

THE USE OF METACOGNITIVE STRATEGIES AMONG ENGINEERING
STUDENTS IN READING ACADEMIC TEXTS

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*Dedicated to:
My husband Marzuki bin Idris
And My Children Marina Izzati, Syazwan Aizad
and Aida Suraya*

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ABSTRACT

This research focuses on readers' metacognitive strategies when reading second language (L2) academic texts. This research seeks to find out readers' perceived use of metacognitive strategies when reading L2 academic texts and the actual metacognitive strategies used by the readers when reading L2 academic texts. Instruments for data collection were questionnaire, think-aloud protocol and interview. The subjects for this study were first year students from Chemical Engineering Faculty. Twenty eight students were chosen from one section of English for Academic Communication class as participants for this research. They were given the adapted questionnaire on Metacognitive Awareness of Reading Strategies Inventory (MARSI) to determine readers' perceived use of metacognitive strategies in reading. Data from the think-aloud protocol were used to determine the actual metacognitive strategies used by readers when reading. Results showed that overall, most of the readers indicated their awareness of the strategies use when reading, with some strategies such as "stop and reread when confused", "translate new information into own language" and "slow down when encounter important information" showed to be used more than others. However, not all the strategies the readers perceived to be using when reading a text were present in the actual reading process, for example, the strategy "draw pictures or diagrams to help understanding" and "focus on overall meaning rather than specific". Furthermore, the readers' perceived use of strategies did not mirror their actual use, for instance, all respondents reported using the strategy "focus on overall meaning rather than specific" but none used this strategy in actual reading. It can be concluded that readers were aware of their metacognitive strategies and did use some of the strategies they reported using.

ABSTRAK

Kajian ini memberi fokus kepada strategi metakognitif pembaca apabila membaca teks akademik dalam bahasa kedua (L2). Kajian ini mengkaji tentang tanggapan penggunaan strategi metakognitif pembaca apabila membaca teks akademik dalam L2 dan strategi metakognitif yang sebenarnya digunakan oleh pembaca apabila membaca teks akademik L2. Instrumen yang digunakan untuk mengumpul data ialah soalselidik, protokol bercakap sendiri dengan kuat (*think-aloud*) dan temuduga. Subjek kajian ini adalah pelajar tahun pertama dari Fakulti Kejuruteraan Kimia. Dua puluh lapan pelajar telah dipilih dari satu seksyen kelas Bahasa Inggeris untuk Komunikasi Akademik sebagai responden kajian ini. Mereka telah diberi soalselidik *Metacognitive Awareness of Reading Strategies* (MARS) yang telah diadaptasi untuk mengenal pasti tanggapan penggunaan strategi metakognitif oleh pembaca dalam pembacaan. Data dari bercakap sendiri dengan kuat (*think-aloud*) telah digunakan untuk mengenal pasti strategi metakognitif yang sebenarnya digunakan oleh pembaca apabila membaca. Hasil kajian menunjukkan bahawa kebanyakan pembaca menunjukkan kesedaran mereka tentang strategi yang mereka gunakan semasa membaca. Terdapat beberapa strategi seperti *stop and reread when confused*, *translate new information into own language* dan *slow down when encounter important information* menunjukkan penggunaan yang banyak berbanding strategi yang lain. Walau bagaimanapun, tidak semua strategi yang pembaca anggap mereka gunakan semasa membaca satu teks telah digunakan semasa proses pembacaan yang sebenar, contohnya, strategi *draw pictures or diagrams to help understanding* dan *focus on overall meaning rather than specific* tidak digunakan oleh pembaca. Tambahan lagi, strategi yang pembaca anggap mereka guna semasa membaca tidak mencerminkan strategi sebenar yang digunakan, contohnya, semua responden menyatakan mereka menggunakan strategi *focus on overall meaning rather than specific* tetapi tiada pembaca yang menggunakannya semasa pembacaan sebenar. Kesimpulan yang dapat dibuat ialah pembaca menyedari tentang strategi metakognitif mereka dan mereka ada menggunakan sesetengah strategi yang mereka anggap digunakan semasa membaca.

