



## Metacognitive Strategy Use or English Proficiency? Influences in Academic Reading Achievement of STEM Students

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### Introduction

After a long history of K-10 basic education in the Philippines, the Department of Education (DepEd) implemented the shift to the K-12 system of education countrywide following the passage of Republic Act 10533 (*An Act Enhancing the Philippine Basic Education System by Strengthening its Curriculum and Increasing the Number of Years for Basic Education, Appropriating Funds Therefor and for Other Purposes*), also known as the “Enhanced Basic Education Act of 2013”. Amidst criticisms that the shift was rushed, without having adequately prepared its students, personnel, and faculty in the transition, and without adequate resources to support the shift, such as classrooms, textbooks, and teachers’ manuals, the implementation pushed through in 2013. Thus, in 2016, the Pamantasan ng Lungsod ng Maynila (University of the City of Manila), a locally-funded public university admitted its first and only batch of high school students into its newly-constituted Senior High School (SHS) Department in the First Semester of School Year 2016-17.<sup>1</sup>

The shift to the K-12 was deemed necessary to decongest the curriculum and give students more time to master key skills (Department of Education, 2010). Often, high school students arrive at the gates of a college without the requisite skills and strategies needed to survive the rigors of academic reading and writing courses. Due to a congested curriculum, time on performing important tasks as well as on developing reading and writing skills is limited, resulting in senior high school students being unable to engage more fully in the learning of reading and writing skills, and in deploying reading strategies that college writing demands.

What are *skills* and *strategies*? Sufficiently distinguished, *skills* refer to automatic processes while *strategies* are deliberate and controlled processes, the possession of which should be at the heart of skilful academic reading (Afflerbach, Pearson & Paris, 2008). Researchers have also highlighted the need for *metacognition* (or the notion of thinking about one’s thoughts) as necessary prerequisites to successful reading. Metacognitive awareness can be about “what one knows (i.e., metacognitive knowledge), what

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<sup>1</sup> By offering classes to Senior high school students, the Pamantasan ng Lungsod ng Maynila absorbed the impact of the lack of high school teachers for the additional two years of basic education, as well as cushioned the impact on its own faculty members who found themselves without students for SY 2016-18.

one is currently doing (i.e., metacognitive skill), or what one's current cognitive or affective state is (i.e., metacognitive experience)" (p. 3). Most importantly, metacognitive strategies are "deliberate, planful, intentional, goal-directed, and future-oriented mental behaviors that can be used to accomplish cognitive tasks" (Flavell, 1971, in Hacker, 1998). According to Afflerbach, Pearson, and Paris (2008):

At the heart of accomplished reading is a balance of both—automatic application and use of reading skills, and intentional, effortful employment of reading strategies—accompanied by the ability to shift seamlessly between the two when the situation calls for it ... When their knowledge is strong and they are given easy text and goals, students can apply their usual skills. In contrast, when their knowledge is sketchy, texts are difficult, and reading tasks are complex, more strategic reading is required. (p. 371)

Accomplished readers are aware of and can, therefore, monitor their comprehension processes, a task Mokhtari and Reichard (2002) claim are crucial for academic success. Once students are aware of their own cognitive resources in meeting the challenges of a reading situation, they could consciously apply strategies to solve complex reading situations (Carrell, 1989, p. 121). Sadly, such concepts are not always addressed in English classes in ESL contexts in the Philippines, relying on the misperception that SHS students are already skilful readers who use metacognitive strategies previously learned in junior high school. Thus, this report will seek to determine senior high school students' English proficiency and metacognitive reading strategy use, as well as their relationship with academic reading comprehension achievement. This report hopes to highlight key issues to help teachers pay more attention to the conscious and deliberate teaching of metacognitive reading strategies.

