

An Investigation on Online Metacognitive Reading Strategies Used by Malaysian Engineering Undergraduates

Dong Kangxing, Chiam Kee Swan & Hafizoah Kassim
Centre for Modern Languages
Universiti Malaysia Pahang
Malaysia

Email: 2094405086@qq.com; chiam@ump.edu.my; hafizoah@ump.edu.my

Abstract—With the prevalent use of computers and Internet, online reading has become an indispensable part of students' academic life. Applying reading strategies to improve comprehension in online reading context plays a significant role in students' learning success. Metacognitive reading strategies serve as the effective tool to enhance reading comprehension. The purpose of this study is to explore the overall profile of online metacognitive reading strategies used by Malaysian engineering undergraduates while reading English academic materials. The data were collected by using the questionnaire adapted by the researcher from previous questionnaire. The findings revealed that the participants' use of online metacognitive reading strategies was relatively moderate. Problem-solving strategy was the most used category of metacognitive strategies, while support reading strategy was the least used. Teachers are suggested to provide explicit instruction in terms of metacognitive reading strategies, as well as how to apply them in online contexts.

Keywords—*metacognitive strategies; online reading; online reading strategies; engineering students*

1. INTRODUCTION

Reading is an essential skill for English learners as the crucial tool for acquiring knowledge and gathering information for academic accomplishments and beyond (Alfassi, 2004). For most readers, reading is the most important skill to master in order to ensure success in learning (Anderson, 2003). Reading becomes even more important when one takes into consideration the fact that as students progress through the education system, they have to become increasingly independent readers to keep up with the challenges of academic pursuit (Swan, 2015).

Reading strategies are processes that learners apply in order to improve their reading comprehension and problem-solving skills when they encounter difficulties in reading. Reading strategies serve as the “secret recipe” in the reading comprehension enhancement (Swan, 2015), help readers overcome comprehension failures and compensate for their insufficient language knowledge (Li, 2020). Comprehending these strategies properly leads to considerable enhancement of reading comprehension. Classifying reading strategies usually focuses on the cognitive reading strategies, metacognitive reading strategies and social strategies (Zhang & Guo, 2020). Among the three categories, metacognitive reading strategies become a primary focus in academia as metacognition, a higher level regulatory behaviour, aims to plan, monitor and evaluate the whole reading process. Readers may fail to plan their learning and monitor their reading progress if they do not use the metacognitive reading strategies (Maarof, 2017). The important roles of metacognitive reading strategies are to enable readers to oversee, regulate, or direct the language learning task, and think about the learning process (Sheorey & Mokhtari, 2001). The use of metacognitive strategies ignites thinking and can lead to higher and better reading performance (Anderson, 2002). It is of great necessity for readers to become aware of these different metacognitive strategy choices and use them to improve their reading comprehension.

Among different categorizations of metacognitive reading strategies, the model fitting the present study proposed by Mokhtari & Sheorey (2002) was particularly designed to measure metacognitive reading strategies of L2 learners while reading academic materials. In this model, metacognitive strategies in reading can be classified in the following three clusters: global reading strategies, problem-solving strategies and support reading strategies. Global reading strategies are those intentional, carefully planned strategies by which learners plan and monitor their reading from a broad perspective, such as setting reading goals, previewing the text as to its length and structure. Problem solving strategies are the specific actions and procedures that readers use while working directly with the text, such as adjusting the speed of reading when the material becomes difficult, guessing the meaning of unknown words and re-reading the text to improve comprehension. Support reading strategies are the basic support

mechanisms intended to help the reader in comprehending the text such as using a dictionary, taking notes, underlying or highlighting textual information.