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LIST OF ABBREVIATION

L1	-	First language
L2	-	Second Language
MARSI	-	Metacognitive Awareness of Reading Strategy Inventory
UTM	-	Universiti Teknologi Malaysia

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CHAPTER 1

INTRODUCTION

1.1 Introduction

In one language classroom, the instructor asked the students to do a reading comprehension exercise in the textbook and before the class ended, the instructor discussed the answers with the students. In another language classroom, the instructor gave the class a reading comprehension test and when the test ended, the instructor collected the exam test papers. These two scenarios are common scenarios that take place in many language classrooms where in the cases above, the two instructors are actually measuring the students' reading comprehension skills and performance. The reading comprehension performances are measured in terms of a product and less attention is given to the process of comprehending the text.

In reality, it is actually quite impossible for us to see the processes of comprehending a text because these processes are mental processes. Though students comprehension of a text can only be inferred based on the scores obtained from a reading test, the test scores do not really show us how readers actually process a reading text for comprehension. This has aroused the interest to investigate how a reader processes a text for comprehension. During reading process readers frequently form hypothesis, make and confirm prediction and use their knowledge of vocabulary and the language to construct meaning (Zhang, 2001; Carrell, 1989). Moreover, readers' background knowledge and the use of appropriate strategies such as previewing text, using contextual cues or making inferences have been said to improve reading comprehension (Sheorey & Mokhtari, 2001). These strategies show how readers interact with written text to make reading more effective and improve comprehension (Singhal, 2001).

Readers' awareness, monitoring and the use of strategies while reading are called metacognitive awareness (Anderson, 2001). Hence, the term metacognition is used to refer to readers' awareness of their thought processes when reading. The idea involved in metacognition is that readers must be aware of how they are processing the information and actively using strategies to comprehend a text. The readers' awareness and strategies used by readers to process a text will be discussed in detail in this study.

1.2 Background of the Study

Reading involves many processes and uses many complex skills. Ruddell and Unrau (1994) state that reading is a meaning-construction process. When a person reads, he constructs his own meaning of the text. The reader will construct his own mental version of what he reads. If he reads a complex text or an unfamiliar text, he might relate it to his existing knowledge in order to understand the text. If he encounters difficult words, he might interpret them from the context they appear and might silently agree or disagree with the text (Cziko et al., 2000). Ultimately, understanding or comprehending what one reads is the essence in the reading process.

Among learners, comprehending what is read is vital in order to succeed. However, according to Pressley and Afflerbach (1995), successful comprehension does not happen automatically because "the readers must internally and purposefully work to create meaning from what they read" (Dakin, 2013 p.10). College or university students, especially, are observed to have already acquired the ability to read complex academic reading texts to help them in their study. However, this might not happen as expected because not all of them are able to understand or comprehend what is read. The situation is even more complicated if the readers have to read and comprehend the second language (L2) texts. As Carrell (1988) puts it "

...without solid reading proficiency, second language readers cannot perform at levels they must in order to succeed, and they cannot compete with their native English speaking counterparts” (p.1).

In Universiti Teknologi Malaysia (UTM), there are seven engineering based faculties and six social science and humanity based faculties. This means that its students consist of engineering and non-engineering students. Most of the programs offered are taught in L2 which is English. For Faculty of Chemical Engineering, one of the core subjects which is taught in English is Introduction to Engineering. As such, the students are required to use English when doing their assignments and projects. The students also have to use reference materials in English to do their assignments or to prepare for examination because reference materials in L1 are limited.

English is used as the medium of instruction to fulfill UTM’s aspiration to be a world class university and to cater for the international students who enroll in the university at the undergraduate and postgraduate levels. Courses that are taught in the Malay Language (L1) also use academic materials written in English extensively. For this reason, reading and comprehending English written texts are paramount. Hence, to cater for the UTM students’ needs, they have to attend English courses. Unfortunately, the students only have four hours of English classes per week.