## **Background of the Study**

### **Self-report of Reading Strategy Use in the Philippines**

In the Philippines, research on self-reports of strategy use among second language learners is scant. There is also a lack of metacognitive reading strategies and use research among senior high school students. Ilustre's (2011) study, which surveyed the reading strategy use of De La Salle University students has sought to determine which among two instruments—SORS (Mokhtari & Reichard, 2002) or Reading Beliefs Instrument (RBI) (Kara-Soteriou, 2007) is a better predictor of reading comprehension skills among college students. In addition, the study sought to find out how active reading beliefs impact comprehension. Estacio (2014), on the other hand, used Mokhtari and Reichard's (2002) instrument, Metacognitive Awareness Reading Strategy Inventory (MARSIS)<sup>2</sup> to assess the same skills in high school students. Both studies found that bilingual Filipinos use all three major types of metacognitive strategies, but that problem-solving skills are used more frequently than others among populations surveyed.

### **Successful Reading Skills and Strategy Use through the Use of Metacognitive Instruments**

The recognition that skilled readers are those in control of their thought processes is a truism that had informed the construction of instruments such as the Metacognitive Awareness of Reading Strategy Inventory (MARSIS) (Mokhtari & Reichard, 2002) and the Survey of Reading Strategies (SORS) (Mokhtari & Sheorey, 2002). Research shows that metacognitive awareness of one's thinking and motivational processes while reading leads to more skilful reading, characterized by the use of flexible reading strategies, employment of periodic self-monitoring strategies, and thinking broadly about the purposes of the task of reading. Yamada (2018) categorically asserted that metacognitive strategies in the learning of English vocabulary among Japanese junior high school students does work (p. 939).

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<sup>2</sup> MARSIS was designed with English as a first language in mind, while SORS is used for students who use English as a second language.

A few studies on L2 readers have relied on self-reports to provide data on participants' awareness of strategies. One example is Mokhtari and Reichard (2002), who used SORS to compare reading strategies among native speakers of English and L2 Arabic speakers. The research found considerable homogeneity among the two groups in their reported use of reading strategies. Both sets of participants displayed a moderate to high awareness of reading strategies, and both showed a clear preference for problem-solving strategies (Endley, 2016, p. 8).

A research that employed a mixed methods design, Iwai's (2009) dissertation explored the role of metacognitive awareness in reading among adult English as a Second Language (ESL) students of various academic levels enrolled in a university in the US while engaged in academic reading. Results show that participating students at different academic levels were aware of and do use metacognitive reading strategies when engaged in academic reading, such as "changing reading speed and strategies for different purposes, activating background knowledge, guessing, marking text, focusing on typographical features (e.g., italics), and summarizing" (Iwai, 2009, p. 140). Furthermore, when encountering challenges in reading comprehension, the students interviewed said they had used contextual clues, re-read a difficult passage, and depended on supportive resources to overcome comprehension problems. However, no clear correlations had been shown between awareness and use of metacognitive strategies and skillful reading.

Employing talk-aloud protocols (TAPs), an explicit method for verbalizing thought processes, is a research design adopted by Hosenfeld (1977), one of the earliest to investigate the relationship between success in reading and strategy use. This research involved the use of strategies used by L1 English high school students reading in French. Dividing participants into "successful" and "unsuccessful" learners based on their performance on a reading proficiency test, Hosenfeld (1977) found that successful readers are those who made use of a number of strategies, among these skipping unessential words, reading in broad phrases, and guessing meanings of new words from contexts, to name a few. Another example is Tavakoli (2014) which used TAP of upper-intermediate EFL students. The study found that "good readers" or "active strategic readers" displayed a wide range of strategy use, including activation of prior knowledge, setting a purpose for reading, making a personal connection to text, making predictions, visualizing monitoring their understanding, summarizing, self-questioning and using context, while "less proficient" readers were unable to employ those strategies, or if they had, use was haphazard and unsystematic.

Studies reporting correlations between level of reading proficiency and strategy use are especially numerous in English as a Foreign Language (EFL) contexts (Endley, 2016). In a study of 120 Iranian EFL students, a clear relationship between the use of metacognitive strategy use and reading proficiency has been established (Rastegar et al, 2017).

