Feature Article

The Effects of Metacognition on Reading Comprehension Tests in an Intermediate Reading and Writing Course

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Reading comprehension skills are paramount to the future success of Japanese students. Contextual clues and key word strategies help students take tests such as the TOEIC and EIKEN, as well as develop critical thinking skills for use in their lives. The introduction of reading comprehension strategies, in and of itself, helps students improve their scores, but the question if students are fully utilizing these skills during a reading comprehension test still remains. To determine whether students are better off with a "directed implementation" versus a "non-directed implementation" of these skills is examined with sixty-four university students of predominately Japanese ethnicity. The data clearly shows that students who are involved in a metacognitive process while utilizing these skills score higher on a reading comprehension test versus students that do not. These results suggest that having students actively utilize these skills, and showing examples of their metacognitive processes, positively influences test outcome.

英文読解力を高める事は日本の学生が、将来成功するために最も大切である。文脈のヒントやキーワードを見極める力は、TOEICや英検といったテストにおいて学生を助ける学習だけでなく、実生活において批判的思考力を伸ばすのに大いに役立つ。また、テストの点数を上げるためには、それらの批判的思考力をふまえた英語読解能力が必要である。しかしながら、学生のテストの点数が、手段の導入の有無によってより有効かどうかを見極める必要がある。本研究結果より、英文読解テストでメタ認知的アプローチをとった学生は、アプローチを行わなかった学生と比べ、明らかに高い点数を記録したことが判明した。よって、これらのメタ認知的英文読解プロセスを多く活用した方がテスト結果に良い影響があることが分かった。

The landscape of learning English in Japan puts a great deal of weight on the value of being able to score well on tests like the Test of English for International Communication (TOEIC) and other, similar, standardized testing systems. All of these tests have many types of assessments, but one common style of evaluation among them is reading comprehension sections. These sections often represent a substantial amount of the point total. One role of an educator, teaching reading and writing in Japan, is to give students skills that will enable them to successfully navigate these types of reading comprehension tests. Skills that help students perform better on standardized tests are also applicable to other situations that may arise in their future.

Background

Reading Strategies and Their Place in Japan

David Moore (2012) identifies seven reading comprehension strategies that effective educators encourage in their students. The seven strategies stated are planning and monitoring, determining importance, asking questions, making inferences, making connections, synthesizing, and visualizing. These strategies help students to improve their mastery of the reading process and afford gains in reading comprehension and vocabulary acquisition (Short & Fitzsimmons, 2007).

It is widely agreed that expert reading is an interaction of four main areas: the reader, the text, the fluency of the reading, and the strategic aptitude of the reader (Nuttal, 1996; Anderson, 1999, 2002; Rasinski, 2010). One major necessity of reading comprehension is the realization that successful comprehension of reading does not occur without concerted effort on the reader's part (Weinstein & Mayer, 1985; Weinstein & Underwood, 1985; Adams & Hamm, 1994; Gettinger & Seibert, 2002; Baker, 2008). Furthermore, students must invoke the strategies or risk losing the benefits of the strategies taught to them (Alexander & Jetton, 2000). This implies that simply teaching students the strategies to employ when reading is not enough. Students must be made to employ strategies in a clear and accountable way. One way to do this is to have the students show their thought processes on the test paper. This practice is akin to a math teacher

who would require students to show their work on a math problem in order to assist the formulas and algorithms becoming cemented in the student's working memory (Schoenfeld, 1992). Requiring English students to show their work seems to be a logical extension of this teaching method.

In Japan, the Test of English for International Communication (TOEIC) is one of the most popular exams for the evaluation of English communication ability (Childs, 1995). The TOEIC tests English ability in grammar, reading, and listening. Many Japanese companies use the TOEIC as a gauge for linguistic competence for their employees—requiring their score either during the company hiring process, or during their employment at a company for purposes of procuring a position with the company overseas (Chapman, 2003; Powers, Kim, & Weng, 2008). In addition to English reading skills being important to finding employment, they are also essential for Japanese employees who deal with correspondence from other countries. Higher TOEIC test scores can influence both the employability and future opportunities of students, as higher scores can translate into better jobs and, according to a student of the author, in some companies, bonuses for scoring over a certain threshold. All of these factors have the possibility of influencing pedagogy in the language learning classroom that employs reading comprehension.

Within the TOEIC, there are three reading sections—incomplete sentences, reading comprehension passages, and double reading questions—which require answering questions about email correspondence (http://www.toeic.or.jp).With much of the TOEIC focused on reading comprehension, reading comprehension skills could prove useful for students.

