21 Input Modification and Self-Questioning: Effect on Level 7 Students' Comprehension of Science Texts

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Abstract: To investigate the effects of simplification and elaboration as well as self-questioning active reading strategy on level 7 students' reading comprehension of science texts, a research investigation was conducted. Following a quasi-experimental research design, 120 level 7 students were assigned to 12 experimental groups, namely High Proficiency-Baseline-self questioning (HP-B-SQ), HP-Baseline-without self-questioning (HP-B), HP-Simplified-self-questioning (HP-S-SQ), HP-Simplified-without self-questioning (HP-S), HP-Elaborated-self-questioning (HP-E-SQ), HP-Elaborated- without self-questioning (HP), Low Proficiency-Baseline-self questioning (LP-B-S), LP-Baseline-without self-questioning (LP-B), LP-Simplified-self-questioning (LP-S-SQ), LP-Simplified-without self-questioning (LP-S), LP-Elaborated-self-questioning (LP-E-SQ), and LP- Elaborated-without self-questioning (LP-E). T-tests and analyses of variance conducted revealed that elaboration and self-questioning active reading strategy have significant positive main effects on high proficiency and low proficiency students' reading comprehension of science texts. However, the absence of significant interaction effect of input modification, self-questioning active reading strategy, and readers' reading proficiency level on the students' reading comprehension of science texts indicates that self-questioning active reading strategy has a positive main effect on students' comprehension regardless of readers' proficiency level and the type of text presented to the students. Hence, based on the data from this study, it is concluded that reader input would have more significant effect on readers' comprehension than text input.

Introduction

A considerable number of articles showing the positive relationship between reading comprehension and science learning have been published (Vacca & Vacca, 1996; Jacobson, 1998; Bowers, 2000; Carnine & Carnine, 2004; Roe, Stoodt-Hill & Burns, 2004). Yet, it is not clear whether such relationship between reading comprehension and science learning can be attributed to the nature of science texts or to the reading strategies that the students use as they read the science texts.

Because reading is a process that can be understood by looking at the interaction between the reader and the text as well as the interaction among the different component skills involved in the reading comprehension (Grabe, 1991), a better understanding of the relationship between reading comprehension and science learning necessitates the investigation of how text input and reader input affect the comprehension of science texts.

A review of literature on text input and reading comprehension reveals that there have been a number of studies conducted to investigate the effect of text modification in the form of simplification--denominalization, transformation of passive constructions to active ones, and replacement of difficult or low-frequency words with more common synonyms and elaboration--presenting synonyms and appositives vis-à-vis difficult or low-frequency words as well as adding clearer signaling of thematic structure in the form of examples and paraphrases on reading comprehension (Yano, Long & Ross, 1994; Tweissi, 1998; Yeung, 1999; Young, 1999; Urano, 2000; Donovan & Smolkin, 2001; Oh, 2001; Brantmeir, 2005; Li, Xu &

Wang, 2005; Hsu & Yang, 2007; Mayor, 2007; Khan, 2007). Interestingly, while the results of the said studies indicate that input modification generally results in better comprehension, whether elaboration is better than simplification or vice-versa remains a debatable issue. Moreover, it is worth noting that only a few studies investigated the effect of input modification on comprehension of science texts; thus, suggesting a need for more research on how input modification either by elaboration or by simplification could improve science text comprehension.

Correspondingly, there has been a substantial body of research on the effect of reader input in the form of using active reading strategies on reading comprehension; and it appears that the most studied strategy is self-questioning because this strategy is believed to be a necessary condition for readers to comprehend written texts (Wong, 1985; Parker & Hurry, 2007). In fact, according to Janssen, Braaksma & Couzijn (2009), a little less than a hundred research studies on self-questioning and reading comprehension have been conducted from 1965 to 2000. In self-questioning studies, participants were asked to generate their own questions about the given reading text before they were asked to answer the subsequent comprehension test. Results of the said studies generally indicate that self-questioning significantly results in better comprehension. Notably, despite the plethora of studies on self-questioning and reading comprehension, it seems that most studies involved narrative texts while only very few investigations dealt with expository science texts. Unfortunately, while some research data suggest that self-questioning significantly promotes comprehension of science texts (André and Anderson's ,1978-1979; King, 1992), other research data indicate that self-questioning does not significantly affect comprehension of science texts (Miciano, 2002). Apparently, there is a dearth of literature on self-questioning active reading strategy and comprehension of science texts.

Thus, in the light of these research gaps, this study on the effects of input modification in the form of elaboration and simplification as well as of self-questioning active reading strategy on the students' comprehension of science texts was conceptualized.

