Effect of Metacognitive Online Reading Comprehension Strategies on Students' Comprehension Achievement in the Digital Era

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Abstract: This study aimed to examine the effects of metacognitive online reading comprehension strategies (MORCS) on students' online comprehension achievement as they read online texts that incorporate hyperlinks or webpages. This study examined the process that students engage in while using MORCS to read online texts and whether there is an improvement in students' comprehension achievement in the digital era. The samples involved thirty technical skills students assigned to treatment class for an experiment. In class, students were taught how to use MORCS as they attempted comprehension tasks given on this link: www.readtheory.com. The MORCS questionnaire was distributed to all samples at the beginning of treatment, and followed by a pre-test was distributed to all the samples via a link to check on their existing comprehension performance. After completing the treatment, a post-test was administered to all the samples for responses by giving them a link. The data were analysed using SPSS software version 24.0. The findings indicated that most students engaged with strategies such as clicking on keywords, scrolling up and down on the text, using the e-dictionary for word meanings, rereading, and using Google translation for words or phrases and pictures, visual aids, or sounds to understand the online text. Others used videos or audio to support their reading for better understanding. The test results showed that after the intervention, there was an improvement in the students' online comprehension achievement. Pedagogical implications and future research were also included in this study.

Keywords: Digital Era, Hyperlinks or Webpages, Metacognitive Strategies, Online Texts, Students

1. Introduction

The originality of this study is based on bringing a new perspective on online reading comprehension strategies among technical-based students and research on a different population in the digital era. This study was conducted in a technical skills institute in East Malaysia. Since the English language is used as a main medium of teaching and learning in the institute; therefore, the students need to understand the four skills of learning a language, which are reading, writing, speaking, and listening. This

study focuses on reading as students are required to improve their language through reading or online reading using materials from the Internet. The researcher believes that reading is one of the most important skills to learn and improve in students' English and communication subjects. The primary purpose of reading in this study was to understand the students' online reading experiences in reading online texts with links or hyperlinks that may require them to use components such as appropriate reading strategies, themes, or textual clues to rise to the potential online reading challenges. Past studies affirmed that reading is a process of understanding the fundamental cognitive process that involves decoding symbols to arrive at meaning for information, an active process of constructing the meaning of words and connecting with prior knowledge for meaningful reading experiences. Past studies found that online reading is not easy because it involves the process of extracting meaning from a text that is in a digital format and incorporates hyperlinks or webpages (Zhang et. al., 2021). Reading for understanding requires students' ability to reason, synthesise, solve problems, and interpret information. Meanwhile, reading in an academic context involves multidimensional interactions between readers, activities, texts, and contexts. These create a supportive classroom environment to enhance the strategic reading process that involves factors that make reading comprehension difficult (Dewi & Sahiruddin, 2020). Online texts involve materials or information that students use with hyperlinks, images, animation, audio-visuals, and videos, making reading more challenging. Previous studies have shown that reading comprehension requires knowledge and application of appropriate reading strategies (Bogaerds - Hazenberg, 2021; Zhang et. al., 2021) to improve reading comprehension effectively.

With the development of new technology towards digitalisation and artificial intelligence, reading online comprehension texts remains a crucial issue in the field of education, especially in teaching and learning English as a second language (Jusoh & Abdullah, 2016a; Mukhriz, 2019). In this paper, the researcher aims to answer three research questions: (1) What are the effects of Metacognitive Online Reading Comprehension Strategies on students' process of reading online texts?, (2) Is there any difference in students' usage of Metacognitive Online Reading Comprehension Strategies before and after the intervention?; (3) Is there any improvement in students' online comprehension achievement after the Metacognitive Online Reading Comprehension Strategies intervention?

2. Literature Review

In the era of technology, the Internet has become one of the most important tools for education and information (Guthrie & Wigfield, 2019). As Internet users increase, literacy practices in reading have also changed in response to the challenges and resources available on the Internet. Online reading has become a common situation for most students, but the effectiveness and efficiency of digital reading are uncertain, as students have not received formal training on ways to read online comprehension texts effectively (Brun-Mercer, 2019). Previous research confirmed that the internet plays a major role in determining today's academic and business success because of its speed in providing information, its potential to retrieve and store information, to assist with problem-solving, and to offer instant connection and interactivity (Cao, et al., 2020; Coiro, 2018; Ruan, et al., 2018).