With new Information and Communications Technology (ICT) penetrating all aspects of society, including education in this digital era, language learners are now exposed to wider access of reading materials on online reading platforms through the Internet and computers, which demands researchers to pay more attention to online reading strategies. In the tertiary learning context, the prevalent use of computers and Internet has become an indispensable part of students' academic life. There are abundant opportunities for students to read online to deal with their academic learning tasks. The students who are already burdened with heavy cognitive loads based on traditional text reading now face new challenges from online reading (Li, 2020). It is of great necessity for teachers to be aware of students' overall profile of reading strategies. In terms of reading strategies, learners with different academic disciplines may have different reading strategy awareness and use, this study aims to explore the overall profile of online metacognitive reading strategies used by Malaysian engineering undergraduates when reading English academic materials. To achieve this purpose, the following question was formulated: what are the profiles of Malaysian engineering undergraduates' use of online metacognitive reading strategies when reading English academic materials?

2. LITERATURE REVIEW

The rapid advancement of Information and Communications Technology (ICT) has fundamentally changed the way people read in the past decades. From traditional paper-based printouts to online tests, the ability and proficiency in online reading have become a more prominent skill with which citizens in this digital era must be equipped (Coscarelli & Coiro, 2015). These skills, such as locating information, synthesizing and evaluating the resources available online, determine how efficiently one can adapt and respond to the world in this digital era (Cheng, 2016).

Reiber-Kuijpers et al. (2021) summarized the new features of online reading: availability of online information, higher level of nonlinearity, websites lay-out and format, and digital functions. These new features cause new challenges in online reading context: reading distraction by different split-formats, slowing-down of reading speed, missing information or losing track during online reading, more navigational skills needed due to nonlinearity of online texts, etc.

Reading behaviours are affected by different contexts. From traditional hardcopy materials to online ones, online readers have to adopt a different repertoire of strategies to deal with multiple layers of texts and concentrate on the process of reading. The structural differences of online texts require new online reading strategies compared with traditional paper reading. As previously mentioned, metacognitive strategies are higher-level regulatory behaviours featured by planning, monitoring and evaluation compared with other types of reading strategies, the combination between online reading settings and metacognitive reading strategies became the focal point.

An investigation of students' use of online metacognitive reading strategies was conducted to identify students' strategies awareness (Vaičiūnienė & Užpalienė, 2013). The sample was composed of 89 students from different bachelor programs at Mykolas Romeris University, Lithuania. The results obtained from the questionnaire "Online survey of reading strategies" (OSORS) revealed that the largest number of students employs problem-solving strategies while reading online. The majority of the top strategies most used by online readers are also problem-solving strategies. It also showed that participants used global reading strategies and support reading strategies relatively moderately compared to problem-reading strategies.

Another research was done to examine the level of metacognitive reading strategy used by students in online reading context (Sitindaon et al., 2013). The subjects of this research were 48 Indonesian students of English Education Study Program. The data were derived through students' response to the OSORS questionnaire and revealed that the most preferable strategy used by the students was problem-solving reading strategy. Furthermore, the data showed that there were 66.7% students as moderate strategy users, 25% as high strategy users and 12.5% as low strategy users.

Furthermore, another research aiming to compare the use of metacognitive reading strategies between first and fourth year university students was conducted by applying the OSORS survey (Amer et al., 2010). The results revealed that the participants in both levels used these strategies relatively moderately. However, fourth year students used global reading strategies clearly higher than the first-year students, meaning fourth year students performed better in terms of metacognitive awareness and critical thinking.

Although a number of researches have been done to investigate the use of online metacognitive reading strategies by second and foreign language learners, it is not clear about the overall profile of online metacognitive reading strategies by engineering students, particularly by Malaysian engineering students from bachelor degree programs.

3. METHODOLOGY

A. Participants

The participants of this study were 69 engineering undergraduates at Universiti Malaysia Pahang, including 30 males and 39 females. The participants involved Malays, Chinese and Indians, representing the diversity of participants' multi-racial and multi-language speaking context. With the average age range of 19 to 22, the participants were from different engineering programs, such as mechanical and automotive engineering, manufacturing and mechatronic engineering, electrical and electronic engineering, chemical and process engineering, civil engineering, computing, industrial sciences and technology, etc.