Specifically, this study was intended to answer the following questions:

1. Does input modification affect the students' comprehension of science texts?
   1.1. Is there a significant difference in the reading comprehension performance of the students who read modified science texts and those exposed to baseline science texts?
   1.2. Is there a significant difference in the reading comprehension performance of the students who read simplified science texts and those who read elaborated science texts?
2. Is there a significant difference in the reading comprehension performance of the students engaged in self-questioning reading strategy and those who were not?
3. Is there a significant interaction effect between self-questioning reading strategy and input modification?
4. Is there a significant interaction effect of students' level of reading proficiency, the type of input modification, and the use of active reading strategy on the students' reading comprehension?

Method

Research Design

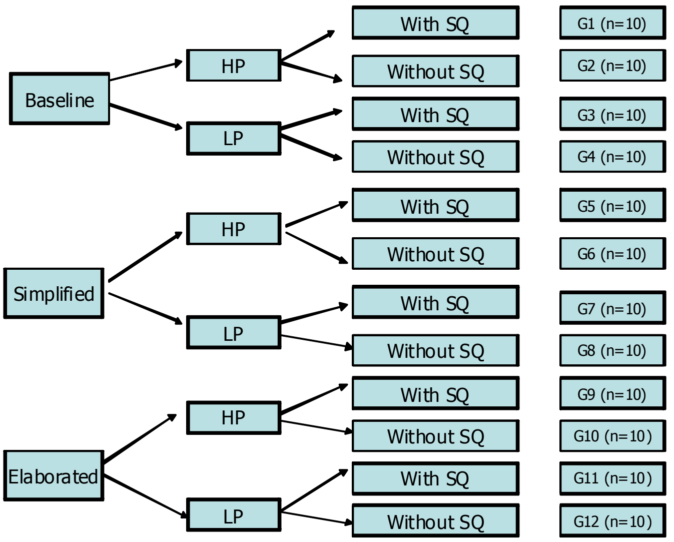
This study employed the quasi-experimental research design as it aimed to investigate the effects of manipulating text (by simplifying and elaborating science texts) and active reading strategy (self-questioning) on the reading comprehension performance of the high reading proficiency (HP) and low reading proficiency (LP) Level 7 (first year high school) students of De La Salle Lipa Integrated School

Participants

Level 7 students coming from nine level 7 classes were included in this study. Adopting Oh's (2001) methodology, this study divided the participants into High Proficiency (HP) and Low Proficiency (LP) groups based on the participants' stanine score in the reading component of the Metropolitan Achievement Test (the standardized test administered to all incoming Level 7 students).

Of the nine classes that participated in the main study--three classes were assigned to each of the three text type groups and were given 2 passages of one type to read: Baseline (B), Simplified (S), and Elaborated (E). There were 6 groups of participants based on reading proficiency and type of text: HP-B, HP-S, HP-E, LP-B, LP-S, and LP-E. To test if active reading strategy in the form of self-questioning would have a significant effect in facilitating comprehension of science text, each of the six groups was further divided into two subgroups namely with self-questioning and without self-questioning. Thus, there was a total of 12 groups of participants: HP-B-self questioning (HP-B-SQ), HP-B-without self-questioning (HP-B), HP-S-self-questioning (HP-S-SQ), HP-S-without self-questioning (HP-S), HP-E-self-questioning (HP-E-SQ), HP-E- without self-questioning (HP), LP-B-self questioning (LP-B-S), LP-B-without self-questioning (LP-B), LP-S-self-questioning (LP-S-SQ), LP-S-without self-questioning (LP-S), LP-E-self-questioning (LP-E-SQ), and LP- E-without self-questioning (LP-E). For the schematic presentation of the participants' distribution to experimental groups, see Figure 1 below.

Figure 1: Diagram of the Participants' Distribution to the Different Experimental Groups



Those with moderate reading proficiency (stanine 5, determined in consultation with the DLSL IS' Admission and Testing Head) also became part of the experimental groups as the experiment was conducted during the regular one-hour English sessions and excluding them would have disrupted the natural classroom setting. To maintain clear distinction between the performance of HP and LP groups, the performance of the moderate proficiency group was excluded from the statistical analysis.

Data for the statistical analyses were collected from 10 students randomly chosen from each of the 12 experimental groups. Thus, 120 students provided the reading comprehension scores that were used for the statistical analyses.