In line with that, motivation and cognitive effort can affect students' attitudes and perceptions towards language learning in a non-linear environment (Ozer & Kilic, 2018). To improve students' ability to read hypertext, metacognitive strategies, and ICT development help to support online academic reading and improve online reading comprehension using a variety of problem-solving strategies, global strategies, and support strategies. Zhang et al., (2021) emphasise a combination of reading and exploration strategies. The limitation of knowledge or strategies may cause challenges for students to understand what they read online. Alejandro, Perez, and Rivera (2023), in their study, highlighted that online classes, especially in the realm of Information and Communication Technology (ICT), pose several challenges for both instructors and students. Thus, students need to be taught to use appropriate online reading strategies that suit their styles in sustaining the English language learning experience (Ulu & Ulusoy, 2019). The effectiveness of online learning achievement depends on students' willingness to adopt and engage themselves in using the Internet (Global Market Insights, 2022). Previous studies perceived that student engagement in online

learning with regards to teaching styles and computer self-efficacy has been suggested to enhance students' learning performance (Alzahrani, Alrashed, Jdaitawi, Abdulghani, Nasr, Ghanem, & Kholif, 2023).

However, internal elements such as personality, attitude, effort, drive, and self-confidence may affect students' participation in learning (Barua et al., 2020). Other confounding factors involving the students' interests in academic majors, participation in class, participation in co-curricular activities, family economic condition, family support, parental guidance, the necessity for getting a job, the necessity for making money, necessity for economic self-sufficiency, necessity for helping the family financially, departmental learning facilities, teachers' quality, student-teacher relationship, and institutional learning environment positively might also affect students' academic performance mediated by their motivation for learning. (Siddiky & Haque, 2024). In spite of that, determining the appropriate reading strategies used by students is crucial because such activities can lead to future illiteracy (Stevani & Ginting, 2022). Studies of comprehension appear to be interrelated and mutually supportive when it comes to screen reading (Stevani & Tarigan, 2023). Suitable strategies are essential because online reading can be daunting for students to search for the most helpful information online, given that digital platforms often include a vast amount of information (Gao et al., 2022). Past studies urged the need to improve student's reading comprehension skills or strategies as well as their reflective and critical thinking skills (Francisco, 2021) for better online comprehension achievement. Students must adhere to the requirements of 21st-century education that need students to learn online and monitor their learning. The importance of metacognitive strategy in reading electronic texts (online texts) turned out to be more critical because of the complexity involved in constructing self-directed intertexts (Akmal & Abd, 2020). Besides that, reflective thinking, inquiry-based learning, ease of use, and perceived usefulness help to influence critical thinking skills among students (Ni, Ma'rof, & Sulaiman, 2024) According to systematic reviews, reading comprehension achievement might improve through training in reading strategies (Talmor et al., 2020; Zhang, 2020). Previous studies indicated that one of the skills in reading comprehension was that a digitally literate learner could identify erroneous, irrelevant, or biassed information used to consolidate knowledge, even if the quality of information and sources seem authoritative and reliable (Shirvani & Porkar, 2022). More importantly, strategies for reading online texts are necessary and compulsory for students to engage in language learning (Manssour, 2021; Magnusson, et.al., 2019).

Therefore, to suit the need to improve students' online reading skills, metacognitive online reading comprehension strategies (MORCS) were used as a guideline for technical skills students. In this study, the students pathed their reading process using the Self-regulated Online Reading Pattern (SORP) that was introduced by Coiro and Dobler (2007). While using MORCS, the students used SORP to focus as they read the text in a non-linear environment and when they had to face a more complex metacognitive process. This meant that the students had to ensure that they read the online text on track, and SORP enabled them to know the next step to take. SORP is often used when students read online reading texts, which are a bit complex and difficult to understand for decision-making processes that help students in planning, predicting, monitoring, and evaluating what they read on the internet. Figure 1 shows the SORP introduced by Coiro and Dobler (2007) to path the process of reading online texts while engaging in using MORCS.

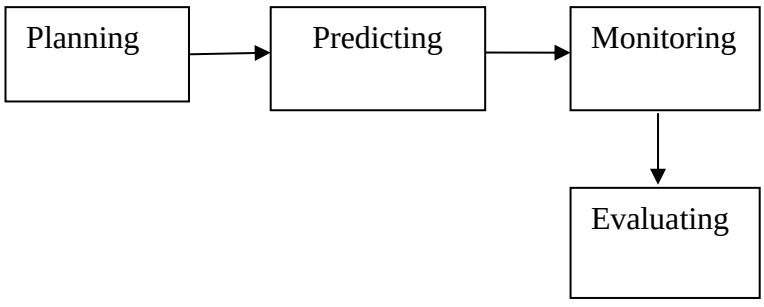

Fig. 1 Process of reading Online Texts as suggested in SORP
Source: Self-regulated online reading pattern (Coiro, 2014; Coiro & Dobler, 2007).