B. Instruments

The questionnaire used in this study is the 'Survey of Online Metacognitive Reading Strategies' adapted by the researcher from 'Online Survey on Reading Strategies' (Anderson, 2003). Some new strategies suitable to the online reading environment and within metacognitive scope were added while some obsolete strategy items were deleted from this new questionnaire. It has 27 items and is divided into three categories: global reading strategies, problem-solving strategies and support reading strategies. Among these 27 items, items 1, 3, 4, 7, 11, 15, 18, 19, 20, 22 are global reading strategies, items 6, 8, 10, 13, 14, 17, 21, 23, 24, 25 are problem-solving strategies, and items 2, 5, 9, 12, 16, 26, 27 are support reading strategies. The questionnaire is a five-point Likert type scale, ranging from one 'I never or almost never do this' to five 'I always or almost always do this'. The higher the score is, the more awareness a student has and more likely to use a specific reading strategy. The reliability index was calculated based on five-point Likert scale items using Cronbach's alpha. The reliability index of the questionnaire was found to be 0.826. The reliability index of each subscale: global reading strategies 0.763, problem-solving strategies 0.734, support reading strategies 0.729.

C. Data Collection

The data were collected in the first semester of the academic year 2019/2020 at Universiti Malaysia Pahang. After getting the administrator's approval, the researcher attended the class and gave a brief explanation regarding this questionnaire survey. The students were told that the survey was important and it must be answered seriously. The survey was conducted on Google Form at language lab classroom and took around 30 minutes.

D. Data Analysis Procedures

The collected data from the questionnaire were analysed by Statistical Package for Social Sciences (SPSS). Descriptive statistics involving mean and standard deviation were employed to figure out the participants' average scores and frequency distributions. The mean scores range from 1 to 5. The classification methods suggested by Oxford & Burry-Stock (1995) were employed, it includes three levels, the reading strategy usage is considered high when the mean score reaches 3.5 or above, 2.5 to 3.4 indicates moderate level strategy use, and 2.4 or below means low level strategy use.

4. RESULTS

As illustrated in Table 1, the overall usage frequency of online metacognitive reading strategies was moderate, showing Malaysian engineering students were relatively aware of certain strategy choices to some extent. In terms of the overall usage of the three categories of online metacognitive reading strategies, problem-solving strategies ($M=3.5592$) was the most used type of strategies. That means the participants were fully aware of using such strategies. The second most used strategies type was global reading strategies ($M=3.3082$), while support reading strategies ($M=3.2557$) was the least used strategies. Among the three categories, the usage of both global and support reading strategies was moderate, while the usage of problem-solving strategies was high.

Table 1: Strategy Use Frequency in Categories

Strategy	Mean	SD	Frequency
Global Reading Strategies	3.3082	0.9646	Moderate
Problem-Solving Strategies	3.5592	0.9736	High
Support Reading Strategies	3.2557	1.1977	Moderate
Overall usage	3.3616	1.0450	Moderate

The data in Table 2 show the top five most used strategies, four of them were from problem-solving strategies category, while only one from global reading strategies category. The strategy of “re-reading” was at the top the list with mean 4.387, followed by the strategies of “read more slowly and carefully”, and “get back on track when they lose concentration”, “use prior knowledge”, and “pay closer attention to the difficult part”, all these were among the most used strategies. The usage frequency of these five most used strategies was high.

Table 2: The Most Used Online Metacognitive Reading Strategies

Rank	Strategy	Mean	SD	Frequency
1	When online text becomes difficult, I re-read it to increase my understanding.	4.3878	0.8370	High
2	I read slowly and carefully to make sure I understand what I am reading online.	4.2449	0.8546	High
3	I try to get back on track when I lose concentration.	4.0020	0.7970	High
4	I use prior knowledge to help me understand what I read online.	3.9302	0.7637	High
5	When online text becomes difficult, I pay closer attention to what I am reading.	3.8184	0.9965	High

The data in Table 3 show the least used five strategies, three of them from global reading strategies category, one from support reading strategies category and one from problem-solving strategies category. The strategy of “review the online text first by noting its characteristics like length and organization” was the least used one with mean 2.9041, followed by the strategies of “take notes”, “look for sites that cover both sides of an issue”, “use typographical features” and “ask important questions about context clues”, all these were among the least used strategies. The usage frequency of these five least used strategies was moderate.

