0.41	—	
	p value	0.15	0.002	< .001	—	
F4	Pearson's r	0.05	0.11	-0.02	-0.08	—
	p value	0.69	0.35	0.84	0.49	—
F5	Pearson's r	0.03	0.08	0.22	0.14	-0.05
	p value	0.82	0.5	0.06	0.25	0.68

From the results of correlation among the five factors and the score of the post-test, structural equation model (path analysis) is conducted by the hypothesis as follows: (1) Factor 2 gives positive effect to the score of the Post-test. (2) Factor 1 gives positive effect to the factor 2. (3) Factor 3 also gives positive effect to the factor 2. (4) Factor 4, which means the reading difficulty, gives negative effect to the factor 3. (5) Factor 5 indirectly gives positive effect to the factor 2 and positive correlation with the factor 3. For the actual analysis, R (ver. 4.0.5) is used. The results are presented in Figure 1.

Figure 1

Path Analysis among Five Factors and Post-test Score



Note. ＊: p < .05, ＊＊: p < .01

For the result of the structural equation model, fit indices must be confirmed. They are as follows; χ^2 = 2.48, df = 8, p value = 0.96, GFI = 0.98, AGFI = 0.97, RMSEA = 0. This process includes the sample size, which is 73 in this survey. From the result of these fit indices, it is possible to interpret that this model is appropriate one.

Discussion and Limitation of this Research

Based on the result of analysis, this section discusses each research question.

RQ1: Does the instruction based on the group discussion of readers concerning questions while reading passage give any effect to the use of reading strategy by Japanese learners of English?

For the RQ1, the result of exploratory factor analysis identifies factor 5, which can be interpreted as the strategy of solving difficulties of English reading by collaborative discussion. This factor has enough factor loading and a sufficient approval alpha coefficient of 0.77.

Among newly added subscales (Q12, Q13, Q14, Q15) a subscale of Q12 (When reading English passage and if I don't understand something, I verbalize that part in Japanese.) is not found to have enough factor loading. This could be because “verbalize”

may be misinterpreted as monologue by the reader, instead of discussion with peers or teacher.

The result of exploratory factor analysis in this research suggests that the strategy of problem solving while reading English passage through discussion with peers or the teacher is recognized or used by participants in EFL situation in Japan.

RQ2: When the instruction proposed in RQ1 is administered, can any effect for the score of reading comprehension be found by structural equation model?

For RQ2, factor 2 (top-down reading strategy based on background knowledge) gives significant effect ($p < .01$) on the post-test score. Factor 1 (ideal reader based on vocabulary learning) has a significant effect ($p < .01$) on factor 2. Factor 3 (interactive reading strategy between bottom-up and top-down) also has a significant ($p < .01$) effect on factor 2. Factor 5 (strategy of solving difficulties of English reading by collaborative discussion) has an indirect effect to factor 2 and is positively correlated with factor 3 to some extent without significance.

From these relationships, it can be interpreted that participants reading the English passage activate a top-down type of reading based on background knowledge, which can have a direct effect for the comprehension. However, their reading comprehension must be supported by their proficiency, including vocabulary learning. To utilize these reading strategies more efficiently, problem solving based on collaborative discussion with peers and teacher can support participants' reading comprehension.

Considering these causative relationships, as the reading model such as the CI model (Kintsch, 1998) suggests, background knowledge accumulated in the long-term memory is an essential part and has a direct effect for reading comprehension. Moreover, for that background knowledge to have positive effect, vocabulary learning is required, including the use of dictionary, and the whole logic of the passage has to be understood. Furthermore, to promote those reading aspects, discussion with peers and teacher concerning difficulties and questions can have a positive effect.

This study has the following limitations. The first one involves the small sample size for the structural equation model as a research design. While the ideal sample size for the structural equation model is still under discussion, based on a function of R (findRMSEAsamplesize) the ideal sample size of SEM for the result of this research is

proposed as 189. However, the sample size of this study is 73. Thus, a larger sample size is required for the future research using structural equation model.

Second, the effects of factor 5 (strategy of solving difficulties of English reading by collaborative discussion) on other factors do not have significance. Looking at the result of exploratory factor analysis, the strategy for problem solving by collaborative discussion during EFL reading is consciously used by participants. This suugests that further adjustment, such as the selection of textbook or way of grouping is necessary for the future research. Moreover, 15 times of lesson might not be enough to confirm the effectiveness of the bottom-up model of instruction administered in this research.

Concerning the research design, previous research has overwhelmingly applied the research design dividing participants into experimental group and control group. Whereas this research design has the advantage of highlighting the effectiveness of a given approach of instruction (or not), an ethical problem arises from the pedagogical perspective. Therefore, replacing the combination of group and instruction design is often employed to guarantee fairness of education. However, the author is not in the position to manipulate the class settings and as already mentioned, 15 times of lesson might not be enough to change the class setting of group and instruction design. This is another reason that the structural equation model is selected for this research. This again raises the limitations of using structural equation model.

Conclusion

This study concluded that instruction of reading strategy based on problem solving by collaborative discussion has certain effects on the use of reading strategy and has an indirect effect on reading comprehension. Hence, allowing students to form groups and discuss the difficulties and questions in reading a passage (EFL situation) using L1, with the guidance of a teacher can be a positive approach especially for the students of low English proficiency level (like participant in this research).

