ICRES International Conference on Research in Education and Science istes Organization
www.icres.net May 18-21, 2023 Cappadocia, Turkiye www.istes.org

Assessing ESL University Students' Metacognitive Online Reading Strategies

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Abstract: Extracting information through online reading has become second nature to ESL students in higher institutions. Although online reading is indispensable among ESL university students, they lack the ability to read effectively. The present study examines students' metacognitive online reading strategies and how those strategies reflect understanding of scientific online reading materials for academic purposes. This was conducted through an online survey and semi-structured interviews. Data was collected among 55 university students enrolled in various Science and Technology courses. Out of the same sample, ten students were selected to participate in the interviews. Data were analyzed using descriptive statistics and thematic analysis with the use of SPSS and NVivo respectively. Thematic analysis was validated using inter-rater reliability analysis through Cohen Kappa analysis that yielded substantial results, indicating that the findings were reliable. Although the findings from the survey revealed that problem-solving strategies were used mainly by students, semi-structured interviews found contradicting results where support reading strategies were believed to reflect understanding by students. Implications that can be drawn are two folds. Students are motivated to use metacognitive online reading strategies depending on the type of texts; two, the need to use different reading strategies to elicit purposeful information based on the subject matter.

Keywords: Metacognitive online reading strategies, English for Science and Technology, university students

Citation: Azmuddin, R. A., Muhammad, N. N., Uthayakumaran, A., & Zahari, H. (2023). Assessing ESL University Students' Metacognitive Online Reading Strategies. In M. Koc, O. T. Ozturk & M. L. Ciddi (Eds.), *Proceedings of ICRES 2023-- International Conference on Research in Education and Science* (pp. 93-112), Cappadocia, Turkiye. ISTES Organization.

Introduction

The most important skill of all four to master when learning a second language (L2) is reading because it directly relates to academic success at all grade levels. This is because information is obtained through reading. Hence, readers must be familiar with the reading process to understand and adhere to such information. It is important to note that the reading process is multifaceted, and learners who are new to reading and unfamiliar with reading strategies require different reading strategies to increase comprehension (Miller, 2017). There are several strategies that readers should consider before reading. This includes becoming aware of metacognition and metacognitive strategies.

Flavell (1976) described metacognition as someone's conscious ability to understand, control, and regulate cognitive process to reach maximum learning. Metacognition is a term that describes the process of comprehending information and realizing the full potential of your own mind through your own cognition (knowledge). In reading, it is the act of actively analyzing what you are reading to grasp its meaning. We refer to metacognitive awareness as our ability to reflect on what we already know with cognitive control. In other words, metacognition and metacognitive awareness are dependent on one another. In short, knowledge and attention go hand in hand.

The past decade has seen a continual development in research on reading strategies and reading comprehension. This consequently led to a demand for quality second language reading courses offered in schools and universities. Hence, to measure up to the aspirations in the Malaysian Education Blueprint, Higher Education (2015 - 2025), students are expected to have bilingual proficiency in Bahasa Melayu as the national language and English as the international language of communication (Ministry of Education [MOE], 2015). With that in mind, classroom reading instructions can be reassessed to improve students' reading comprehension. In addition, researchers have begun to emphasize reading strategies in studies of second language reading in the last 30 years. The discovery of reading strategies is vital for many reasons. They are believed to disclose the ways of learners' processes between the link with the text and the metacognitive process that they have (Daguay-James & Bulusan, 2020; Flavell, 1979; Newton, Ferris, Goh, Grabe, Stoller, & Vandergrift, 2018). In other words, it enables readers to read the text first, then organize and synthesize the information to reach their cognitive objectives.

There has been a significant increase in the studies of reading strategies employed by ESL university students (Daguay-James & Bulusan, 2020; Aziza M Ali & Abu Bakar Razali, 2019; Nguyen, 2018). Recently, the exponentially emerging online academic reading materials have become a choice of reference for students. However, in a different study conducted by Nazarov & Kovalev (2017) which concerns the transformation of 'new readers', digital materials are not the most preferred choice in reading. They have demonstrated that the reading format most preferred by youths is printed reading material as compared to digital and audio reading material, especially in Russia, the Czech Republic, and the USA. Interestingly, this result ties well with the

previous study by Jeong (2012), wherein students preferred printed reading materials as compared to digital reading material. It is interesting to note that the findings also revealed the reading comprehension of reading printed material is higher compared to digital material.

However, nowadays, online reading has become an integral part of educational practices. In academic settings, online materials have now become the main source of information for students, especially those in universities. Students are now required to read materials online daily, which can be an overwhelming experience if they struggle to understand what they read. For example, reading academic scientific materials may be difficult for students where English is not their first language. Considering the discussion above, the study on the reading strategies employed in reading online materials in the context of ESL STEM university students is yet to be explored. The following research questions were addressed:

1. What are the online reading strategies mostly used by ESL university students in reading online materials?
2. How do online reading strategies reflect students' understanding of online scientific materials?

Although previous studies have concentrated on metacognitive online reading strategies in improving reading comprehension (Miller, 2017; Ostovar-Namaghi & Noghabi, 2014; Sheorey & Mokhtari, 2001), more research is needed in online reading strategies used by university students in reading EST online materials. Therefore, this paper is determined to identify the metacognitive online reading strategies employed by ESL science and technical university students.