Table 3: The Least Used Online Metacognitive Reading Strategies

Rank	Strategy	Mean	SD	Frequency
1	I review the online text first by noting its characteristics like length and organization.	2.9041	1.1543	Moderate
2	I take notes while reading online to help me understand what I read.	3.0449	1.1819	Moderate
3	When reading online, I look for sites that cover both sides of an issue.	3.0653	0.8360	Moderate
4	I use typographical features like bold face and italics to identify strategically key information.	3.1045	1.2626	Moderate
5	I ask important questions about context clues.	3.1061	0.9399	Moderate

5. DISCUSSION

The purpose of this study is to examine the overall profile of online metacognitive reading strategies used by Malaysian engineering undergraduates. The questionnaire survey shows that Malaysian engineering degree students are moderate users of online metacognitive reading strategies when reading online academic texts. As students at the tertiary level progress through the education system and read more academic materials in the online environment, they are expected to use different online metacognitive reading strategies to comprehend the information. They need to be aware of their cognitive process and master these online metacognitive reading strategies to facilitate their comprehension during reading.

It also reveals that engineering undergraduates use problem-solving strategies more frequently and support reading strategies least frequently, which means that engineering students are adept in using problem-solving strategies to solve specific and trivial problems, but the energy and time required for applying support reading strategies such as using dictionary and paraphrasing might to some extent explain the participants' reluctance of using support reading strategies. The results are also consistent the findings in De Leon & Tarrayo (2014), who found problem solving strategies were used most frequently among 100 EFL learners at a public high school in the Philippines, followed by global and support reading strategies.

Reading is one of the most significant elements of tertiary education for academic success. However, despite its significance, many Malaysian English for Second Language (ESL) learners at the tertiary level struggle to cope with studies due to poor study skills with the core problem is reading (Ellis, 1996). Some of the contributing causes for this reading problem are factors such as low level of proficiency in the English language, vocabulary size, etc. (Majid et al., 2003). As a consequence, when online text becomes difficult, they need to re-read it, read more slowly and carefully, pay closer attention to the difficult part, and get back on track when they lose concentration, all these are among the most used strategies. Students use these strategies frequently to facilitate reading comprehension.

Concerning the least used reading strategies, two of them are "I review the online text first by noting its characteristics like length and organization" and "I use typographical features like bold face and italics to identify strategically key information", being unfamiliar and inexperienced with online reading strategies and online reading tools might explain their less use of these strategies. These strategies are also related to students' navigating skills when reading online for academic purposes, and such navigating behaviours are essential to successful online reading. The other least used strategies include "I ask important questions about context clues", this strategy requires readers to have the ability of critical thinking, and part of the reason it was the least used might be the lack of critical thinking skills in our exam-oriented and theory-based education system (Fadhullullah & Ahmad, 2017); (Shah, 2011). The strategies "taking notes" and "look for sites that cover both sides of an issue" are also among those less used as readers might regard these strategies as time- and energy-consuming.

These least used reading strategies also justify the significance of online metacognitive reading strategies instruction. Teachers should be aware of students' least used but useful strategies when reading in online settings, and they can provide explicit instruction about metacognitive reading strategies in online reading context. Teachers are suggested to integrate effective online metacognitive reading strategies to language lessons by assisting students to know how to use these strategies to overcome problems when reading online for academic purposes.

6. CONCLUSION

The survey illustrated that Malaysian engineering degree students were moderate users of online metacognitive reading strategies, they used problem-solving strategies more frequently, however, global reading strategies, support reading strategies, and those concerning online reading functions and tools were used less frequently. This justifies the need for students to be aware of these different types of metacognitive reading strategies and learn how to use them in online settings in order to improve reading comprehension.