Based on SORP, each time a student is faced with a new webpage that contains a new series of links to choose from and new information to read or interact with, this cycle begins again. This means that, when the student is given a new online task, the student would first plan what should be done for reading and predict what to expect from the texts. Then, when they start to read, the students monitor what they read and ensure that they understand the content or messages of the texts. The last process is evaluation. At the evaluation stage, students are required to check their choice of answers and the suitability of materials that may help them achieve their reading goals.

The webpages that students can utilise for reading comprehension practice or comprehension practice include ReadTheory.org, ReadWorks, and UsingEnglish.com. The many web pages and hyperlinks that lead to reading materials are important platforms to polish the students' understanding of the target language. The need for reading comprehension and the widespread use of laptops, mobile phones, and the internet has broadened the role of reading literacy (Ahmadi, 2017; Caverly al. et., 2019).

3. Methodology

Sample

The sample of this study involved a group of 30 semester one students who were assigned to an experiment class. The students' proficiency and knowledge of the English language were based on their Malaysian Certificate of Education examination (SPM) English results.

Instrument

This study used an experimental type of research method with one treatment group. It focuses on the quantitative method using a questionnaire, pre-test, and post-test. The instruments were the Metacognitive Online Reading Comprehension Strategy (MORCS) questionnaire and the comprehension tests. The MORCS questionnaire consists of forty-six (46) items and four categories: Global strategies (12 items), Predicting strategies (10 items), Problem-solving strategies (12 items), and Support strategies (12 items). This questionnaire used the Likert scale according to the following: 1 = Never, 2 = Seldom, 3 =Sometimes, 4 = Often, 5 = Always. The MORCS reliability was determined using Cronbach's Alpha, and the value is more than 0.70 or 70% of the standard reliable alpha value often used for a research instrument. Meanwhile, the tests were extracted from the www.ReadTheory.com webpage and validated by a content expert from a local university.

Procedure

The data collection process began with quantitative data from students' responses to the MORCS questionnaire on the Google form link given to check on the student's existing knowledge of MORCS strategies. After that, the students were asked to answer a pre-test question via the Google form link given at the initial stage for feedback and to check on their fluency in attempting comprehension questions extracted from the Internet. After completion, all thirty (30) students joined the treatment sessions. The students were taught to use MORCS items when they read online texts for better comprehension and to check on the process the students engage themselves in while using the MORCS items. The students completed the tasks and ensured the use of MORCS items to guide them when they read the tasks online. The students discussed answers with the teacher in charge of the sessions. After completing all the sessions, a post-test link was blasted out to the students to be answered within one and a half hours to check on whether the students' reading comprehension achievement would increase after the treatment. The data was gathered and analysed using SPSS version 24 software.

4. Findings and Discussion

4.1 Effect of Metacognitive Online Reading Comprehension Strategies on Students' Process of Reading Online Texts

In this study, the effect of MORCS used by the students could be seen based on Wiersma (2002) Mean Score Range and its Likert Scale Equivalent, where the mean scores ranging from 4.20 to 5.00 are regarded as "always", mean scores ranging from 3.40 to 4.19 are regarded as "often", mean scores ranging from 2.60 to 3.39 are regarded as "sometimes", mean scores ranging from 1.80 to 2.59 are regarded as "rarely or seldom", and mean scores ranging from 1.00 to 1.79 are regarded as "never" used by the students. Table 1 displays the T-test result that was conducted to determine the effect of MORCS usage by the students before and after the intervention.

a. Usage of MORCS while students were reading the online text

The effect could be seen in the overall usage of MORCS while the students were reading the online texts given in the intervention class.