Literature Review

Reading Strategies

Reading requires cognitive and metacognitive reading strategies to effectively understand texts. Cognitive strategies involve thought processes that are also known as metacognitive reading strategies. They are self-regulated and self-monitoring thinking processes that are used by readers from various reading strategies based on the objectives and reading context. For example, cognitive strategies are procedures or actions used directly when readers are working with a text such as trying to guess words that they are not familiar with, whereas metacognitive strategies are actions that learners plan to manage reading, such as previewing the length and organization of the text (Sheorey & Mokhtari, 2001). Hence, being aware of reading strategies is important to ensure overall academic success.

Several studies have concentrated on metacognitive reading strategies in EFL and ESL classroom settings to enhance the reading comprehension of online texts. Stronger emphasis has been placed on metacognitive awareness and reading comprehension. Carrell, Devine, and Eskey (1988) and Sheorey and Mokhtari (2001) clearly define metacognitive awareness as reading strategies that readers employ during reading. They further

laborated that metacognitive awareness is the ability of the reader to set his reading goals and their awareness of their own reading process. The use of metacognitive reading strategies will enable readers to overcome problems they face when reading and ultimately help achieve reading comprehension. Research on metacognitive reading strategies has categorized these strategies into three subgroups: global, problem-solving and support strategies.

Global strategies are when readers plan their reading by previewing the text or having a purpose in mind whereas, problem-solving strategies refer to the actions of readers reading a text, such as guessing the meaning of words or rereading. Support reading strategies are those that readers use to assist in reading, such as looking up words in dictionaries or highlighting (Sheorey & Mokhtari, 2001). All these sub-categories fall under metacognitive reading strategies. When readers use metacognitive reading strategies, it enables them to overcome any problems they encounter and ultimately achieve comprehension. As stated in many studies, learners who are proficient readers utilize more metacognitive strategies than those who are less proficient (Magogwe, 2013; Miller, 2017), and they appear to monitor their reading process (Wu, 2014). This allows for better reading ability and proficiency. To become proficient readers, students should pay attention to metacognition and metacognitive strategies.

Metacognitive Online Reading Strategies

Studies have indicated that metacognitive awareness is an essential reading strategy for successful comprehension. Similarly, various studies have explored the use of metacognitive online reading strategies among students at the university level. In a local study by Zailani Jusoh and Liza Abdullah (2015), OSORS was used to identify online reading strategies among 155 students. The study compared two academic disciplines to identify differences in strategy use among the two groups. The study concluded that there was no significant difference in the strategy used among the two groups. However, problem-solving strategies were most favoured. This contradicts Nor Fazlin Saaduayah and Nadzrah (2011) that found support strategies to be most favoured. Similarly, in another local study by Ruhil Amal, Nor Fariza and Afendi (2017) most students used metacognitive reading strategies when reading academic texts online. The study was conducted among 55 Science and Technology students in a public university. Data was collected through OSORS among students. The data revealed that the mean score for each sub-category was 3.79, 3.51 and 3.22 for problem-solving, global and support reading strategies respectively. Hence, this indicates that problem-solving strategies were mostly used by university students.

In recent years, various studies have focused on metacognitive awareness as a reading strategy at the university level. For example, Zaidatul Akmal Abd Hamid et al. (2020) conducted a study on 495 students in the Centre of Foundation Studies of a local public university using OSORS to find out their metacognitive online reading strategy awareness. The study revealed that the students mostly used problem-solving strategies when dealing with online reading materials, followed by support strategies, and the least used strategy was global reading strategies. In relation to that, it was also reported that the top three most used problem-solving strategies by the

students were re-reading the text, paying closer attention to what they read and reading slowly and carefully to understand the text. In another study done by Heri Mudra (2018), aimed to explore the metacognitive online reading strategies used by 65 pre-service EFL teachers at a state college in Indonesia and to describe their experiences implementing those strategies. Data were collected both quantitatively and qualitatively using OSORS and semi-structured interviews, respectively. His study revealed that global reading strategies were the most frequently used strategy by his respondents, followed by problem-solving strategies and the last was support strategies. Surprisingly, the results do not seem to correlate with the findings of other studies which reported problem-solving strategies as the most favoured strategy (Zailani Jusoh & Liza Abdullah, 2015; Ruhil Amal et al., 2017; Zaidatul Akmal Abd Hamid, Ismail Sheikh Ahmad, Mohd Shukri Nordin & Zainurin Abdul Rahman, 2020). Meanwhile, the results from the semi-structured interviews indicated that there were various strategies employed to comprehend the online texts - focusing on simplified and colourful texts, translating texts into their mother tongue, which is Indonesian, reading for fun and utilising schemata or previous knowledge. Overall, these studies highlight the need for the application of metacognitive reading strategies to become successful online readers.