Besides, the results on most and least used strategies show that tertiary ESL students used some specific strategies frequently, while used some strategies less frequently, thus sufficient and explicit teaching and practice of online metacognitive reading strategies are suggested to improve students' usage of those strategies which were less used but vital for efficient and competent online reading process. Instructors are urged to provide explicit instruction in terms of metacognitive reading strategies, as well as how to apply them in online contexts. Furthermore, critical thinking skill, a significant factor impacting learners' metacognitive strategies awareness and use, should also be taught in reading strategies classes.

Additionally, this study only investigated the overall profile of online metacognitive reading strategies by Malaysian engineering undergraduates, it is recommended for future studies to examine the effects of online metacognitive reading strategies instruction on students' strategies awareness and usage. A possible future study could also examine the effects of online metacognitive reading strategies instruction on ESL students' reading comprehension performance.

APPENDIX

Survey of Online Metacognitive Reading Strategies

The purpose of this survey is to collect information about the various strategies you use when you read academic materials online in English. Each statement is followed by five numbers, 1, 2, 3, 4, 5, and each number means the following:

'1' means that 'I never or almost never do this' when I read online.

'2' means that 'I do this only occasionally' when I read online.

'3' means that 'I sometimes do this' when I read online. (About 50% of the time.)

'4' means that 'I usually do this' when I read online.

'5' means that 'I always or almost always do this' when I read online.

1. I have a purpose in mind when I read online.
2. I take notes while reading online to help me understand what I read.
3. I use prior background knowledge to help me understand what I read online.
4. I scan the online text and take an overall view of the online text to see what it is about, whether it will serve my purpose before reading it.
5. When online text becomes difficult, I read aloud to help me understand what I read.
6. I read slowly and carefully to make sure I understand what I am reading online.
7. I review the online text first by noting its characteristics like length and organization.
8. I try to get back on track when I lose concentration.
9. I print out a hard copy of the online text then underline or circle information to help me remember it.
10. I adjust my reading speed according to what I am reading online.
11. When reading online, I decide what to read closely and what to ignore.
12. I use reference materials (e.g. an online dictionary) to help me understand what I read online.
13. When online text becomes difficult, I pay closer attention to what I am reading.
14. I stop from time to time and think about what I am reading.
15. I use critical context clues to help me better understand what I am reading.
16. I paraphrase (restate ideas in my own words) to better understand what I read online.
17. I try to picture or visualize information to help remember what I read online.
18. I use typographical features like bold face and italics to identify strategically key information.
19. I check my understanding and previous guesses when I come across new information.
20. I try to guess from a broad perspective what the content of the online text is about when I read.
21. When online text becomes difficult, I re-read it to increase my understanding.
22. I ask important questions about context clues.
23. When I read online, I guess the meaning of unknown words or phrases.
24. I distinguish between fact and opinion in online texts.
25. When reading online, I look for sites that cover both sides of an issue.
26. When reading online, I translate from English into my native language.
27. When reading online, I think about information in both English and my mother tongue.

BIO PROFILE

Dong Kangxing holds his Master of Arts (in English Language) from Hebei University of Science and Technology, China. He is now pursuing his English Education doctoral degree in Universiti Malaysia Pahang. His expertise includes ELT, reading, psychology, interpretation and translation. Corresponding email: 2094405086@qq.com

REFERENCES

- Alfassi, M. (2004). Reading to learn: Effects of combined strategy instruction on high school students. *Journal of Educational Research*, 97(4), 171–185. <https://doi.org/10.3200/JOER.97.4.171-185>
- Amer, A., Al Barwani, T., & Ibrahim, M. (2010). Student teachers' perceived use of online reading strategies. *International Journal of Education and Development Using Information and Communication Technology*, 6(4), 102–113. <https://doi.org/10.1002/acp.2350020108>
- Anderson, N. (2002). Using telescopes, microscopes, and kaleidoscopes to put metacognition into perspective.