With the limited number of hours of teaching and learning, together with the need to complete the syllabus and the assessments required by each individual English course, there is no room to teach students reading and to use appropriate reading strategies to comprehend text. It is also quite impossible to embed metacognitive training during class hours when the lecturer has lots of input to give students to prepare them for the assessments and also final exam. It is said that metacognitive strategies help students read better and understand better. Research shows that students who use metacognitive strategies when reading will become better readers and comprehend what they read better (Dewitz & Dewitz, 2008; Eilers & Pinckley, 2006; Cross & Paris, 1988). Similarly, if students in UTM use

metacognitive strategies when reading, they would be able to read and understand their discipline specific academic texts better.

Research by Thiede et al., (2003) and Abromitis (1994) have revealed the important role of metacognitive awareness on reading comprehension such as monitoring one's reading and understanding. When readers monitor their reading, they will be aware when they have difficulty understanding the text. They will use strategies to help them understand the text. Due to research evidence which show the importance of metacognitive awareness of strategies, it will be interesting to find out if the engineering students in UTM are aware of their metacognitive strategies and if they use these strategies when reading. Hence, this has led the researcher to embark on this research which aims to investigate readers' metacognitive awareness of reading strategies and the strategies used when reading L2 academic texts.

1.3 Statement of the Problem

At undergraduate level, although it is assumed that all students would have acquired the decoding and word recognition skills which enable them to read, some readers still have problems decoding words written in L2 (Martino & Hoffman, 2002; Dietrich, 1994). This inability often leads to problems in constructing meaning. While native speakers of English have less or no problem with grammar and vocabulary in reading, L2 readers have to struggle with their limited knowledge of grammar and vocabulary of the target language besides struggling to understand the content. This situation often occurs with university students who have to read L2 academic texts in their content area subjects like engineering. Most often, these students fail to master the knowledge in their content area discipline which subsequently lead to poor academic performance.

In UTM, problems often occur when the students are weak in English. They usually have difficulty to process the information in the text and lack the information to complete tasks assigned by their course instructor or to answer

examination questions. Some of them are still unable to decode words written in L2 academic texts. They also have problems understanding unfamiliar terms or new words and deriving meaning from text. This inability has a powerful impact on the processing of L2 reading (Davis & Bistodeau, 1993). Consequently, all these problems affect the students' academic performance.

Much research on metacognition in L2 reading strategies suggested that readers' metacognitive awareness are related positively to their success in L2 reading comprehension (Pressley & Afflerbach, 1995; Brown, 1992; Carrell, 1989; Olshavsky, 1976-1977). Students who have problems comprehending text could be because they lack awareness of the metacognitive strategies and even if they do have metacognitive awareness of the strategies, many have not fully utilized the strategies to help them read better. They might not be aware of how to employ reading strategies in planning, regulating and evaluating their own reading processes. Due to this, it is vital to make the students aware of the importance of metacognitive strategies when reading a text.

Although there were quite a number of research on metacognitive strategies and reading comprehension, research on the use of metacognitive strategies when processing engineering texts are few. Researchers on metacognitive pointed out that the promotion of metacognitive awareness and strategies can enhance learning (Taylor, 1999) and that metacognition contributes to L2 reading comprehension (Pintrich, 1999). Hence, this research was proposed to investigate engineering students' metacognitive awareness of reading strategies. Furthermore, this research also aims to investigate the actual strategies used by the students and to find out if the actual strategies use mirror the students' perceived use of metacognitive strategies.

1.4 Purpose of the Research

The purpose of this research is to investigate the use of metacognitive strategies among engineering students when reading L2 academic texts. Specifically

the research will focus on readers' metacognitive awareness and perceived use of reading strategies when reading L2 academic texts and the actual metacognitive strategies readers use when reading L2 academic texts. Last but not least, the purpose of this research is to determine the extent readers' actual use of metacognitive strategies mirror the perceived use when reading L2 academic texts.

1.5 Research Objective

The objectives of the research are:

1. To investigate readers' metacognitive awareness and perceived use of reading strategies when reading L2 academic texts.
2. To identify the actual metacognitive strategies readers use when reading L2 academic texts.
3. To determine the extent readers' actual metacognitive strategies use mirror the perceived metacognitive strategies use when reading L2 academic texts.