Reading strategies and reading comprehension

Newton et al. (2018) proposed interrelating skills and knowledge resources that affect reading comprehension among ESL students. Among the skills mentioned is the ability to apply reading strategies when dealing with difficult academic reading texts and observe reading comprehension with reading goals. However, the extent to which reading strategies employment's relation to reading comprehension is mixed (Gatcho & Hajan, 2019; Rastegar, Mehrabi Kermani & Khabir, 2017; Zuriyani Md Yasin & Mohamed Ismail Ahamad Shah, 2019). Gaucho and Hajan (2019) reported a significant increase in comprehension after explicit metacognitive reading strategies among ESL school students. A similar conclusion was reached by Rastegar et al. (2017), whereby a significant and positive relationship is found between metacognitive reading strategies and comprehension among ESL Iranian university students. This does not seem to be the case in the local Malaysian setting as Zuriyani Md Yasin and Mohamed Ismail Ahamad Shah (2019) pointed out that no correlation exists between reading strategies and reading comprehension. However, to become a proficient reader, students should pay attention to metacognition and metacognitive strategies.

Theoretical Discussion

Metacognitive Theory

The process of achieving reading comprehension requires a few factors related to metacognitive theory. Flavell (1979) posits that the mind perceives and monitors the cognitive process by determining the goals set for the task, strategies and actions employed to achieve the desired goals based on interactions between metacognitive experiences and metacognitive knowledge. Both metacognitive experiences and metacognitive knowledge are introduced as metacognitive strategies that relate to metacognitive theory. Metacognitive theory was expanded

into a metacognition model by Anderson (2002). This was then adapted to relate to the current study that focused more on reading strategies as opposed to Anderson (2002) that focused on mechanisms for learning strategies through metacognition. Both Flavell (1979) and Anderson (2002) theories and models were chosen for the current study because they depict principles that are useful for examining metacognitive reading strategies. Based on these principles, Anderson (2003) created an Online Survey of Reading Strategies (OSORS) that was very similar to Survey of Reading Strategies (SORS) created by Sheorey and Mokhtari (2001). However, OSORS and SORS differ in terms of some of the elements linked to reading online that cannot be used for reading printed texts such as 'search' activities. These instruments are widely used in SL reading research that included reading habits in an online environment, which SORS lacked.

Methodology

The aim of the study was two-fold. Firstly, it attempts to identify metacognitive strategies frequently used by ESL learners while reading EST online materials. Secondly, it purports to assess the influence of these strategies in understanding the online materials. To achieve this, a mixed-method research design was adopted for this study. In doing so, semi-structured interviews were conducted to support the data gained from OSORS.

Participants

Data were collected among students (n=55) that were enrolled in English for Technical Communication (ETC) course undertaken in their second-year study from the various undergraduate Science and Technology programs at the university. The participants consisted of 39 (71%) male and 16 (29%) female students between the ages of 20-22 years old. From this sample (n=55), ten students were purposely selected to take part in the semi-structured interviews. To elaborate further, opportunistic sampling was undertaken when selecting these ten volunteer participants as it can lead to novel ideas and surprising findings (Creswell, 2008). Pseudonyms were then used for each participating student (n=10) to conform to anonymity.

Instruments

Data was collected using a web-based survey platform. The survey consisted of a demographic profile and five-point Likert-scale statements. The statements were based on the Online Survey of Reading Strategies (OSORS) adapted and adopted from Anderson (2003). The survey measured metacognitive online reading strategies for academic purposes. It is made up of 36-items that measures: global reading strategies (16 items), problem-solving strategies (11 items) and support reading strategies (9 items) (Appendix A). The reliability for the Global Reading Strategies, Problem Solving Strategies and Support Strategies were 0.77, 0.64 and 0.69, respectively. The Cronbach alpha for the overall survey is 0.92. Hence, making the survey a reliable instrument.
The semi-structured interview protocol was used to support the data gathered from OSORS. A set of questions was designed by the researcher that was guided by a study by Chen (2009) on a similar topic. Chen (2009)

explored students' online knowledge of reading strategies and their thinking processes as they read texts on the internet. Similarly, the current study also explored these elements of online reading strategies and measured strategy applications before, during and after reading materials on the internet. Ultimately, the questions used by Chen (2009) were restructured and used for the current study that explored tertiary level students' online reading strategies when reading academic EST online materials.

Data Collection

Data was collected twice (in week two and week four) during a 14-week academic calendar. In Week 2, the students (n=55) answered OSORS through an online survey. Students took approximately 15 minutes to complete the survey that was conducted through Survey Monkey after class time. From the sample, ten students were selected to be involved in the semi-structured interviews. In Week 4, the interviews were conducted at the participants' preferred time and location. All 10 participants agreed to be a part of the research and filled up consent forms. It was also agreed that pseudonyms would be used throughout the study to conform to anonymity.

Data Analysis

To obtain the frequency of each sub-category from OSORS, quantitative data analysis was determined through mean, median, standard deviation mode, which was computed through Statistical Package for Social Science (SPSS) software. However, qualitative data analysis was analysed and cross-checked by two raters. This form of verification was crucial to determine the level of agreement among the raters towards the themes created by the researcher. These raters are considered 'outside' experts who can confirm the themes and act as neutral individuals toward the data analysis (Cohen, 1960). The rating process was conducted separately and the rater's agreement on the codes, their definitions and comments were noted. Then, the researcher discussed any disagreements and feedback. Next, modifications were made based on their suggestions. The numbers of agreed and disagreed items from each rater were then gathered and calculated to obtain the Kappa value. The Kappa value was pulled from the interview data.