A final study that uses self-reporting of strategy use is Malcolm (2009), who examined reading strategy use among medical students in Bahrain. Grouped based on English proficiency, all students reported high use of metacognitive strategy use. As with several other studies, Malcolm (2009) found a clear tendency among participants to use problem-solving strategies over global and support strategies, albeit with "a few significant differences in the reported reading strategy use of low and high proficiency students" (p. 645). One dimension that Malcolm's study has particular relevance for the current study is the use of English proficiency, a factor not yet explored in studies conducted in the Philippines.

## Method

Does English proficiency impact Grade 11 SHS students' comprehension of academic texts? Or is the use of metacognitive reading strategies wholly responsible for helping them comprehend academic texts? One hundred and forty-three (143) Grade 11 Filipino STEM were administered the IELTS' sample academic reading test composed of 40 items. Afterwards, students were asked to assess their uses of reading strategies, using the Survey of Reading Strategies (SORS) instrument (Mokhtari & Sheorey, 2002). Lastly, levels of English proficiency were determined using a free, downloadable, written part of

the English Unlimited proficiency test.

## Research Questions

The current study adds to the small number of research studies on the use of metacognitive strategies. The goal of this initial study is to find out how metacognitive reading strategy use and English proficiency impact achievement in the comprehension of academic texts.

The following questions are posited:

1. What is the level of English proficiency among Grade 11 STEM students at the Pamantasan ng Lungsod ng Maynila (PLM)?
2. What metacognitive reading strategies subscales do Grade 11 STEM students use predominantly?
3. Does metacognitive awareness of reading strategies have any relationship with academic reading comprehension achievement among PLM students?
4. Does proficiency in English have any relationship with academic reading comprehension achievement among PLM students?

## Participants

A total of 143 Grade 11 students from 4 sections of the STEM strand participated in this study. Non-random purposive sampling was used to identify the sample population of Grade 11 students for the school year 2016-2017, which means that these students were the researcher's students during the 2nd semester of the 2016-17 academic year. There were 69 males and 74 females.

## Setting

The research setting is the Pamantasan ng Lungsod ng Maynila (PLM) where 987 students were enrolled in Grade 11. The languages of instruction are Filipino and English.

## Instruments

Three main instruments, the Survey of Reading Strategies (SORS) (Mokhtari & Reichard, 2002), an inventory of reading strategies that measures metacognitive awareness, a free online academic reading sample test of IELTS, and Unlimited English proficiency test were used in this study.

### Survey of reading strategies (SORS)

The survey, which consists of 30 items, each of which uses a 5-point Likert scale ranging from 1 ("I never or almost never do this") to 5 ("I always or almost always do this") is a catalog of strategies used when reading academic texts in English. Specifically, the instrument is a measure of three categories that make up skilful reading:

- a. *global reading strategies* (GLOB), which are strategies that are "intentional, carefully planned techniques by which learners monitor or manage their reading," such as previewing text length, etc. There are 13 statements in this category.
- b. *problem-solving strategies* (PROB), are "localized techniques" that readers fall back on when the text becomes difficult, such as "employing context clues to guess the meaning of an unfamiliar word", etc. There are 8 such strategies in the inventory; and,

- c. *support strategies* (SUP) which measure basic strategies such as using dictionaries, or highlighting information for easy understanding. There are 9 of these items in the survey.

The survey instrument has been field-tested with ESL college students in the United States and the internal reliability of the questionnaire obtained through Cronbach's Alpha was reported to be 0.89, indicating a "reasonable degree of consistency in measuring awareness and perceived use of reading strategies among non-native students of English" (Mokhtari & Sheorey, 2002, in Tavakoli, 2014, p. 321). When the same instrument was field-tested among 85 SHS students, the obtained Alpha Coefficient was also 0.89, indicating a highly reliable index for the questionnaire. For purposes of interpretation, the key to averages are as follows: 3.50 or higher means "High" level of strategy use; 2.5 to 3.49 means "Medium" level of strategy use, while 2.49 or lower means "Low" level of strategy use (Mokhtari & Sheorey, 2002, adapted in Oxford, 1990).