Data Gathering Procedures

To ensure the uniform implementation of the data gathering procedure, the researcher was the one who administered the reading test. Within each class, the same procedure was observed. Each class was randomly assigned to elaborated, baseline, or simplified condition. The students in each class were assigned to with self-questioning or without self-questioning condition based on their seating arrangement. Upon completion of the initial class routine such as greetings and checking of attendance, the researcher introduced herself and oriented the class regarding the conduct of the reading comprehension test. Following that, instructions on how each group would accomplish the task were given separately. To ensure that the students understood the instructions, pre-written instructions were posted on the board, and the researcher went around the classroom to check if the instructions were correctly followed. In order to ensure that the without self-questioning group was preoccupied as the other group accomplished its task, the members of the without self-questioning group were asked to write a 5-sentence paragraph describing their new class. On the other hand, the members of the self-questioning group were asked to generate questions about the passages read by completing five of the content-free general questions adopted from King (1992).

Question Stems

The students were instructed that of the five questions that they were to generate, the first three should contain the three compulsory question stems while the last two may contain any of the free-choice question stems. This procedure was followed in order to ensure that students in the self-questioning group were guided to generate types of questions that were congruent to the types of questions that were asked in the comprehension test (i.e. general comprehension questions, literal questions, inferential questions). In addition, the students under the self-questioning group were asked to provide answers to their own questions.

Table 1: presents the question stems the students were instructed to use in generating questions.

Compulsory Question Stems

1. What is the main idea of________________________?
2. What is another example of ______________________?
3. What would happen if ___________________________?

Free-Choice Question Stems

1. Explain how ___________________________________.
2. What is the difference between ________________ and ______________?
3. What conclusion can you draw about ______________?
4. How does ________________ affect _______________?
5. How is _______________ related to ________________?

After clearly explaining the task of each group, questions clarifying the instructions were entertained. Thereafter, the test materials consisting of the questionnaires and the answer sheets were distributed to the students. The students were asked to read and understand each of the two short passages and to answer each of the two sets of nine multiple-choice questions that appeared immediately after each passage. The test materials were collected only when the whole class had completed the task. The researcher was the one who checked the students' answers to the comprehension tests.

Instrument

To ensure the content validity of the instrument, the selection of the reading passages as well as the construction of the reading comprehension test was done by the researcher in consultation with experienced science teachers and experienced reading teachers from the De La Salle Lipa Integrated School. They were considered experienced because they had obtained an advanced degree, had rendered at least ten years of teaching at De La Salle Lipa, and had assumed an administrative position. In addition, a pilot study was conducted to ensure the face validity of the instrument.

The reading passages were selected among science passages in Irmark's (1976) Beginning Scientific English. The passages from which the reading passages in this study were chosen consist of 200-400 words. Any science text whose baseline or elaborated version falls outside the 200-400 word range were not considered because according to the level 7 science teachers, reading passages that exceed 400 words are already confusing for the level 7 learners while reading passages with less than 200 words do not usually provide sufficient information that could be the basis of formulating literal, inferential or interpretive, and general comprehension questions.

Baseline Passages

The two reading passages were lifted from Beginning Scientific English by Irmark (1976). The content of this book had been previously judged by the level 7 teachers as authentic science texts and appropriate to the level of understanding of level 7 students because the topics contained in the book are "advanced" versions of the topics that were already introduced in levels 4, 5, and 6.

Modified Reading Passages

The researcher constructed the simplified texts by adapting the baseline texts (from Irmark, 1976) through the reduction of the embedded clauses that students perceived to be difficult to understand into sentences with simpler syntax. Likewise, some passive sentences were transformed into active sentences. Furthermore, words perceived by the pilot study participants as difficult or uncommon were replaced with synonyms that students considered easier to understand.

On the other hand, the researcher constructed the elaborated texts by adapting the baseline texts (from Irmark, 1976) through the addition of redundancy and clearer signaling of thematic structure in the form of examples, paraphrases, and repetition of the original information. Synonyms and definitions of unfamiliar words were also juxtaposed with the unfamiliar words. Thus, the elaborated texts resembled the integrated vocabulary format of Yeung (1999).

Reading Comprehension Test

The students' comprehension of the information in the passages was measured with an 18-item multiple-choice test consisting of nine items for each passage--three for general comprehension (giving title, identifying main idea, summarizing), three for literal comprehension (identifying information explicitly stated in the text), and three for inferential comprehension (drawing implications by applying the message of the text). Hence the 18-point multiple-choice type of test featured six questions measuring general comprehension, six questions measuring literal comprehension, and six questions measuring inferential comprehension. One point was given for each correct answer that each participant gave. The passing score for the reading comprehension test was set at 9, which corresponds to 50% of the expected perfect score of 18 points.

Data Analyses

The data set for this study consisted of scores of 10 students randomly drawn from each of the 12 experimental groups. Thus, the data set that was subjected to statistical analyses was composed of 120 scores.

T-test and analysis of variance (ANOVA) were used to analyze the data set.