To validate the themes, Cohen Kappa inter-rater reliability analysis was used in the SPSS software. Cohen's Kappa was used to calculate the probability of similarity between the raters. The following formula was used to calculate the Kappa value of the developed themes.

$$k = \frac{fa - fc}{N - fc}$$

Inter rater one:

$$k = \frac{18 - 10}{20 - 10} = \frac{8}{10} = 0.8$$

Inter rater two:

$$k = \frac{16 - 10}{20 - 10} = \frac{6}{10} = 0.6$$

Mean score .8+.6 ÷2 = 0.7

The calculation yielded a K value of 0.7 for the interviews. The K value for the interviews indicated there was substantial agreement thus, showing that the data analysis had high reliability. Another method for enhancing data trustworthiness and credibility is through triangulation. Denzin (1978) as cited in Merriam (2009) addressed four triangulation types, where this study applied multiple methods of data collection to triangulate the data. For this, data collected from OSORS was checked against what students answered in the semi-structured interviews. The purpose was to also identify how ORS reflect students understanding of reading online materials. In addition, for the semi-structured interviews, the themes that were derived from the interview transcripts were matched with the OSORS statements alongside the descriptive statistics.

Results

This study explored the metacognitive online reading strategies mostly used by students in reading EST online materials. In doing so, a survey was conducted online using the Online Survey of Online Reading Strategies (OSORS), which consists of three parts: Problem Solving strategies, Global Reading strategies and Support Reading Strategies. In addition, semi-structured interviews were conducted to support the data gained from the OSORS, which were then matched against the statements in OSORS and reported. Each subpart is described statistically in the following sections.

Problem-Solving Strategies

The three most frequent problem-solving strategies used were P26 (When an online text becomes difficult, I reread it to increase my understanding), P14 (When an online text becomes difficult, I pay closer attention to what I am reading) and P9 (I try to get back on track when I lose concentration) with the mean score M = 4.40, 4.26 and 4.13, respectively. For P26, out of 55 participants, 29% answered *"4" usually* and 56% answered *"5" always*. This showed that a total of 47 students chose to reread an online text which is difficult to comprehend.

The second highest strategy number P14, with a total of 47% answered *"4" usually* and 40% answered *"5" always* equating to a total of 48 students who concentrate on their online reading materials when the text becomes difficult. While the third highest statement under problem-solving strategies was P9 where, 45% answered *"4" usually* while 36% answered *"5" always* indicating that 45 students believe they would get back on track when they lose concentration. Similarly, these three statements were also listed in the top 5 problem-solving strategies frequently used by the participants in the study conducted by Zaidatul Akmal Abd Hamid et al. (2020) and generally, most of the statements under this strategy received high mean scores. Overall, data on OSORS indicated that students used problem-solving strategies the most in reading online materials for academic purposes. Figure 1 shows the strategies most employed under problem-solving strategies.

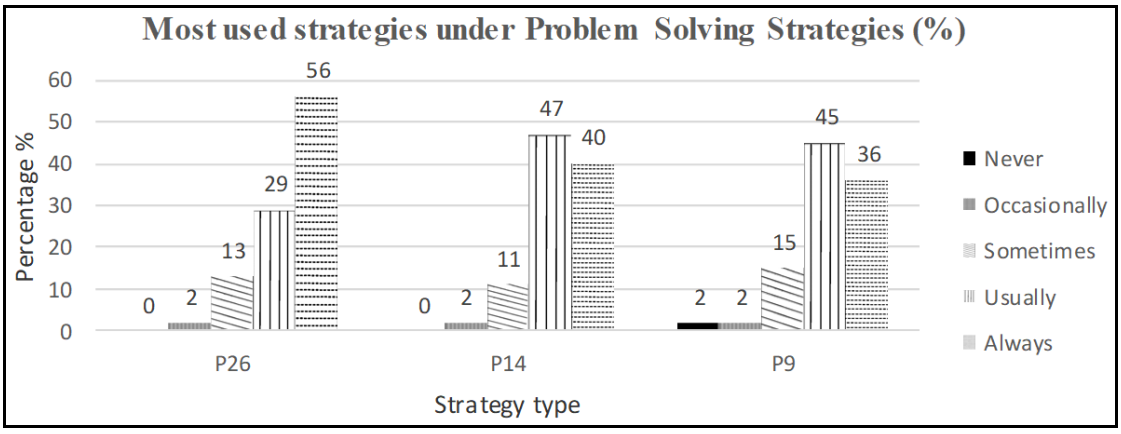

Figure 1. Problem-Solving Strategies

In addition to the data obtained from OSORS on problem-solving strategies, identification of problem-solving strategies was also obtained through semi-structured interviews. For example, three students mentioned the need to evaluate online reading texts by rereading the materials. This was problem-solving strategy No 26; *when an online text becomes difficult, I reread it to increase my understanding*. The extracts below depict this point:

- "Because just now I got write down the important points, then I will *go through the text again* so as to make sure I understand the context." (Will)
- "I will print out the article and *read it again.*" (Fatin)
- "After reading, I will usually *look at my points* that I have jot down then I *look whether it is complete* or incomplete and if it is nothing much information that I get, then I will go to another text." (Ida)

All three students above believe that rereading an online text would assist them to understand the texts better. This proves that online reading strategies were significant in understanding online scientific materials. For example, a study in a local context found students used problem-solving strategies the most in reading an English text to understand what they read (Abdul Rahim Hamdan, Mohamed Najib Ghaffar & Ahmad Johari Sihes, 2010). The study was conducted among a group of 57 students in a tertiary level institution in Malaysia. The study found that students put more attention to difficult texts by rereading them to increase understanding. Hence, problem-solving strategies such as rereading difficult texts are important for ESL learners. Meanwhile, two students reported using problem-solving strategies by evaluating the texts while reading online. The extracts below reflected strategy No 32; *I critically evaluate the online text before choosing to use information I read online*.