This need for reading comprehension skills, and the fact that the private university at which this author teaches utilizes a TOEIC-style unified reading comprehension test for both first- and second-year students, led to the action research described in this paper. Would skills and strategies be enough to help students improve their reading comprehension scores, and would the students need assistance in their metacognitive processes to fully utilize the strategies introduced in class?

Metacognition in Education

Metacognition, or "thinking about thinking" (Alexander & Jetton, 2000), includes actively knowing about when, where, and how to implement strategies for learning or problem solving, as well as engaging in the use of said strategies. The "thinking about thinking" definition of metacognition is something of a gross oversimplification. Metacognition can be thought of as two overlapping areas in this regard: metacognitive knowledge and metacognitive processes (Dunlosky & Metcalf, 2009; Jacobs & Paris, 1987; Nelson & Narens, 1990; Schwartz & Bacon, 2008). Metacognitive knowledge can be broken down into three aspects (Jacobs & Paris, 1987). The declarative aspect is what students know about their ability to learn. The procedural aspect is what the students know about how to implement strategies. The conditional aspect regulates the when and where strategies are used. Metacognitive processes can be broken down into monitoring and control (Nelson & Narens, 1990). The metacognitive process of monitoring is represented by a student understanding where they are in a task or learning situation and judging if the task is able to be completed. The metacognitive process of control is in charge of making choices as to which strategy to implement and when to terminate a task if it is deemed, by the monitoring process, as unable to be completed.

These five factors are all in play in a student's brain at the same time (Carroll, 2008) and are relevant to the student's educational life. This action research set out to determine if requiring students to perform metacognitive processes and utilizing metacognitive knowledge during a test would result in better reading comprehension scores. Since students need to consciously employ strategies in order for them to be effective (Alexander & Jetton, 2000), metacognition on the reading comprehension strategies taught before a test is required during the taking of a test. While there have been studies on reading comprehension skills and metacognition (Carrell, Pharis, & Liberto, 1989; Cubukcu, 2008; Takallou, 2011;Tregaskes & Daines, 1989), none of them, save for Cubukcu (2008) in a different manner, have required proof of a student's metacognitive processes on a reading comprehension test.

While there are studies that suggest metacognition has a positive effect on

reading comprehension (Cubukcu, 2008; Takallou, 2011;Tregaskes & Daines, 1989), further studies needed to be conducted to gauge if explicit teaching of metacognitive strategies influences the use of reading comprehension strategies. The underlying hypothesis of this paper is that students who are required to show proof of their metacognitive processes, during the employment of reading comprehension strategies will achieve higher test scores than students who are not required to show their processes.

This study compared the reading comprehension test scores of students who were required to show their metacognitive processes and those who were not on a reading comprehension test. For the purposes of this study, metacognitive processes refer to participants consciously thinking about the implementation of the previously introduced reading strategies during a reading comprehension test. The current pilot study was conducted in order to find an answer to the following question regarding the effect of students illustrating their metacognitive processes on a reading comprehension test.

1. Is there any significant difference in reading comprehension test scores between learners who are required to engage in metacognition by showing their reading comprehension strategies and those who are not?

Methodology

Subjects

The participants in this pilot study consisted of 64 college students split between a control group (n = 31) and a test group (n = 33) including 62 Japanese students, one Chinese student, and one Korean student. All students were sophomores at a private university in Japan, enrolled in the required Reading and Writing Two (RW2) classes which had been streamed into the high-beginner to low-intermediate levels of English as defined by the Common European Framework of Reference for Languages (CFER). Each participant was a member of either the science or engineering department, and all participants had completed six weeks of reading comprehension strategy instruction focusing on contextual clues to find meaning, key word identification, making connections, and synthesizing information from multiple areas of a reading passage on intermediate (CEFR

A2 and B1 level) reading comprehension activities. The reading subjects that the students were exposed to ranged from humorous stories and work emails to general science topics and mechanical engineering. Each group attended class for 90 minutes twice a week, where they studied both reading comprehension and process writing methods. Reading comprehension strategy instruction occurred during one of their two classes a week, for the six-week period. As a result of reading comprehension strategy instruction, all students were familiar with the reading strategies prior to the taking of the test. The control group originally consisted of 33 members, but two participants did not take the reading comprehension test, so the null scores were dropped for this pilot study.

Instructional Background

Of the seven reading comprehension strategies given by Moore (2012), this study focuses on three—planning and monitoring, making connections, and synthesizing—which were explicitly taught to the students in both the control and test groups. These three were chosen so as to give the students a broad range of skills in a short amount of time that can assist in this aspect of a test like the TOEIC. The planning and monitoring strategy was chosen to give students a skill to manage time during the test. Making connections and synthesizing strategy was added to give students higher order thinking skills to assist in choosing correct answers. Making connections as a reading comprehension skill is very similar to the metacognitive strategy Cucukcu (2008) examined, i.e., searching according to goals.