Table 1. The Overall Result for Students' Usage of MORCS Before and After Intervention

MORCS	Before Intervention (n=30)		After Intervention (n-30)		t	p
	M	SD	M	SD		
Global Strategy (GS)	3.69	0.85	3.90	0.80	3.52	.00*
Predicting Strategy (PS)	3.69	0.79	3.88	0.75	3.53	.00*
Support Strategy (SS)	3.67	0.79	3.85	0.85	3.53	.00*
Problem Solving Strategy (PSS)	3.78	0.82	3.90	0.82	3.61	.00*
Overall	3.71	0.81	3.88	0.81	3.81	.00*

*p < :0.5

The overall mean score for the four categories of strategies before the intervention was (M=3.71; SD=0.81) compared to after the intervention (M=3.88; SD=0.81). There was an increase of mean score (M=0.17; SD=0.00). The mean score for GS was increased from (M=3.69; SD=0.85) to (M=3.90; SD=0.80); $t(56)=3.52$, $p<0.05$ after the intervention, mean score for PS was increased from (M=3.69; SD=.79) to (M=3.88; SD=0.75); $t(56)=3.53$, $p<0.05$ after the intervention, mean score for SS was increased from (M=3.67; SD=0.79) to (M=3.85; SD=0.85); $t(56)=3.53$, $p<0.05$ after the intervention and mean score for PSS was increased from (M=3.78, SD=0.82) to (M=3.90; SD=0.82); $t(56)=3.61$, $p<0.05$ after the intervention. These results indicate that there was effect of MORCS used by the students as they read the online texts after the intervention. It was also found that the students applied more MORCS after the intervention to help them gain better comprehension. This result confirms research by Talmor et al., (2020) and Zhang, (2020), which indicate that comprehension achievement improves through training and practicing of reading strategies. Besides that, past study stated that determining the appropriate reading strategy is crucial for students as such practice might lead to an increase in better literacy in the future (Stevani & Ginting, 2022). Another effect was that the students used the appropriate online reading strategies that suited their styles in sustaining the English language learning experience (Ulu and Ulusoy, 2019), which could enhance comprehension. Students' engagement in online learning with regards to teaching styles and computer self-efficacy, in fact, enhances their learning performance (Alzahrani, Alrashed, Jdaitawi, Abdulghani, Nasr, Ghanem, & Kholif, 2023).

4.2 Differences in the Usage of Metacognitive Online Reading Comprehension Strategies Among Students Before and After the Intervention

This section's findings indicate differences in students' usage of metacognitive online reading comprehension strategies before and after the intervention. The results are explained in subheadings (a), (b), (c), and (d).

a. Usage of MORCS to Read Online Text at the Planning Stage

At the planning stage, the effect of using MORCS among the students could be seen from the differences in average mean scores. The results indicated that the majority of the students in this study used GS item 1 (M =4.10; SD =0.84) after the intervention compared to (M=3.57; SD=0.89) before the intervention, which gave a difference of mean M=0.53. This portrayed the effect of MORCS on the students' interest to read online texts for fun and to enjoy their reading.

Table 2. Usage of GS Items Before and After Intervention

No.	Item	Before Intervention		After Intervention		Difference	
		M	SD	M	SD	M	
1	.I read pages on the Internet for fun	3.57	.89	4.10	.84	0.53	
2	.I read on the Internet for academic purposes	3.60	.86	3.63	.71	0.30	
3	When reading online, I look for sites that cover both sides of an issue	3.73	.87	3.83	.79	0.10	
4	I have a purpose in mind when I read online comprehension	3.70	.65	3.60	.85	-0.10	
5	When reading online text, I decide what to read closely and what to ignore	3.53	1.00	3.80	.81	0.27	
6	I think about whether the content of the online text fits my reading purpose	3.77	.86	3.87	.78	0.10	
7	I think about what I know to help me understand what I read online	3.83	.87	4.00	.69	0.17	
8	.I ask myself questions when I read the online text	3.70	.99	4.00	.94	0.30	
9	When I read online, I guess what the content of the online text is about	3.83	.83	4.10	.79	0.27	
10	When I read online comprehension, I check my understanding when I come across new information	3.81	.68	4.13	.82	0.32	0.14
11	When I read online, I evaluate the information presented in the online text	3.37	.89	3.73	.87	0.36	
12	When reading online text, I use typographical aids like boldface and italics to identify key information	3.87	.82	3.97	.67	0.10	
Valid N (listwise)	30						

As seen in Table 2, the items that reported an increase in mean score after the intervention were item 11 with a difference of M =0.36, item 10 was M=0.32, both item 2 and item 8 mean scores were M=0.30 and item 9 and 5 mean score was M =0.27. This shows that the effect of focusing on MORCS helped the students in planning their online reading for better comprehension. The students were aware that

planning is essential as they read the text in a non-linear environment and when they had to face a more complex metacognitive process (Manssour, 2021; Magnusson et al., 2019).

b. Usage of MORCS to Read Online Text at the Predicting Stage

At the predicting stage, with MORCS the students learnt to predict what to expect from their reading and set a target of what to achieve from the online texts for the benefits of learning. This shows that Predicting Strategy (PS) as one of the MORCS components also helped the students to focus and path their reading stages to achieve their reading goals.