Results and Discussion

Input Modification and Reading Comprehension

To ensure that the mean score difference could be attributed mainly to input modification, only the scores of the participants from the Without Self-questioning (WSq) groups were considered. The mean reading comprehension scores of the WSq High Proficiency (HP) and Low Proficiency (LP) participants assigned to the three text-type-groups appear in Table 2.

Table 2: Mean Scores and Standard Deviations of the Participants Assigned to the Three Text Types

Text Type	Mean Score	Standard Deviation
High Proficiency (n=30)		
Baseline	7.7	1.57
Simplified	8.7	2.16
Elaborated	9.6	1.43
Low Proficiency (n=30)		
Baseline	5.4	1.5
Simplified	5.2	1.75
Elaborated	6.7	1.34

As can be seen in Table 2, the HP and LP participants assigned to the elaborated science texts obtained higher mean scores compared to their counterparts assigned to either baseline science texts or simplified science texts. In the HP group, the reading comprehension performance of the participants assigned to the simplified science texts appears to be better than the reading comprehension performance of the participants assigned to the baseline science texts.

On the other hand, in the LP group the mean reading comprehension score of the participants assigned to the simplified science texts seems to be slightly lower than the mean score of those who were assigned to the baseline science texts. This observation runs counter to the findings of previous studies which suggest that simplified texts generally yield better reading comprehension performance than baseline texts (Yano, Long, & Ross, 1994; Tweissi, 1998; Urano, 2000; Oh, 2001; Li, Xu, & Wang, 2005; and Khan, 2007). However, this unexpected finding could not just be ignored because it corroborates the observation of Young (1999) that simplification through the replacement of low frequency words with high frequency ones and the transformation of passive sentences into active ones sometimes yields lower reading comprehension scores compared to baseline texts. Moreover, this statistically insignificant but interesting finding seems to support the contention of Long and Ross (1993, p. 29) that simplification "dilutes the semantic content of the original"; thus, simplification sometimes hinders the comprehension of science texts.

ANOVA revealed that the observed difference among the mean reading comprehension scores of the HP and LP participants across text types is significant at alpha level .01 [F_{stat}=5.10, $F_{crit\ (df=2)}$= 3.17]. The results suggest that generally, there is a significant difference in the reading comprehension performance of the students exposed to modified science texts and those exposed to baseline science texts.

To investigate where the significant difference revealed by the ANOVA lies, the mean scores were compared using t-tests. Correspondingly, the comparison of the mean scores within each proficiency level revealed that in the HP group, the observed difference between the reading comprehension performance of the participants assigned to the simplified science texts and the reading comprehension performance of those assigned to baseline science texts is not significant at alpha level .05 [t_{stat} =1.18, $t_{(crit\ df\ =29),}$ =1.73]. Similarly, t-test indicated that the observed difference between the reading comprehension performance of those assigned to elaborated science texts and those assigned to simplified science texts is not significant either. Conversely, the comparison of means showed that the observed difference between the reading comprehension performance of the participants assigned to elaborated science texts and the reading comprehension performance of those assigned to baseline science text is significant. Hence, based on the limited data obtained from this study, it could be stated that HP students benefit more from the facilitative effect of the elaboration of science texts. This finding is consistent with the assertion of Oh (2001) that elaboration facilitates reading comprehension because elaboration allows readers to construct meaning through linguistic context provided by the elaborative text.

In the LP group, t-tests revealed that the observed difference in the mean reading comprehension scores of the participants exposed to simplified and baseline science texts is not significant [t_{stat} =.27, $t_{(crit\ df\ =29),}$ =1.73] while the observed difference in the mean reading comprehension scores of students exposed to elaborated and baseline science texts is significant [t_{stat} =2.04, $t_{(crit\ df\ =29),}$ =1.73]. In addition, comparison of the mean reading comprehension scores of the participants exposed to elaborated science texts and those exposed to simplified science texts indicated that the observed 1.3 unit difference (in favor of the elaborated science texts) is significant at alpha level .05 [t_{stat} =2.15, $t_{(crit\ df\ =29),}$ =1.73]. That elaboration yielded significantly higher mean reading comprehension score compared to simplification is contrary to the observation of Oh (2001) and Yano, Long, and Ross (1994). This difference in findings may be due to the fact that this study used science texts while non-science texts were used in the studies of Oh (2001) and Yano, Long, and Ross (1994). As posited by Wood (1982), simplification of science texts by breaking down complex sentences into simple sentence constructions disrupts the close connection between the communicative fields that is very important in the comprehension of science texts.

Self-questioning active reading strategy and Reading Comprehension

The mean scores of the participants in the self-questioning (SQ) and without self-questioning (WSq) groups were compared to see the effect of self-questioning on the reading comprehension of science texts. Table 3 presents the reading comprehension performance of the HP participants in the SQ and WSq groups.