### **English unlimited placement test**

English Unlimited is a 120-item, multiple-choice test designed to help teachers determine a student's proficiency, and to see at what levels—from Starter to Advanced—they may be placed: scores of 0-15 place students in the Starter level; 16-35 in the Elementary level; 36-55 in the Pre-intermediate level; 56-75 in the Intermediate level; 76-95 in the Upper intermediate level; and 96-120 in the Advanced level. To check the reliability of the instrument among Filipino SHS students, the instrument was field-tested among 81 students (58 females and 23 males) from the same university. Using KR 20, the obtained reliability of the instrument is .88, which means it is a reliable instrument. Considered the gold standard in reliability testing, KR 20 gives a "much more accurate estimate of reliability than K-R21" and avoids underestimating the reliability of language tests (Brown, 2005, p. 181).

### **IELTS' academic reading sample test**

The IELTS academic practice reading test is a standardized test composed of 40 questions based on three texts, which were on topics STEM students would find interesting, such as *Chronobiology*, *Triune brain*, and *Helium*. A variety of question types—where test takers are expected to fill in gaps in a passage of written texts or to supply one-word answers to questions—was used. The test took 60 minutes to administer. The internal reliability of this instrument when piloted among Senior High School students is 0.86, indicating that the instrument is reliable. To see at what levels students may be placed, scores of 0-8 indicates modest user; scores of 9-16 indicates competent user; scores of 17-24 indicates good user; scores of 25-32 indicates very good user; and scores of 33-40 indicates expert user.

## **Results and Discussion**

In determining whether the proficiency of individual students or students' use of metacognitive reading strategies accounted for their success in solving reading comprehension problems, a quantitative research method was employed. To determine the relationship between reading comprehension, proficiency, and metacognitive reading strategies, zero-order correlation analysis was used. Stepwise regression analysis was also used to identify the variables that predicted reading comprehension. Table 1 presents the descriptive statistics on metacognitive awareness of reading strategy use.

TABLE 1  
*Descriptive Statistics on Metacognitive Awareness of Reading Strategy Use*

<i>SORS sub-scales</i>	<i>N</i>	<i>Min</i>	<i>Max</i>	<i>Mean</i>	<i>SD</i>	<i>Interpretation</i>
1. Problem-solving strategy (PROB)	143	2.38	5.00	4.03	0.55	High level
2. Global reading strategy (GLOB)	143	2.46	4.92	3.62	0.54	High level
3. Support reading strategy (SUP)	143	2.00	5.00	3.50	0.60	High level
Overall metacognitive awareness of reading strategy use	143	2.50	4.95	3.72	0.44	High level

Table 1 illustrates that, overall, Grade 11 STEM students in PLM have a high level of metacognitive awareness of reading strategy use ( $M = 3.72$ ,  $SD = 0.44$ ). This means that students know but use these strategies only sometimes when reading academic texts in English. Students claim that they use a lot of them. More specifically, problem-solving strategies, such as *reading more slowly and more carefully to understand the material*, *adjusting reading speed according to the type of materials read*, and *stopping from time to time to think about what is being read*, are predominant strategies ( $M = 4.03$ ,  $SD = 0.55$ ). Surprisingly, support strategies, such as *taking down notes while reading*, *underlining/encircling information to help in remembering*, and *using reference materials*, like dictionaries, have been reported as strategies used less frequently ( $M = 3.50$ ,  $SD = 0.60$ ), surprisingly since these strategies taught in school are indispensable tools for skilful reading. Similar results were yielded by Ilustre's (2011) study, where problem-solving strategy use was highest ( $M = 3.91$ ,  $SD = 0.54$ ) and support strategy lowest ( $M = 3.25$ ,  $SD = 0.66$ ) among 226 participants from a private university in Manila (p. 36).