1.6 Research Questions

This research attempts to seek answers to these questions:

1. What are readers' metacognitive awareness and perceived use of reading strategies when reading L2 academic texts?
2. What are the actual metacognitive strategies used by readers when reading L2 academic texts?
3. To what extent do the actual metacognitive strategies use mirror the perceived metacognitive strategies use when reading L2 academic texts?

1.7 Significance of the Research

This research is significant because the data will reveal some important insights into readers' awareness of the metacognitive strategies they use to process texts for comprehension. Since several studies have indicated that metacognitive awareness is important for readers, this awareness should be encouraged not only among ESL readers but also readers of content area subjects. Research by Mokhtari & Sheorey (2001), Pressley & Afflerbach (1995) and a few others have proven the importance of metacognitive awareness of reading strategies in comprehension of texts. For this reason, the findings of this research will inform the course instructors on their students' metacognitive awareness of strategies when reading texts so that they can help the students with comprehension process.

The findings from this research will help course instructors regardless of subject area or field of study to pay more attention to encourage metacognitive awareness when their students need to read academic texts. Findings from think-aloud protocol would give invaluable insights to course content instructors on how readers actually process their text for comprehension i.e. readers' metacognitive awareness and the strategies they used to comprehend texts. This information is useful to course instructors because they might be able to identify the strategies used by skilled readers that enhance the students' comprehension and encourage the struggling readers to adopt the strategies in their reading.

Reading in English language is not restricted to only language classes as students in UTM have to read their content subject reference texts in English. This is because reference materials in the Malay language are limited. Hence, the findings from the analyses of the think-aloud protocols could help course instructors to determine whether metacognitive strategy training course is necessary for their students to help them with their reading of academic texts.

Last but not least, it is hoped that the results from this research will be of value to the course instructors not only in engineering but also non-engineering field as they will be more informed on how text comprehension arises based on readers'

reading experiences, especially by good readers, so that struggling readers may be assisted to produce high level reading and thinking processes using similar strategies.

1.8 Scope of the Research

The respondents of this research were the first year UTM students of Faculty of Chemical Engineering. The research focused mainly on the students' metacognitive awareness and perceived use of reading strategies and the actual use of the strategies to comprehend text. The researcher's main interest was to investigate readers' awareness of the strategies they perceived as using when reading L2 academic texts and the actual strategies used when reading L2 academic texts. The adapted Metacognitive Awareness of Reading Strategy Inventory (MARSI) was given to the respondents to find out readers' awareness and perceived use of strategies when reading L2 academic texts. Think aloud protocol and interview were used to obtain data on the actual strategies used when the students were reading L2 academic texts as well as to compare the perceived use and the actual use of the strategies when reading.

Data from the questionnaire were analyzed using percentages and frequency count. Data from the think aloud and interview were transcribed and analyzed according to the coding scheme that have been established based on the strategies listed in the MARSI. The questionnaire was distributed to the respondents prior to the think aloud and interview session. The think aloud session was held a few days later and the interview was conducted immediately after the think aloud session.

1.9 Theoretical Framework

The analysis of readers' use of metacognitive strategies and comprehension process are based on theories such as metacognition, constructivism theory and schema theory. Flavell (1979) first introduced the term metacognition in the 1970s and since has become an important concept especially in educational psychology and cognitive development and in 1979 he proposed a model of metacognitive monitoring that consists of metacognitive knowledge, experience, goals and tasks, and strategies. Metacognition has been simply defined as "thinking about thinking" or one's awareness of his or her cognitive activity. Metacognition monitors one's ability to reflect on one's own cognitive processes. It will tell the reader what he knows and does not know or when he has problems with comprehension. This is known as metacognitive knowledge.