Table 3: Reading Comprehension Performance of the HP Participants in the Self-questioning and Without Self-questioning Groups

Reading Strategy	Mean Score	Standard Deviation
Self-Questioning (n=30)	10.33	1.83
Without Self-Questioning (n=30)	8.67	1.86

Table 3 shows that the HP participants assigned to the SQ group obtained a mean reading comprehension score that is almost 20% higher than the mean reading comprehension score obtained by the participants assigned to the WSq group. Moreover, the data that appear in Table 3 indicate that the SQ and the WSq groups have almost similar standard deviations, thus suggesting that the observed difference in the reading performance of these two groups could not be attributed to the individual differences of the members in each group but to the treatment applied to each group. T-test revealed that the observed difference in the mean scores of the SQ and WSq groups is significant at alpha level .05 [t_{stat} =3.50, $t_{(crit\ df\ =58),}$ =2.00]. This result suggests that self-questioning active reading strategy enhanced the HP students' comprehension of science texts regardless of the text type the students were exposed to.

The effect of self-questioning active reading strategy on the LP students' reading comprehension performance is summarized in Table 4.

Table 4: Reading Comprehension Performance of the LP Participants in the Self-questioning and Without Self-questioning Groups

Reading Strategy	Mean Score	Standard Deviation
Self-Questioning (n=30)	8.13	1.66
Without Self-Questioning (n=30)	5.77	1.63

As can be seen in Table 4, there appears to be a considerable difference in the mean reading comprehension scores of the participants who engaged in self-questioning active reading strategy and the participants who did not engage in self-questioning active reading strategy. The SQ participants outperformed the WSq participants by almost 41%. Comparison of these mean scores revealed that the observed difference in the performance of the LP participants in the SQ and WSq groups is significant at alpha level .05 [t_{stat} =5.57, $t_{(crit\ df\ =58),}$ =2.00]. This information suggests that like their HP counterparts, LP participants benefitted from engaging in self-questioning active reading strategy.

Interaction Effect of Factors Contributing to Reading Comprehension

The data in Table 5 were used to test the interaction between self-questioning active reading strategy and input modification.

Table 5: Mean Scores of HP Students in the Self-questioning and Without Self-questioning Groups Across the Different Text Types

Reading Strategy	Baseline		Simplified		Elaborated	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Self-questioning	10.1	1.37	10.5	1.9	10.4	2.27
Without Self-questioning	7.7	1.57	8.7	2.16	9.6	1.43

Table 5 reveals that regardless of text type, the participants in the SQ group noticeably outperformed the participants in the WSq group in the multiple-choice-type reading comprehension test. Worth noticing also is the fact that despite the participants' apparent lack of knowledge regarding the contents of the science texts, all of the participants who engaged in self-questioning active reading strategy obtained passing mean scores or scores equivalent to at least 50% of the total number of multiple-choice-test items. On the other hand, in the WSq group, only the participants exposed to elaborated science texts obtained a passing mean score. Similarly, when subjected to t-test, the mean reading comprehension score of the WSq participants exposed to the elaborated text was found to be not significantly different from the mean reading comprehension score of the SQ participants exposed to elaborated science texts. This finding suggests that in the absence of deliberate engagement in self-questioning active reading strategy, elaboration may also enhance the reading comprehension of HP students.

To test whether there is a significant interaction effect of self-questioning active reading strategy and input modification, the scores of the HP students in the SQ and WSq groups across different text types were subjected to an ANOVA--the results of which are presented in Table 6.

Table 6: Summary of the ANOVA for the HP Students in the Self-questioning and Without Self-questioning Groups Across the Different Text Types

Source of Variation	SS	df	MS	F	P-value	F crit
Between						
Column (Text Type)	12.4	2	6.2	1.876682	>.05	3.17
Row (Active Reading Strategy)	41.67	1	41.67	12.61312**	<.01	4.02
Interaction	6.53	2	3.265	.988285	>.05	3.17
Within	178.4	54	3.303704			
Total	239	59				

Table 6 shows that the main positive effect of self-questioning active reading strategy on the HP participants' reading comprehension of science texts is significant while the main effect of input modification is not significant. In addition, it can be seen in Table 8 that the interaction effect of input modification and active reading strategy on the reading comprehension performance of the HP participants is not significant either. This suggests that self-questioning active reading strategy yielded significant positive effect on the HP participants' reading comprehension of science texts regardless of the text type to which the participants were exposed.

Equally interesting are the statistics from the LP group presented in Table 7.