- "I try to find more sources and *analyse each source whether it is reliable* or not reliable. I try to collect more information, then only I categorise the information." (Omar)
- "I try to *evaluate* the text. Do I need it?" (Amin)

Based on the excerpts above, two students admitted the need to evaluate online reading materials. This shows that students set their reading goals by evaluating the online reading text. Analysing the text critically helped the readers to decide whether to adapt the content or not (Heri Mudra, 2018). To summarize, Table 1 illustrates the themes identified in the interview responses that were matched with problem-solving strategies items in OSORS.

Table 1. Semi-Structured Interview Themes Matching Problem-Solving Reading Strategy Statements

Themes	Statement No.	Problem-Solving Strategy (in OSORS)
Reread online materials *(n = 3)*	26	When an online text becomes difficult, I reread it to increase my understanding.
Evaluate online text *(n = 2)*	32	I critically evaluate the online text before choosing to use information I read online.

Referring to Table 1, data gained from OSORS was supported through the analysis from the semi-structured interviews. The themes derived from the semi-structured interviews matched strategy No 26 (n=3) and 32 (n=2) in OSORS. Similarly, a study that looked at types of metacognitive online reading strategies and frequency in the use of these strategies found that less proficient learners used problem-solving strategies the most while proficient learners were found to use global strategies the most (Eghlidi, Abdorrahimzadeh, & Sorahi, 2014). A probable explanation for this is that students needed to take actions while working with online texts to achieve comprehension. They believed this is dealt with rereading when encountering difficult texts, paying closer attention to the difficult text they are reading and critically thinking about what they are reading, all of which are important components of problem-solving strategies.

Global Reading Strategies

The highest mean score for global reading strategies was for strategy number G3 (I think about what I know to help me understand what I read online) with 4.02, followed by strategy number G18 (I use context clues (i.e. look at other words) to help me better understand what I am reading online) with a mean score of 3.82 and 3.71 for strategy number G24 (I check my understanding when I come across new information). Both G24 and G25 (I try to guess what the content of the online text is about when I read) have the same mean of 3.71, and hence, the standard deviation is considered. The standard deviation for G24 is 0.78 while standard deviation for G25 is 1.04. G24 is chosen as the most-used global reading strategy instead of G25 because of its smaller standard deviation. A smaller standard deviation indicates that the data has small variation, and the data is less dispersed. Smaller standard deviation also means that the data is more consistent and, therefore, more precise.

Based on global reading strategy number G3, 58% answered *"4" usually*, while 23% answered *"5" usually*. This indicates that 45 participants (81%) think about what they know to help them understand what they read online. Based on Schema Theory, recall and comprehension are dependent on the reader's background

knowledge and how it is matched to textual data (Carrell et al., 1988). This shows that background knowledge plays a significant role in online reading comprehension. With 53% answering *"4" usually* and 20% *"5" always* for strategy number G18, this clearly illustrates that students (*n*=40) used contextual clues to help them have a better understanding of what they read online. In addition, more than half (66%) (*n*=36) of the participants checked their understanding when they came across new information while reading online. This contributes to 53% of students that answered *"4" usually* while 13% answered *"5" always*. Figure 2 depicts the most global reading strategies used by students.

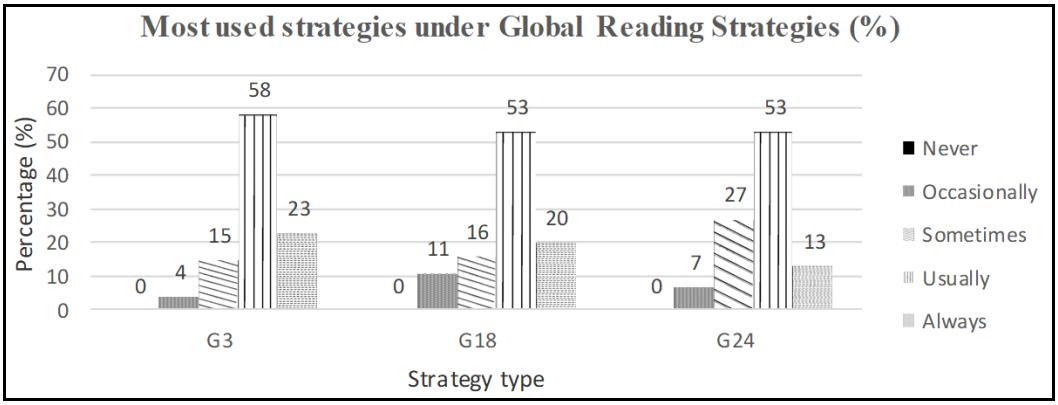

Figure 2. Global Reading Strategies

Based on the semi-structured interviews, having a purpose in mind before reading EST online materials is important. This theme matched OSORS strategy No. 1 *I have a purpose in mind when I read online*. The extracts below described this further:

- "I think I will clear my mind and *focus on what I am reading*." (Seth)
- "Before I start reading, *I am going to plan* what am I going to search and *what is it about* before I look for the text." (Kaden)
- "I read the title and then I try to understand, *if it's interesting I will read everything if it's not I am going to stop*." (Omar)

Two of the students (Seth and Kaden) claimed they used this strategy before reading EST online materials. Another student (Omar) will determine what to read and what to ignore. This finding echoed an earlier study on online reading among 54 ESL university students where global strategies were found to be used more for reading online materials (Ostovar-Namaghi & Noghabi, 2014). The study concluded that when students can plan their reading, it implied that they were clear about the objectives of reading. This becomes a determining factor for successful learning. As Sheorey and Mokhtari (2001) hypothesize, metacognitive awareness encompasses the ability to set reading goals and awareness of the reading process. Based on the interview excerpts, it can be concluded that all three students utilize metacognitive knowledge. This contributes to successful reading of

online materials.

Scanning through the text before reading was one of the most preferred global strategies students used. This was like OSORS strategy No 30; *I scan the online text to get a basic idea of whether it will serve my purposes before choosing to read it*. The interview transcripts below illustrate that students scanned the text before reading.

- "Basically, when I am just reading the Science and Technology hypertext, I am just *scanning through* the lines and paragraph." (Ida)
- "Before I read the text from the online and because the text is very long right, *I will go through some points* from the text *to see what the points are* in the first paragraph, second paragraph, and third paragraph so on. So, *I* can *easily understand* about the content inside later on." (Will)
- "Normally I will *scan through* the article first rather than reading the entire text." (Tini)
- "Normally I will *scan through* the article first la". (Fatin)

Four students employed scanning strategy before reading to gain a general idea of the passage. It is considered a global reading strategy that provides students with an overview of the text. Clearly, students believe scanning through the online material is a much-needed reading strategy. This strategy transferred from paper-based reading was also found in a study that investigated online reading (Park & Kim, 2017). The study found that students adjust their reading strategies based on different reading environments and purposes. Overall, these results corroborate the notion that students transferred paper-based reading strategies to online reading.

Another feature of Global reading strategy that was identified in students' reading process was strategy No. 16; *I use tables, figures, and pictures in the online text to increase my understanding*. This is an important reading strategy as it allows readers to predict the text. In doing so, students would be able to activate their background knowledge when they apply this strategy before reading. This form of global reading strategy includes noting the length of the text, number of paragraphs or number of words. Interview excerpts below support this finding.

- "Normally I will read the title first and then *see whether it contains the graphics or photos* and then I will direct to the contents." (Cindy)
- "I will see the *title first*. Mostly I'll see the title first." (Qay)
- "First, before I read an article I will *look for the title of the article* about what and then I will *open several article* and *read overall*." (Fatin)
- "Before I read, I will skip through to the end and *count as how many paragraph* it has." (Amin)

The excerpts above highlight four examples of students reading strategy in noting text features such as graphics or photos and number of paragraphs. This reading strategy may provide students with beneficial information about the text to increase their understanding of the reading text. Identifying text features before reading is important because it prepares students for what to expect in the reading texts. The students admitted that they

would scan the text, look at the title, and note text features before reading. According to Heri Mudra (2018), students preferred reading simplified and colourful texts which can help them to visualize the information to better understand the texts. Hence, it is important for students to utilize appropriate reading strategies before reading to activate their background knowledge of the reading materials. Table 2 illustrates global reading strategy statements matching the themes derived from the semi-structured interviews.

Table 2. Semi-Structured Interview Themes Matching Global Reading Strategy Statements

Themes	Statement No.	Global Reading Strategy Statement
Having a purpose *(n=3)*	1	I have a purpose in mind when I read online.
Scanning *(n=4)*	30	I scan the online text to get a basic idea of whether it will serve my purposes before choosing to read it.
Using text features and noting text characteristics *(n=4)*	16	I use tables, figures, and pictures in the online text to increase my understanding

As shown in Table 2, the themes identified in the semi-structured interviews that matched the global reading strategies obtained from the OSORS are strategy No. 1 (n=3), strategy No. 30 (n=4) and strategy No. 6 (n=4). It is apparent from this table that students used global reading strategies when reading online materials. Hence, reflects the use of online reading strategies in understanding online reading materials.

Support Strategies

The three most frequently used strategies under support strategies were strategies number S13 (I use reference materials (e.g. an online dictionary) to help me understand what I read online), S23 (I go back and forth in the online text to find relationships among ideas in it) and S36 (When reading online, I think about information in both English and my mother tongue). The lowest among the three most used support strategies is strategy S36 with the mean score of 3.71. 19 students answered *"4" usually* and 15 *"5" always* indicated that students do think about what they read in the language that they were familiar with to ease their understanding when reading online materials.

Strategy number S23, received the second most mean, M = 3.76 among the three most used support reading strategies. This shows that students try to find relationships among ideas when they read online materials to increase their understanding. On the other hand, strategy number S13 gave the highest mean, M = 3.93. Strategy number S13 indicates that participants use reference materials to guide them in understanding the text they read with 38 students stating that they *usually* and *always* do this. Figure 3 shows the most strategies used under support reading strategies in percentages.