In both the control and test groups, reading comprehension test scores at the start of the course were lower than expected. The control and test group both scored an average of just over ten out of twenty-five points on their first reading comprehension test, where the hope was that they would have an average score that was in the passing range. This prompted the author to introduce reading comprehension strategies into the classes to help bring students' skills up. From week four of the course, all participants were instructed in a variety of reading comprehension strategies including, but not limited to the following: developing a plan to read, identifying key words, identifying meaning from

context, making connections between the questions and reading passage, and putting information from two or more locations in the text together to synthesis new information. Making connections inside reading passages as well as between the test questions and the reading passage is a skill that students can make use of in their future professional lives. Similarly, being able to synthesize information from multiple sections of a reading is an invaluable skill that translates beyond the classroom into the students' possible future employment areas. Planning and monitoring was chosen to give students the ability to look at a text critically and immediately start breaking down the questions and text to make sense of the information presented.

Both groups were instructed on showing their metacognitive processes by either drawing lines between the questions and reading passage or labeling the area where the student felt the answer was with the numeral of the question number. Since all of the participants were members of either the science or engineering department, a small number of the reading exercises focused on different aspects of science and engineering.

Reading Comprehension Test

The test of reading comprehension was taken from a reading comprehension practice from the department of philosophy in the University of Venezia (Gebhardt, 2012). This test was chosen for two primary reasons: one, it is freely available and two, it contains reading passages of various topics and a variety of question types. The test consisted of four reading passages of 100 to 150 words each. The content of the four tests ranged widely with topics such as movies and medicine. While the test was not designed for science and engineering students, it did in a limited sense cover one science topic about medicine. The first three reading passages were paired with five multiple-choice reading comprehension questions each, and a fourth reading of 10 true/false questions. The maximum score on the test was 25 points, and the time given to each group to complete the test was 60 minutes. The students were not allowed to leave early if they finished the test within the 60-minute window. It should be noted that this test underwent no reliability testing and was used primarily for the two reasons stated

above. Future research should employ standardized reading comprehension tests that are more commonly recognized in the educational community.

Procedure

This study was conducted in week 10 of a 15-week course in a private Japanese university. The control group (n = 31) and test group (n = 33) were both given the same reading comprehension test. For the control group, the instruction was to take the test normally. For the test group, in addition to taking the test and checking their answers, they were required to show their thought processes by connecting key words in the questions to the area in the reading passage where they thought the answers were located. Out of four sets of reading comprehension and questions, participants in the test group were required to show their thought process on at least one. Students were not directed in how to show their thought processes, but were encouraged to draw lines to utilize the making connections strategy (Figure 1), as was practiced in the training sessions. Some participants in the test group only showed where they found the answers by indicating the point in the passage with a number that corresponded to the number of the question, but this did demonstrate that they were making connections between the questions and the locations of the answers in the text. All of the participants in this study were required to answer all the questions to avoid artificially lowering the group's mean score.

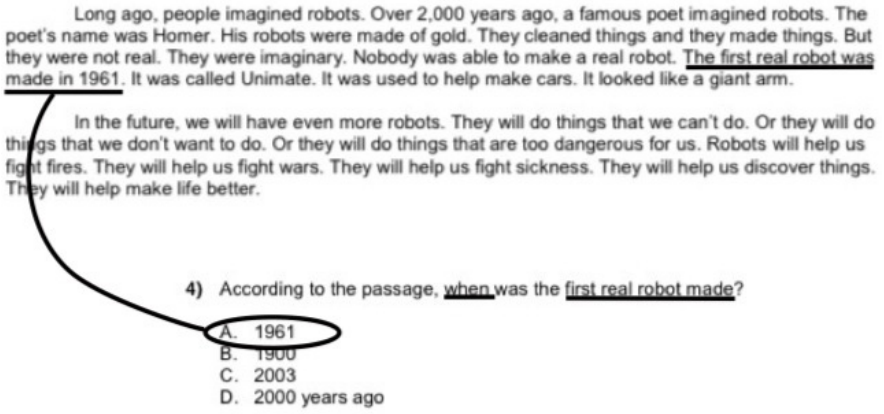

Figure 1. Example of drawing lines to utilize the making connections strategy.