For the future research, to address the limitations of this study, a larger sample size is required and adjustments are also required for the instruction. In addition, future studies should analyze specific difficulties and questions that participants discuss and the processes of how those difficulties and questions are solved. Concerning this point, Cain and Oakhill propose classification of difficulties of reading in L1, as “word-, sentence- and discourse-level” (Cain & Oakhill, 2004, p.314). These concepts can be applied to the difficulties of reading in second or foreign language and the process of the specific problem solving by readers can be analyzed not only quantitative data but

qualitative data (e.g. reader's interview or think aloud data). Such research can shed light on the improvement of reading comprehension instruction under EFL/ESL situation.

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Appendices

Appendix A: The Overall Result of Questionnaire

When reading silently in English	mean	Std. Deviation
1. I am able to anticipate what will come next in the text	3.08	0.91
2. When reading silently in English, I am able to recognize the difference between main points and supporting details.	3.53	0.93
3. When reading silently in English, I am able to relate information which comes next in the text to previous information in the text	3.48	0.85
4. When reading silently in English, I am able to question the significance or truthfulness of what the author says.	3.10	0.90
5. When reading silently in English, I am able to use my prior knowledge and experience to understand the content of the text I am reading.	3.82	0.92
6. When reading silently in English, I have a good sense of when I understand something and when I do not.	3.63	0.90
When reading silently in English, if I don't understand something,		
7. I keep on reading and hope for clarification further on.	4.03	0.88
8. I reread the problematic part.	4.01	0.83
9. I go back to a point before the problematic part and reread from there.	3.92	1.05
10. I look up unknown words in a dictionary.	4.16	0.91
11. I give up and stop reading.	2.30	0.89
12. When reading English passage and if I don't understand something, I verbalize that part in Japanese.	2.81	1.15
13. When reading English passage and if I don't understand something, I ask questions and discuss with peers in Japanese.	2.80	1.20
14. When reading English passage and if I don't understand something, I ask questions and discuss with teacher in Japanese.	2.85	1.15

15. I review and remember the part of question and answer about what I don't understand.	2.96	1.03
When reading silently in English, the things I do to read effectively are to focus on		
16. mentally sounding out parts of the words.	3.56	1.04
17. understanding the meaning of each word.	3.93	0.77
18. getting the overall meaning of the text.	4.04	0.86
19. being able to pronounce each whole word.	2.95	1.00
20. the grammatical structures.	3.38	0.94
21. relating the text to what I already know about the topic.	3.63	0.92
22. looking up words in the dictionary.	3.86	1.02
23. the details of the content.	3.36	0.95
24. the organization of the text.	3.48	0.80
When reading silently in English, things that make the reading difficult are		
25. the sounds of the individual words.	3.01	1.20
26. pronunciation of the words.	3.22	1.26
27. recognizing the words.	3.32	1.07
28. the grammatical structures.	3.51	1.06
29. the alphabet.	1.92	0.95
30. relating the text to what I already know about the topic.	2.80	1.08
31. getting the overall meaning of the text.	3.37	1.02
32. the organization of the text.	3.27	0.98
The best reader I know in English is a good reader because of his/her ability to		
33. recognize words	4.26	0.94
34. sound out words.	3.84	1.07
35. understand the overall meaning of a text.	4.12	0.94
36. use a dictionary.	3.52	1.08
37. guess at word meanings.	4.08	0.94
38. integrate the information in the text with what he/she already knows.	3.99	0.98
39. focus on the details of the content.	4.01	0.89

Note: Concerning the English proficiency of participants, sentence in each subscale is presented using L1 (Japanese).

Appendix B: The Reading Test used in the Research

Finding Their Way

Yesterday, Jenny and her sister, Sophie, went by car to visit their cousin Ben in the countryside. They were looking forward to meeting him because they had not seen him for a long time. While Jenny drove, Sophie used the maps application on her smartphone to find the way to his house. She had never done this before, so she was a little nervous at first. However, the maps application (1). It told her the easiest route and where Jenny needed to turn. However, just before they reached Ben's town, Sophie's smartphone's battery died. She did not have a charger so she could not use her smartphone. Jenny stopped the car at a convenience store. Luckily, she had written (2) on a piece of paper. She called Ben from a public telephone outside the convenience store and told him what happened. He soon came to the convenience store to meet them. They were very glad to see him.

Q Put a circle on an appropriate alternative for each bracket ((1) and (2))

(1)

1 was easy to make　　2 was very helpful

3 cost a lot of money　　4 stopped working

(2)
1 Ben's phone number　　2 the name of Ben's town
3 her home address　　4 what she needed to buy

Q Write the meaning for each double underlined English expression in Japanese.
maps application →　　charger →

Q Write the meaning of the underlined sentence in Japanese.

Q Jenny and Sophie are driving a car. Explain ①the purpose and ②the process to achieve that aim.(Concerning ②, include the information about smartphone.)
① aim
② the processes to achieve that aim

Q the title “Finding their way” has double meaning. Explain each meaning (first and second).
(1)First meaning
(2) Second meaning

Note: Concerning the English proficiency of participants, each question is presented using L1 (Japanese).