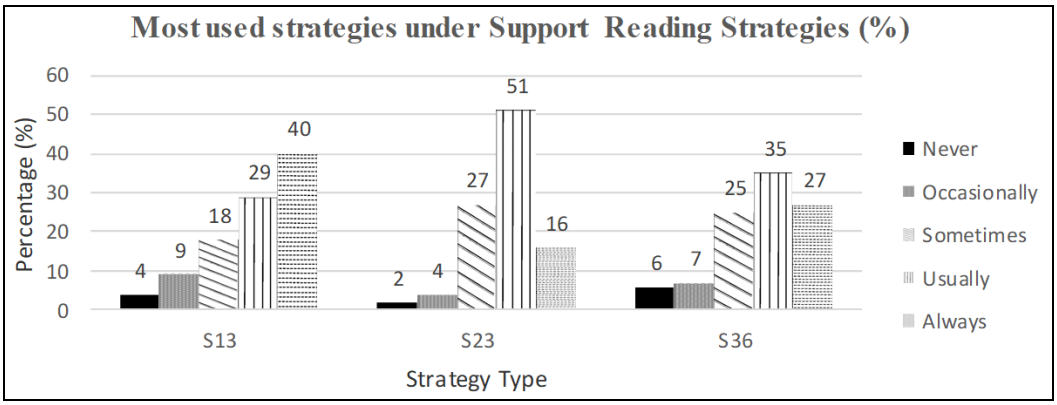

Figure 3. Support Reading Strategies

It is believed that support strategy No 2 *I take notes while reading online to help me understand what I read* are reflected the most in the semi-structured interviews. Most students have a preference to use this reading strategy while reading EST online materials. As displayed in the excerpts below, eight students reflected this reading strategy:

- "I will *take note the important information* that I wanted. I will *jot down the points* that I get from the text and I will try to understand from the elaboration." (Ida)
- "I will find the main point and *make some writing on the paper* about the main point. That is all". (Amin)
- "Maybe *I can jot down in the notebook* and somewhere then *next time I can use* it when I want to find out". (Cindy)
- "I usually will *jot down the important points* from what I read. For future reference I guess". (Tini)
- "After I read something like note means something that related to academic, I will make some *note in a piece of paper* so that I will know what the main point of the text I read." (Kaden)
- "I will prepare a paper or prepare the note inside the laptop, then I will go through the points and *write it down the notes* and *maybe highlight* it. Or *I'll underline certain words* that I don't understand." (Will)
- "While reading, I will *underline the main points and important messages* that being delivered from the text or *I will do a mind-map* in simpler form so that I can roughly get what it meant by just referring to the mind-map." (Seth)

The interview transcripts above reflect the strategies students used when they read EST online materials by writing down important information, underlining main points and even doing a mind-map. They believe that these strategies are important because the notes that are written down may be used in the future or can be used as a reference and shared with others. This indicated that the students do invoke conscious strategies and utilize metacognitive knowledge in reading. Flavell (1979) posits that metacognitive knowledge allows a person to prioritize tasks and use various strategies to achieve the desired goals.

After reading EST online materials, some students summarize and paraphrase the ideas to understand and remember the texts better. This is support strategy No. 19 in OSORS *I paraphrase (restate ideas in my own words) to better understand what I read online* as depicted in the excerpts below:

- "I will *summarize my ideas and rewrite it* in full sentences so that it is complete and can understand better." (Seth)
- "Because just now I got write down the important points, then *I will go through the text again and paraphrasing* it so as to make sure I understand the context." (Will)
- "I will *summarize the point of article* and rephrase it a little". (Fatin)
- "I just *review it again* and *make it simpler*." (Ida)
- "I usually *make a conclusion* about it. I bear in mind what I understand from the paragraph." (Kaden)

The excerpts above illustrate various forms of support reading strategies that students use. This includes summarizing, paraphrasing, and reviewing. According to the students, these strategies enable them to understand and remember the texts better. Another common support strategy used by students was to use reference materials such as online dictionaries and Google Translate to understand what they are reading online. This is support strategy No 13 *I use reference materials (e.g. an online dictionary) to help me understand what I read online*. This can be seen in the interview excerpts below.

- "I always read the text first. Later if I do not know the words, some vocabularies, so I will *check the dictionary*". (Qay)
- "I *check the dictionary online.* So, that later on I can go through the text easily. Also, I will go *google search* the words. Other than google search, like wikipedia and so on". (Will)
- "Sometimes when I found the problem I just *google* actually or I *look for dictionary* to find the meanings". (Tini)
- "For phrases, I just basically *'google'* it and then try the different webs that give the *meaning for that terminologies.*" (Ida)
- "*I* will *refer to the dictionary* or internet…Try to *search for the meaning of the phrases*". (Kaden)
- "I *will refer to dictionary* to search for the words and its meaning online. *I also look for example of sentences and the way of using that words in a sentence*…I will search online maybe other websites maybe google translate for the meaning of the phrases." (Seth)

As the interview excerpts depict, students relied heavily on using online dictionaries and Google Translate when they face reading difficulties such as incomprehensible words or sentences during reading. This indicated that students monitor their reading process by making the effort to comprehend the text they are reading. Students comfortably resort to these online resources when they face decoding problems. Using online support resources to compensate for the lack of word knowledge is found to be common among learners in online reading environments (Huang, Chern, & Lin, 2009) because decoding is crucially important for reading comprehension

(Grabe & Stoller, 2013). To summarize, Table 3 illustrates OSORS statements that matched the themes derived from the semi-structured interviews.