Flavell stressed that metacognitive knowledge might be consciously or unconsciously activated by the individual while metacognitive experience refers to the internal responses of an individual to his metacognitive knowledge. This experience will provide internal feedback to the learner on the current progress, degree of comprehension and future expectations and completion of tasks. Difficult task will provoke more metacognitive experience than the less difficult task. Readers might use this experience to solve problems related to the task at hand or they might abandon the task altogether. To achieve the desired goals and tasks, learners will depend heavily on metacognitive knowledge and experience. They will determine whether they have enough or lack of information, whether the task is familiar or unfamiliar, or the task is well or poorly organized to achieve the desired goals. Finally, the last category mentioned in Flavell's model is the strategies which refers to cognitive and other behaviors taken by a learner to achieve his goals and tasks. Here the readers will match the strategies and goals based on the available information and knowledge that he has. Flavell believed that a reader with good metacognitive skills and awareness will be able to monitor his learning process, cognitive activities and comprehension. All these processes taken by the readers indicate that reading is an active process and readers play an active role to ensure the success of their learning process.

According to Constructivism Theory (Bruner, 1960) learning is an active process meaning that knowledge is actively constructed. The emphasis of constructivism is on the process, collaborated learning, and understanding. It concerns with how we make sense of our world (Brooks, 1999). In the context of reading, when a reader reads a text, he will construct his own understanding of the text using his experience of things and events or schemata and will reflect on these experiences. In constructing the meaning, the reader will process the information using his metacognitive strategies. Some of the metacognitive strategies involve, for example, asking question, previewing and predicting. When the reader comes across new information, he will process it and try to understand it by checking his schemata to see if this new information similar to what he already knows.

Readers not only use strategies to comprehend text but also bring their experience and knowledge or schemata to help them. Schema theory is based on the belief that comprehension involves one's knowledge of the world (Stott, 2001). However, having schemata alone does not entail comprehension because the reader needs to activate his schemata. If the schemata are not activated then comprehension will be disrupted. Figure 1.1 describes how a reader processes the text for comprehension where he makes use of the metacognitive strategies as well as his schemata to comprehend text.