Table 7: Mean Scores of LP Students in the Self-questioning and Without Self-questioning Groups Across the Different Text Types

Reading Strategy	Baseline		Simplified		Elaborated	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Self-questioning	8.4	1.51	7.8	1.75	8.2	1.81
Without Self-questioning	5.4	1.51	5.2	1.75	6.7	1.34

Table 7 indicates that the reading comprehension performance of the LP participants assigned to the SQ group appears to be better than the reading comprehension performance of LP participants assigned to the WSq groups. Worth noticing is the fact that the greatest mean score difference (3 points in favor of SQ) between SQ and WSq groups comes from the participants exposed to the baseline science texts while the least mean score difference comes from the participants exposed to the elaborated texts. This observation seems to suggest that the use of self-questioning active reading strategy enhances the LP participants' comprehension of science texts more than input modification.

The results of the ANOVA performed on the reading comprehension test scores of the LP participants assigned to SQ and WSq groups across the different text types can be seen in Table 8.

Table 8: Summary of the ANOVA for the LP Students in the Self-questioning and Without Self-questioning Groups Across the Different Text Types

Source of Variation	SS	df	MS	F	P-value	F crit
Between						
Column (Text Type)	9.1	2	4.55	1.733945	>.05	3.17
Row (Active Reading Strategy)	84.02	1	84.02	32.01891**	<.01	4.02
Interaction	6.03	2	3.015	1.148977	>.05	3.17
Within	141.70	54	2.624074			
Total	240.85	59				

Table 8 indicates that self-questioning active reading strategy has a significant main effect on the reading comprehension performance of LP participants. Moreover, the data in Table 8 highlight the fact that the main effect of input modification as well as the interaction effect of the self-questioning active reading strategy and input modification on the reading comprehension performance of the LP participants is not significant. These findings which are similar to the results of the ANOVA for the HP participants suggest that the main beneficial effect of self-questioning active reading strategy on the Level 7 students' comprehension of science texts does not vary as a function of the text type to which the students are exposed.

Finally, to test if there is a significant interaction effect of students' level of reading proficiency, the type of input modification, and the use of self-questioning active reading strategy on the students' comprehension of science texts, the data in Table 9 were analyzed.

Table 9: Mean Scores of Students Exposed to Different Types of Texts Across Active Reading Strategy Groups and Reading Proficiency Levels

Text Type	Self-Questioning		Without Self-questioning	
	HP	LP	HP	LP
Baseline	10.1	8.4	7.7	5.4
Simplified	10.5	7.8	8.7	5.2
Elaborated	10.4	8.2	9.6	6.7

Table 9 illustrates that the HP participants performed better than the LP participants in the 18-point multiple-choice-type science reading comprehension test regardless of variation in text type and engagement in self-questioning active reading strategy. However, it is noticeable that the difference in the mean scores obtained by HP and LP participants is lower in the SQ group (average mean scores difference = 2.2) than in the WSq group (average mean scores difference = 2.9). It is also interesting to note that the t-test revealed that the difference between the mean score of the LP participants assigned to SQ group and the HP participants assigned to the WSq group is not significant at alpha level .05 [t_{stat} =1.17, $t_{(crit\ df\ =58),}$ =2.00]. This observation seems to imply that given a science reading comprehension task, LP students may compensate their reading deficiency by engaging in self-questioning active reading strategy. A careful consideration of the data in Table 9 further reveals that the mean reading comprehension score of the LP participants in the SQ group exposed to baseline science texts is almost 1% higher than that of the HP participants in the WSQ group exposed to baseline science texts. Hence, it could be deduced that when tasked to read baseline or authentic science texts, LP readers may use self-questioning active reading strategy to facilitate their comprehension.

ANOVA revealed that the main effects of reading proficiency level and engagement in self-questioning active reading strategy on the participants' performance in the reading comprehension test are significant at alpha level .001 [Fstat=36.07402, Fcrit (df=3)= 2.70]. Conversely, the main effect of the input modification is not statistically significant. The observation that input modification does not have statistically significant effect on reading comprehension of science texts may be due to the fact that only elaboration appears to have considerable effect on the participants' performance. Likewise, the interaction effect of proficiency level, self-questioning active reading strategy, and input modification on the participants' comprehension of science texts is not significant. These results appear to imply that while reading proficiency is certainly an important factor that contributes to the students' comprehension of science texts, LP readers are not doomed to fail in reading comprehension tasks because they could benefit much from engagement in self-questioning active reading strategy which is very likely to facilitate their comprehension (Spence, 1995).

Conclusions

Based on the results of this study, the following conclusions were drawn.