TABLE 2  
*Means and SD of Metacognitive Reading Strategies, Proficiency, and Reading Comprehension Scores*

	<i>N</i>	<i>Mean</i>	<i>SD</i>	<i>Interpretation</i>
Proficiency	143	84.52	12.15	Upper Intermediate
Global	143	3.62	0.53	High Level
Problem Solving	143	4.03	0.55	High Level
Support	143	3.50	0.60	High Level
Reading Comprehension	143	19.62	7.22	Good User

To answer the first research question, *What is the level of English proficiency among Grade 11 STEM students in PLM?* Table 2 shows that there is an Upper Intermediate level of English proficiency among Grade 11 STEM students in PLM based on the mean score of 84.52. Of the three major categories of metacognitive reading strategies, problem-solving strategies was reported to be the category used most frequently. The mean score for problem-solving strategies was 4.03 and scored the highest among the three. Its standard deviation is 0.55, indicating that the scores collected were near each other. Results show that students in PLM have a high level of metacognitive awareness of strategy use. With regard to reading comprehension, a mean of 19.62 indicated that students are good users of these strategies. Interestingly, Ilustre (2011), in her research involving the metacognitive reading strategies of college students from a private school reported roughly the same findings ( $M = 3.91$ ,  $SD = 0.54$ ) (p. 36).

Thus, to the question, *What metacognitive reading strategies do Grade 11 students employ in solving academic reading comprehension problems?*, the answer is that problem-solving strategies, such as guessing the meaning of an unfamiliar word, reading slowly and carefully, regulating concentration when it seems to be flagging, and other "localized" or "go to" techniques that students have as part of their reading repertoire, are more commonly employed than either global or support strategies.

## Correlation Analysis

To determine the relationship between reading comprehension, proficiency, and metacognitive reading strategies, zero-order correlation analysis was used at 0.05 significance level.

TABLE 3

Zero-Order Correlations between Proficiency, Metacognitive Reading Strategies, and Reading Comprehension

	(1)	(2)	(3)	(4)	(5)	(6)
Proficiency	0.092	-				
Global	0.058	0.162	-			
Problem Solving	0.042	0.305	0.534	-		
Support	0.029	0.014	0.409	0.370	-	
Reading Comprehension	0.041	0.685	0.215	0.321	-0.061	-

As seen in Table 3, there is a weak positive correlation between reading comprehension and problem-solving strategies ( $r = 0.321, p < 0.05$ ) as well as between reading comprehension and global reading strategies ( $r = 0.215, p < 0.05$ ). On the other hand, there is a very weak negative correlation between reading comprehension and support reading strategies ( $r = -0.061, p > 0.05$ ). As for the overall correlation between academic reading achievement and metacognitive reading strategy used it was revealed that there is a very weak positive correlation ( $r = 0.194, p < 0.05$ ) exists. However small, the correlation is significant.

Results also show that a strong positive correlation exists between academic reading achievement and English proficiency ( $r = 0.685, p < 0.05$ ). A moderate positive correlation between global reading strategies and problem-solving strategies ( $r = 0.534, p < 0.05$ ), a research finding consistent with Ilustre's (2011) research. Unlike her study, though, there is only a moderate positive correlation between support reading strategies and global reading strategies ( $r = 0.409, p < 0.05$ ) and weak positive correlation between support reading strategies and problem-solving strategies ( $r = 0.370, p < 0.05$ ). The same is true of the correlation between problem-solving strategies and proficiency ( $r = 0.305, p < 0.05$ ). Furthermore, it was found that proficiency has a very weak positive correlation with global reading strategies ( $r = 0.162, p > 0.05$ ) which does not have a significant correlation.

### Stepwise Regression Analysis

After determining the correlation between the variables, stepwise regression analysis was then used to identify the variables that predicted reading comprehension. For the stepwise regression analysis, only the variables that are significantly correlated with reading comprehension were used. These variables are proficiency, global reading strategies, and problem-solving reading strategies.