TESOL Matters, 12(4).

- Anderson, Neil. (2003). Scrolling, clicking, and reading English: Online reading strategies in a second/foreign language. *The Reading Matrix*, 3(3), 1–33.
- Cheng, R. (2016). Reading online in foreign languages: A study of strategy use. *The International Review of Research in Open and Distributed Learning*, 17(6), 164–182. <https://doi.org/10.19173/irrodl.v17i6.2567>
- Coscarelli, C. V., & Coiro, J. (2015). Reading multiple sources online. *Revista Linguagem & Ensino*, 17(3).
- De Leon, J. A. V., & Tarrayo, V. N. (2014). “Cyber” reading in L2: Online reading strategies of students in a Philippine public high school. *Journal on English Language Teaching*, 4(2), 8–17. <https://doi.org/10.26634/jelt.4.2.2793>.
- Ellis, M. (1996). The Missing Link: Academic Study Skills - Between ESL and University Courses. In Jayakaran Mukundan & The Chee Seng (edu.). *Trends in English Language Teaching*. (pp. 117-121) University Putra Malaysia Press, Serdang.
- Fadhlullah, A., & Ahmad, N. (2017). Thinking Outside of the Box: Determining Students’ Level of Critical Thinking Skills in Teaching and Learning. *Asian Journal of University Education*, 13(2), 51–70.
- Li, J. (2020). Development and validation of Second Language Online Reading Strategies Inventory. *Computers and Education*, 145(January 2019), 103733. <https://doi.org/10.1016/j.compedu.2019.103733>
- Maarof, N. (2017). Strategies in Reading Academic Texts. *Conference Pape, January*. <https://www.researchgate.net/publication/316273424>
- Majid, F. A., Jelas, Z. M., & Azman, N. (2003). Selected Malaysian adult learners’ academic reading strategies: A case study. *FACE E-Journal*, 1–11.
- Mokhtari, K., & Sheorey, R. (2002). Measuring ESL Students’ Awareness of Reading Strategies. *Journal of Developmental Education*, 25(3), 2–10.
- Oxford, R. L., & Burry-Stock, J. A. (1995). Assessing the use of language learning strategies worldwide with the ESL/EFL version of the Strategy Inventory for Language Learning (SILL). *System*, 23(1).
- Reiber-Kuijpers, M., Kral, M., & Meijer, P. (2021). Digital reading in a second or foreign language: A systematic literature review. *Computers & Education*, 163, 104115. <https://doi.org/https://doi.org/10.1016/j.compedu.2020.104115>
- Shah, N. Z. (2011). *Critical Thinking and Employability of Computer-related Graduates: The Malaysian Context*. Dublin City University, Ireland.
- Sheorey, R., & Mokhtari, K. (2001). Differences in the metacognitive awareness of reading strategies among native and non-native readers. *System*, 29(4), 431–449. [https://doi.org/10.1016/S0346-251X\(01\)00039-2](https://doi.org/10.1016/S0346-251X(01)00039-2)
- Sitindaon, M., Wijaya, B., & Salam, U. (2013). Metacognitive Online Reading Strategy Practiced By English Students. *Jurnal Pendidikan Dan Pembelajaran Untan*, 2(11).
- Swan, C. K. (2015). Effects of Online Reading Strategies and Learning Styles on Reading Comprehension of Malaysian Tertiary Esl Learners. *Upm*, 151, 10–17.
- Vaičiūnienė, V., & Užpalienė, D. (2013). Metacognitive Online Reading Strategies in Foreign Language Learning Context at University. *Social Technologies*, 3(2), 316–329. <https://doi.org/10.13165/st-13-3-2-06>
- Zhang, X., & Guo, L. (2020). Cognitive and Metacognitive Reading Strategies Training in EFL Reading. *Advances in Social Science, Education and Humanities Research*, 428. <https://doi.org/10.2991/assehr.k.200401.028>