Table 3. Semi-Structured Interview Themes Matching Support Reading Strategy Statements

Themes	Statement No	Support Reading Strategy Statement
Taking down notes *(n=7)*	2	I take notes while reading online to help me understand what I read
Paraphrasing & summarizing *(n=5)*	19	I paraphrase (restate ideas in my own words) to better understand what I read online
Using reference materials *(n=6)*	13	I use reference materials (e.g. an online dictionary) to help me understand what I read online

It appears that strategy No 13 (n=7), is an important global reading strategy for the students. Students believe they need to use reference materials such as online dictionaries and google translate to help them understand difficult online reading materials. They also needed to ask friends or lecturers to understand some difficult reading texts they encountered.

Discussion

Results from OSORS indicated that students perceived problem-solving strategies to be more useful than global and support strategies. However, there is an inconsistency of data in OSORS to that of the semi-structured interviews. The interviews found problem-solving strategies to be the least used and support reading strategies were used the most by students. For example, 8 students admitted to taking notes while reading online, another 5 admitted to paraphrasing and summarizing ideas read online, while another 8 used reference materials to assist reading of online materials. In contrast to problem-solving strategies, only 3 students reread and 2 evaluate online materials. In total, there were 21 counts of using support reading strategies compared to only 5 students using problem-solving strategies. As reported by Zailani Jusoh and Liza Abdullah (2015), students in Information Technology course were generally more familiar with the Internet features such as online dictionaries and references, which could be a probable explanation why they employed more support reading strategies compared to other students in different field of studies. This is similar in the current context as students in this study. As all participants were from Science and Technology background, they might be applying support strategies more frequently than the other strategies due to the nature of the reading materials that they are dealing with throughout their studies. In addition, Zaidatul Akmal Abd Hamid et al. (2020) also reported that the use of reference materials to aid reading of online materials had the highest mean score of 4.17 in their study and none of the statements under support strategies fell under the low level of mean score. This shows that students are quite familiar with the use of support strategies when reading online.

Based on semi-structured interviews, most of the students reported that they are quite capable of using various

strategies in reading online materials. Four students (Will, Fatin, Ida, and Kaden) use all the strategies (problem-solving, global and support strategies) when reading online. However, there is some evidence to suggest that students lack other important reading strategies such as guessing contextual clues, visualizing information, and deciding what to read and whether content of online text fits reading purposes. These strategies are important to equip learners with online reading skills for them to effectively learn in an online environment (Magogwe, 2013). As past studies show, many students still need guidance at all levels and in most content areas (Green 2013; Lai et al 2014 and Wise 2009 as cited in Armbrecht (2018). Lessons should be executed to show or demonstrate how to use these strategies successfully. Therefore, there is a need to continue applying online reading strategies such as problem-solving strategies efficiently at all levels, including university and in all subject areas with multiple modalities.

The data also revealed that the metacognitive online reading strategies chosen were interrelated and led to one objective that is to improve student's understanding towards the text they read online. This is especially important for ESL students who are reading EST online materials at a higher level. Students in higher education need to use higher order thinking skills when reading academic online materials such as EST. Based on the statements selected by the students, it is believed that students need to apply these strategies in reading online materials at tertiary level.

Conclusion

The aim of this study was to explore the metacognitive online reading strategies used by university students in reading EST online materials. The contrasting data from two research instruments found a mismatch in the application of metacognitive online reading strategies among the students. The mismatch of data describing the students' familiarity to reading strategies may depend on the type of texts, need and the nature of texts (Daguay-James & Bulusan, 2020). Although students are prone to unconsciously reverting to metacognitive reading strategies, Ruhil Amal et al. (2017) asserts the need for students to be guided in the process of applying metacognitive reading strategies to promote effective understanding of texts. The employment of online metacognitive reading strategies emphasised the need for students to be aware of their reading objectives. The participants are ESL science and technology undergraduate students who are confronted with technical reading materials that require problem-solving strategies more than global and support strategies. The focus and interaction with a reading text will differ uniquely from field to field. It is imperative to note that the popularity of metacognitive online reading strategies found in this study is not conclusive to all technical fields.

Recommendations

There are several emerging research directions in the study that call for further action. The most prevalent research direction is the need to draw comparisons between different datasets. The engagement of focus groups with students from other fields of study can provide a comprehensive input on the effectiveness of online

metacognitive reading strategies. In addition to obtaining insights on the effectiveness by comparing the two datasets, the inclusion of a bigger sample in a study could provide a better representation of students' online metacognitive reading performance. Secondly, the underpinning of this study focused solely on online reading strategies in the academic settings. Future research could focus on the integration of technological tools and learning management systems in achieving comprehension regardless of texts. Another potential research strand is studying students' experience whilst applying online reading strategies. By investigating students' experiences in applying online reading strategies, not only will it provide insights into students' motivation but will also aid future research in understanding why certain reading strategies are preferred by students. This research is hoped to be a source for future contributions in studying metacognitive reading strategies.

Acknowledgements or Notes

This research was supported by IIUM-UMP-UiTM Sustainable Research Collaboration Grant 2020 (SRCG) ID: RDU200725.

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