First, only elaboration results in significant gains in the HP and LP students' reading comprehension of science texts. This conclusion supports Kim and Van Dussen's (1998) contention that elaborations provided in the text could enhance the reading comprehension of readers with low prior knowledge regarding the content of the reading texts. Likewise, this conclusion appears to confirm the finding of Oh (2001) that elaboration yields significant positive effect on HP and LP learners' reading comprehension performance. However, it runs counter to the findings of Li, Wang, & Xu (2005), Mayor (2007), and Khan (2007) which suggest that simplification generates significantly better effect on learners' reading comprehension compared to elaboration. The apparent discrepancy in these observations could be attributed to the fact that the texts used in this study are science texts. The opportunity to deal with "text information" through redundancy and clear thematic signaling provided by text elaboration seems to be more beneficial to the comprehension of science texts than to the comprehension of non-science texts (Oh, 2001, p. 91). Thus, the results of this study suggest that elaboration of science texts could help students understand difficult texts because elaboration encourages the readers to engage in metacognitive strategies which in turn results in better comprehension (Russell, 1974).

Second, self-questioning active reading strategy yields significant positive effect on the science reading comprehension performance of the students. This conclusion supports the findings of Duell (1975, as cited in Wong, 1985), André & Anderson (1978-1979), and Singer & Donlan (1982) which imply that the engagement in self-questioning active reading strategy results in significantly better reading comprehension of both narrative and expository texts. Thus, this conclusion highlights the apparent benefit that learners could derive from actively engaging in self-questioning as they construct meaning from science texts and understand science reading materials. Consequently, the results of this study suggest the importance of establishing a classroom environment that promotes students' questioning and encourages the students' inherent eagerness to ask questions and persistence to seek answers to their questions.

Third, there is no significant interaction effect between self-questioning active reading strategy and input modification, thus indicating that the main positive effect of self-questioning on the students' reading comprehension of science texts does not vary as a function of the type of science texts the students are exposed to. This conclusion supports the contention of metacognitive theorists that self-questioning results in better comprehension and learning of content area texts because self-questioning enhances both the readers' metacognitive knowledge and metacognitive regulation (Janssen, 2002). Hence, in the absence of elaboration of texts, readers could engage in self-questioning active reading strategy to enhance their reading comprehension.

Fourth, there is no interaction effect of students' level of reading proficiency, the type of input modification, and the use of self-questioning active reading strategy on the students' reading comprehension. This conclusion implies that teaching students to engage in self-questioning active reading strategy may help "close the achievement gap and lessen the inequity created by ability grouping" (Futrell & Gomez, 2008, p. 74). Some schools have been guided by ability grouping in determining the type of instruction delivered to the learners. Unfortunately, instead of helping low proficiency learners to cope up with the seemingly difficult demand of education, ability grouping has deprived the low proficiency learners of equal opportunity to be exposed to authentic, enriched, and challenging content that could prepare them for the demands of national and international assessments as well as of the global workplace. Most of the time, the low proficiency learners are exposed to a relatively "watered-down curriculum" which tends to simplify the lessons and lessen the LP learners' opportunity to engage in metacognitive strategies that would teach them how to learn and apply what they have learned (Futrell & Gomez, 2008, p. 75). The results of this study indicates that exposing LP learners to authentic texts with elaboration and encouraging them to engage in metacognitive strategies such as self-questioning could improve their performance not only in content area reading comprehension but in other aspects of learning as well.

Finally, based on the results of this study, it could be concluded that reader input appears to have more significant effect on students' reading comprehension than text input. As revealed by the data obtained from this study, self-questioning active reading strategy yielded statistically significant positive effect on the level 7 students' reading comprehension of science texts regardless of the text input presented to the students. Hence, the use of varied teaching strategies that would encourage students to actively engage in the process of reading to learn could greatly help especially the students who have low reading proficiency level.