Results

Data Analysis

An unpaired *t*-test was employed to analyze the two sets of test scores. A statistical representation of the analyzed data is given in Table 1. Table 1 comprises of data that addresses the question— *Is there any significant difference in reading comprehension test scores between learners who are required to engage in metacognition by showing their reading comprehension strategies and those who are not?*

As the data shows (Table 1), the test group displays a mean of 13.39 points with a standard deviation of 1.97, and the control group displays a mean of 11.48 points with a standard deviation of 1.86. This data suggests that the two groups differed significantly in their average and mean test scores ($t = 3.9855$; $p = 0.0002$).

Discussion

In previous reading quizzes, the difference between two groups' scores was not statistically significant ($t = 1.7059$; $p = .2301$) (Table 2), which is particularly

Table 1
Final Test Data Analysis

	Mean	SD	n
Control Group	11.48	1.86	31
Test Group	13.39	1.97	33

$p = 0.0002$ $d = 1.0$

Table 2
Control vs. Test Score Comparison

	Control Mean	Test Mean
Quiz 1	10.40	10.64
Quiz 2	11.04	11.10
Study Test	11.48	13.39

noteworthy when comparing them to the scores in this study. It bears noting that the students in the test group were only required to show their metacognitive processes on one of the four test items. Only one reading passage was required due to time restraints of the reading comprehension test. Future experiments could investigate the effect of requiring the students to show their metacognitive processes on every test item.

As the results indicate (Table 1), the required metacognitive processes while participants actively employing reading comprehension strategies resulted in better overall scores. The *t*-test value of 3.9855 and standard error of difference of 0.479 are very promising for future studies. The *p*-value of 0.0002 is also very exciting in that it shows a strong statistical significance, even with such a small sample size (n=64). The scores reflect the direct and positive influence of engaging in metacognitive processes during reading comprehension strategy implementation. In order to gauge the effect size of this study, a Cohen's *d* was determined (Table 1). The *d* value of 1.0 shows a very large effect size. The combination of the large effect size and the high statistical significance is exciting in that it suggests this study could easily be scaled up to larger numbers with similar results as those found in this action research.

The ability to increase the likelihood of finding correct answers on a reading comprehension test by requiring metacognitive activity during the test makes this study interesting. By requiring proof of reading strategies during the taking of the test, scores increased significantly. This also supports previous work on metacognition and education where a positive impact was observed when introducing metacognition to a class (Cubukcku, 2008). The hypothesis put forth is supported but will need future studies to replicate the findings. The correlation between showing the participants' strategy application on one part of a four-part test also begs the question of what would happen if they were required to show this implementation on all parts of a test. It is the belief of this author that the difference between the control group and test group would widen even further.

Pedagogical Implications

As the data suggests, having students show their work on a test resulted in better scores on reading comprehension tests. This pilot study suggests that requiring the students to actively participate in thinking about implementation of reading strategies, as well as showing proof of these thought processes, may be effective in helping to improve test scores. It is interesting to note that in subsequent lessons this author observed students in the test group continue to show their work, albeit at a reduced rate, after the study.

Metacognition has the potential to offer a wide range of benefits for students. One outcome an educator might expect would be better self-monitoring of learning behavior in students and ease of strategy implementation when needed on tests such as TOEIC. Metacognition also influences other learning skills and dispositions by aiding in planning, monitoring, and regulation of a student's cognitive processes which are relevant to both deductive and inductive thinking, as well as critical thinking (Dimmitt & McCormick, 2012; Pintrich, 2002). In regards to this author's students, metacognition can provide benefits past the classroom. Science and engineering fields require a great deal of critical thinking. Metacognition and the associated skills and dispositions not only help to pass a reading comprehension test, but those same cognitive processes will help them in their future endeavors. It has been shown in this action research that students can benefit from top-down instruction of skills and strategies, but it is perhaps more important that the students are expected to use metacognitive processes to fully utilize what they have learned.

Future Research

This study must be replicated using a larger pool of participants from a greater range of skills. This author hopes to include other teachers and classrooms in similar studies in the near future. Larger sample sizes and expanding the requirement of showing the implementation of strategies to the entire test should result in more definitive data that this style of metacognition has a positive impact on scores. Standardization of the reading comprehension test and using more sophisticated methods of data analysis would also benefit the collection

of data. As previously mentioned, students in the test group continued to show their work in later quizzes, which is another avenue of study that needs to be explored. The question of lasting benefits of any method is incredibly important for teachers and students alike. Further research into metacognition with other styles of cognitive processes, such as Cubukcu (2008) examined, would be interesting.

Conclusions

Ultimately, the best strategies for students are the ones that are actually employed when needed. Giving students every possible way to do better in their lives, be it on a TOEIC test or in their future jobs, is essential. By giving students the opportunity to engage in metacognitive processes of "thinking about their thinking" or actively thinking about what they know, teachers help them to build skills that will stay with them beyond the walls of the classroom.

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