TABLE 4

Stepwise Multiple Regression Analysis on Proficiency and Metacognitive Reading Strategies

	Model	B	Std. Error	Beta	t	Sig.
1	Constant	-14.497	3.114		-4.656	0.000
	Proficiency	0.407	0.036	0.685	11.165	0.000
2	Constant	-18.832	3.982		-4.729	0.000
	Proficiency	0.397	0.037	0.668	10.815	0.000
	Global	1.437	0.832	0.107	1.727	0.000
3	Constant	-20.393	4.179		-4.880	0.000
	Proficiency	0.385	0.038	0.647	10.136	0.000
	Global	0.830	0.970	0.062	0.856	0.394
	Problem Solving	1.185	0.977	0.090	1.213	0.227

TABLE 5  
*R Square and Adjusted R Square for each model*

Model	R Square	Adjusted R Square
1	0.469	0.465
2	0.480	0.473
3	0.486	0.475

In Table 5, it can be concluded that the most significant model is Model 3 (adjusted *R Square* = 0.475,  $p < 0.05$ ) with three predictors accounting for 5.236% variance. The strongest predictor of reading comprehension in this model is proficiency as seen in Table 4 (Beta = 0.647, SE = 0.038,  $t = 10.136$ ,  $p < 0.05$ ).

## Conclusion

The question, *Is English proficiency, or is the use of metacognitive reading strategies responsible for helping bilingual Filipinos in comprehending academic texts?* is at the heart of this research. The present research has sought to determine which of the two—a student’s level of English proficiency or his/her use of active metacognitive strategies—is responsible for academic text comprehension, as evidenced in reading comprehension test scores. Results clearly showed a preference for problem-solving strategies, a finding not only reached in the few studies conducted in the Philippines, but also in studies abroad, most notably among Gulf ESL students (Endley, 2016) where students learn English as a foreign language. Furthermore, results show that the strongest predictor of reading comprehension among bilingual Filipino STEM students is their proficiency. This is found to be similar to findings reached by studies reviewed by Endley (2016). He noted, however, that where English proficiency is not clearly measured, results may be deemed difficult to assess (p. 190).

English proficiency, skillful reading, as well as the strategic deployment of techniques arguably impact reading comprehension. As such, ESL teachers should be quick in spotting weak readers early on. With early identification, weak readers could develop metacognitive reading strategies either through direct teaching or through modeling, as suggested in previous research (Endley, 2016). Conscientious efforts to make students become aware of and to take control of their own reading processes is thus imperative. In addition, constant monitoring of high and low English proficiency students should also be made and an attempt to address their deficiencies should be made as quickly as possible. In PLM where the PLMAT is the sole measure of proficiency, the department concerned should devise ways of ensuring that PLM students reach a level of English proficiency so that comprehension would not be severely challenged.

## Limitations

Because a standard instrument that measures second language learners’ proficiency in English was not used for logistical reasons—the prohibitive cost of tests, and lack of manpower and space for testing other global measures of proficiency, such as speaking and listening, the placement test that was used in this study may not have been perfect for determining participants’ English proficiency. The instrument itself was loaded with culture-specific items which could have impacted Filipinos’ responses. Also, since students were in a classroom and not a laboratory during the administration of tests, psychological and physical distractions, such as noise inside as well as outside the room, room temperature, students’ readiness, and time constraints may have influenced the way students responded to the instruments and tasks. Future research should address these constraints by administering tests in a laboratory-based context, and through the use instruments that have minimal culture loading. In short, to ensure sound conclusions, great effort must be made to control for these external variables. Another limitation of the study is the nature of the metacognitive reading strategy instrument that was based on students’ self-

report. Many researchers (Mokhtari & Reichard, 2002; Mokhtari & Sheorey, 2002) have echoed the fact that data generated from students' self-reports ought to be analyzed with caution.

The results of the current study may also be limited in its generalizability, as it only tested a select group of STEM students. Future research may involve a bigger number of participants, and to use other factors, like a participant's first language, for example, in determining reading comprehension, before any definite conclusion is reached regarding the correlational relationship among the factors mentioned here.

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