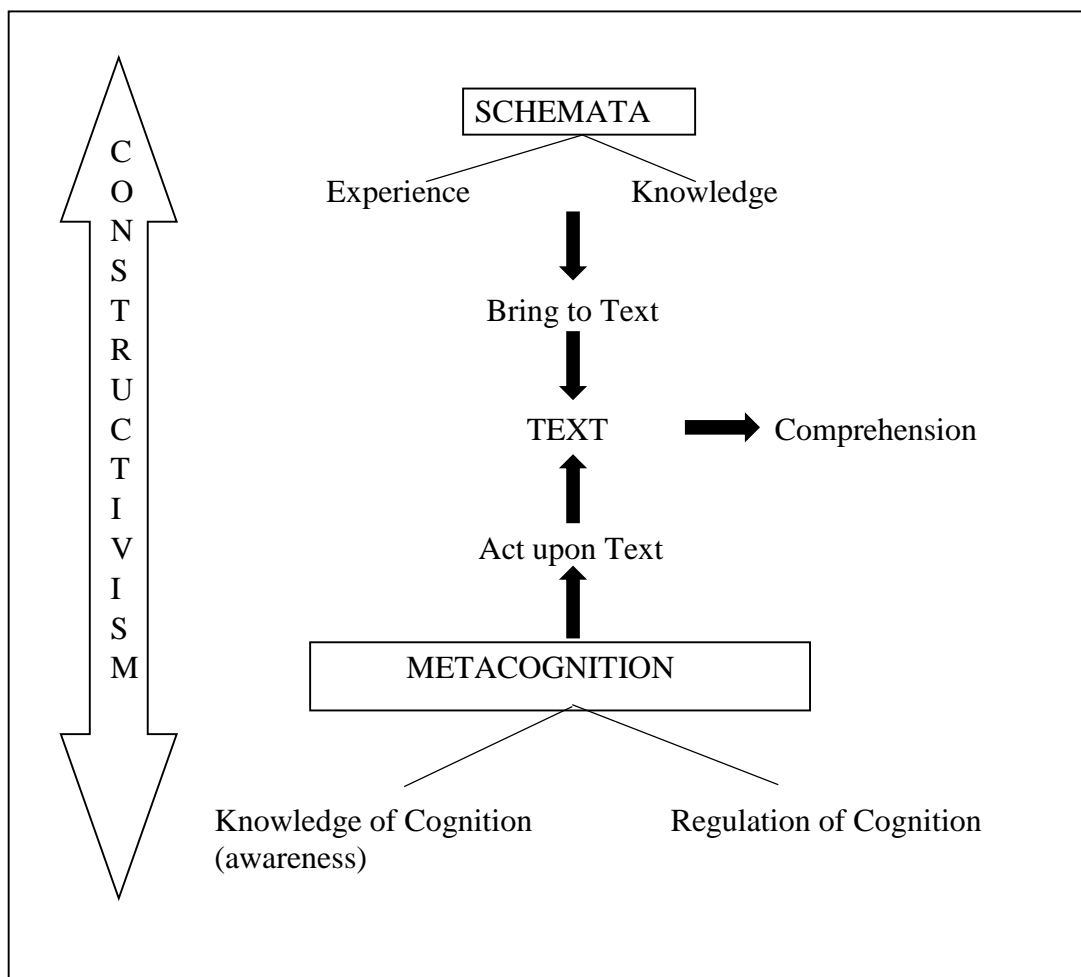


Figure 1.1: Readers' Text Processing for Comprehension

According to Figure 1.1 metacognition consists of knowledge of cognition and regulation of cognition. Knowledge of cognition refers to the reader's awareness of the strategies while regulation of cognition refers to the execution of the strategies. When a reader reads an academic text, he is aware of a list of strategies he can use to comprehend the text and use the strategies that he thinks will help him comprehend the text. At the same time he also activates his schemata which consists of his experience and prior knowledge. Based on constructivism theory, a reader will use these elements i.e. the metacognitive awareness and strategies as well as his schemata simultaneously to process the text which results in comprehension.

A reader who monitors his comprehension is said to have metacognitive knowledge or awareness. A skilled reader usually knows when he understands what

he is reading and knows when what he is reading does not make sense. There are three variables that will determine the success or failure of the meaning making process. They are the readers themselves, the text and the strategies they use. When reading the reader will use his schemata or background knowledge, his experience and also his beliefs in processing the text. It will help if the text is familiar to the reader or the information and clues are abundant because the reader will make use of these information and clues to help him comprehend the text. However in trying to understand the meaning of the text, the reader needs to use appropriate strategies especially when they encounter problems along the process.

If the reader succeeds in his meaning making process he will continue his reading and if he encounters problems in comprehending he will use remedial strategies or fix up strategies (O'Malley and Chamot, 1990) to remedy the problems. There are cases when skilled readers will not resort to remedial strategies but continue reading and look for other clues to help them solve the problem. This monitoring will work continuously and the same pattern will be repeated as described by Figure 1.1.

1.10 Definition of Terms

The following terms appear regularly throughout this thesis and they are defined as how they are used in the context of this research.

a) Metacognitive Awareness

Metacognition refers to one's knowledge of one's own cognition processes and regulation of cognition. Mokhtari and Reichard (2002) referred to metacognition as awareness and monitoring processes. Carrell (1989) has used the term metacognitive awareness to describe the monitoring process of her subjects. Flavell (1979) has used the term metacognition to describe about the awareness of one's reading process. For this research, the term metacognitive awareness

means readers' awareness of the metacognitive reading strategies and aware of the strategies they perceived as using when reading L2 academic texts.

b) Metacognitive Strategies

Metacognitive strategies refers to “the strategies that are used by learners as a mean to manage, monitor and evaluate their learning activities” (Lv & Chen, 2010 p.136). In this research the term metacognitive strategies refers to the strategies students use when reading L2 academic texts.

c) L2 academic texts

L2 academic texts refer to the text/s used by the readers in their content area course. Dickinson (2004) described academic texts as having certain features that differentiate them from non-academic texts. Some of the features include argumentative in nature which means there is a ‘process of reasoning’ and ‘answers specific question’ in the writer’s own words, and conform to certain linguistic constraint. For this research, L2 academic texts refers to texts used by readers in their discipline.

d) Think-aloud Protocol

Think-aloud protocol refers to the readers’ act of reporting their thoughts during the reading process (Katalin, 2000). For this research think-aloud protocol refers to the readers’ oral response while they are reading the text ‘Carbon Footprint’.

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