References

1. Andre, M., & Anderson, T. (1978-1979). The development and evaluation of self-questioning study technique. *Reading Research Quarterly, 14*(4), 606-623.
2. Bowers, P. (2000). *Reading and writing in the science classroom.* USA: Houghton Mifflin Company. Retrieved June 19, 2013 from http://www.eduplace.com/science/profdev/articles/bowers.html.
3. Brantmeier, C. (2005). Effects of reader's knowledge, text type, and test type on l1 and l2 reading comprehension in Spanish. *The Modern Language Journal, 89*(1), 37-53.
4. Carnine, L., & Carnine, D. (2004). The interaction of reading skills and science content knowledge when teaching struggling students. *Reading & Writing Quarterly, 20,* 203-218.
5. Donovan, C., & Smolkin, L. (2001). Genre and other factors influencing teachers' book selections for science instruction. *Reading Research Quarterly, 36*(4), 412-440.
6. Futrell, H., & Gomez, J. (2008). How tracking creates a poverty of learning. *Educational leadership, 65*(8), 74-75.
7. Grabe, W. (1991). Current developments in second language research. *TESOL Quarterly, 25*(3), 375-406.
8. Hsu, P., & Yang, W. (2007). Print and image integration of science texts and reading comprehension: A systemic functional linguistics perspective. *International Journal of Science and Mathematics Education, 5*(4), pp. 639-659.
9. Irmark, D. (1976). *Beginning scientific English Book 2.* Great Britain: Hazell Watson & Viney Ltd, Aylesbury, Bucks.
10. Jacobson, J.M. (1998). *Content area reading: Integration with the language arts.* USA: Delmar Publishers.
11. Janssen, T. (2002). Self-questioning as a literary reading strategy: An exploration of empirical research. *L1-Educational Studies in Language and Literature, 2,* 95-120.
12. Janssen, T., Braaksma, M., & Couzijn, M. (2009). Self-questioning in the literature classroom: Effects on students' interpretation and appreciation of short stories. *L1-Educational Studies in Language and Literature, 9*(1), 91-116
13. Khan, B. (2007). *Effect of simplification and elaboration as text modification strategies on Cambodian EFL students' reading comprehension.* Unpublished master's thesis, De La Salle University, Manila.
14. Kim, S., & Van Dusen, L. (1998). The role of prior knowledge and elaboration on text comprehension and memory: A comparison of self-generated elaboration and text-provided elaboration. *The American Journal of Psychology, 111*(3), 353-378.
15. King, A. (1992). Comparison of self-questioning, summarizing, and notetaking-review as strategies for learning from lectures. *American Educational Research Journal, 29*(2), 303-323.
16. Li, Y., Wang, Q., & Xu, S. (2005). The effects of simplified and elaborated texts on second language reading comprehension: An exploratory study. *Vigo International Journal of Applied Linguistics, 2,* 45-74.
17. Long, M., & Ross, S. (1993). Modifications that preserve language and content. In M.L. Tickoo (Ed.), *Simplification: Theory and application (RELC anthology series no. 31)* (pp. 29-52). Singapore: SEAMEO Regional Language Centre.
18. Mayor, M. (2007). *Effect of interactionally modified and premodified input on second language comprehension.* Unpublished master's thesis, De La Salle University, Manila.
19. Miciano, R. (2002). Self-questioning and prose comprehension: A sample case of ESL reading. *Asia Pacific Education Review, 3* (2), pp. 210-216.
20. Oh, S. (2001). Two types of input modification and EFL reading comprehension: Simplification versus elaboration. *TESOL Quarterly, 35*(1), 69-95.
21. Parker, M., & Hurry, J. (2007). Teachers' use of questioning and modeling comprehension skills in primary classrooms. *Educational Review, 59*(3), 299-314.
22. Roe, B., Stoodt-Hill, B., & Burns, P. (2004). *Secondary school literacy instruction: The content areas.* USA: Houghton Mifflin Company.
23. Russell, J. (1974). Mental elaboration and cognitive performance. *The Journal of Negro Education, 43*(2), 202-211.
24. Singer, H, & Donlan, D. (1982). Active comprehension: problem-solving schema with question generation for comprehension of complex stories. *Reading Research Quarterly, 17*(2), 167-180.
25. Spence, D.J. (1995). *Explicit science reading instruction in grade 7: Metacognitive awareness, metacognitive self-management and science reading comprehension.* Paper presented at the annual meeting of the National Association for Science Teaching at San Francisco, USA
26. Tweissi, A. (1998). The effects of the amount and type of simplification on foreign language reading comprehension. *Reading in a Foreign Language, 11*(2), 191-206.
27. Urano, K. (2000). *Lexical simplification and elaboration: sentence comprehension and incidental vocabulary acquisition.* Retrieved February 23, 2008 from http://www.urano-ken.com/research/thesis.pdf
28. Vacca, R.T., & Vacca, J.L. (1996). *Content area reading.* (5th ed.). USA: Harper Collins Publishers Inc.
29. Wong, B. (1985). Self-questioning instructional research: A review. *Review of Educational Research, 55*(2), 227-268.
30. Wood, A. (1982). An examination of rhetorical structures of authentic chemistry texts. *Applied Linguistics, 3*(2), 121-143.
31. Yano, Y., Long, M., & Ross, S. (1994). The effects of simplified and elaborated texts on foreign language reading comprehension. *Language Learning, 44*(2), 189-219.
32. Yeung, A. (1999). Cognitive load and learner expertise: split attention and redundancy effects in reading comprehension tasks with vocabulary definitions. *The Journal of Experimental Education, 67*(3), 197-217.
33. Young, D. (1999). Linguistic simplification of SL reading material: Effective instructional practice: *The Modern Language Journal, 83*(3), 350-366.

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