Table 3. Usage of Predicting Strategy Items Before and After Intervention

No.	*Item*	Before Intervention		After Intervention		Difference
		M	SD	M	SD	M
13	I think this online text will lead me to the answer to my assignment	3.67	.84	3.83	.75	0.16
14	I am hoping this online text will take me to the exact information to complete the tasks.	3.73	.74	4.10	.78	0.37
15	If I click here on online text, I'd expect to find the correct answers for my assignment.	3.60	.77	3.80	.71	0.20
16	If I scroll through the text, I expect to understand the online text.	3.77	.73	3.93	.83	0.16
17	If I use typographical features like boldface and italics, I'd expect to identify key information in the online text	3.47	.63	3.90	.71	0.43
18	I check to see if my guesses about the online texts are right or wrong	3.83	.75	3.83	.75	0.00
19	If I highlight the words meaning, I'd expect to understand better the online text.	3.63	.85	3.86	.68	0.23
20	If I use the grow and shrink the font size functions, I'd expect to identify new words	3.60	1.03	3.77	.77	0.17
21	If I use Caret to navigate the reading pane, I'd expect to increase online reading speed	3.60	.77	3.90	.80	0.30
22	If I use the thesaurus, I will get the correct meaning or answers.	3.97	.76	3.87	.73	-0.10
Valid N (listwise)	30	3.69	0.79	3.88	0.75	0.19

Results in Table 3 demonstrated that PS items that had higher differences in mean scores between the students' responses before and after the intervention were item 17 with the mean score difference of M=0.43, item 14 was M=0.37, item 19 was M=0.23, item 21 was M=0.30 and item 15 was M=0.20. The higher the differences in mean scores represented, the more often the students responded to PS items to help them manipulate, interpret, and benefit from the knowledge gained from the online texts. Coiro and Dobler (2007) believed that predicting should be used as a crucial strategy when students read complex online texts. The results showed that students made predictions, had expectations, and checked on their reading goals. Their reading might lead their reading focus to better comprehend the texts and achieve their reading goals.

c. Usage of MORCS to Read Online Text at Problem-solving Strategy Stage

As shown in Table 4, it was found that the PSS items were components in MORCS that the students used quite often. The effect on the students' ways of tackling the online text could be seen from the differences in mean scores. The students' responses to the online texts increased after the intervention compared to before the intervention. This is probably due to the student's awareness of the strategies that could help them better comprehend the online texts.

Table 4. Usage of PSS Items Before and After Intervention

No.	Item	Before Intervention		After Intervention		Difference
		M	SD	M	SD	M
23	I try to get back on track when I lose concentration reading online	3.73	.79	3.70	.88	-0.30
24	When reading online text becomes difficult, I pay closer attention to what I am reading	3.83	.83	3.73	.91	-0.10
25	When I read online, I scroll through the text to help me understand the overall view of the text	3.90	.76	4.00	.87	0.10
26	When reading online, I guess the meaning of unknown words or phrases	3.73	.83	3.70	.70	-0.30
27	I stop from time to time and think about what I am reading online	3.80	1.03	3.90	.76	0.10
28	When an online text becomes difficult, I re-read it to increase my understanding	4.03	.72	4.10	1.01	0.07
29	I read slowly and carefully to make sure I understand what I am reading online	3.97	.76	4.13	.86	0.16
30	I can distinguish between fact and opinion in online text	3.50	.82	3.90	.80	0.40
31	I evaluate the online text before using it	3.90	.61	3.80	.61	-0.10
32	When reading online text, I am going back and forth between the text	3.57	.97	3.83	.83	0.26
33	I apply page up and page down to get the meaning of the online text	3.70	.84	4.10	.76	0.40
34	I adjust my reading speed according to what I am reading online	3.67	.84	3.90	.88	0.23
	Valid N (listwise) 30	3.78	0.82	3.90	0.82	0.12

Table 4 portrays an increase in usage for most of the items in PSS. The results showed the differences in average mean scores of the students' responses while using PSS items after the intervention compared to the mean score before the intervention. As seen in Table 4, PSS item 32, item 34, and item 29 had increased in mean score differences M =0.26, M =0.23, and M=0.16. The PSS item 30 and item 33 had the highest increase, where both mean score differences were M=0.40. The PSS items that slightly increased after the treatment session were item 25, item 27, and item 28. Others showed no difference, as students might have used the items moderately depending on their reading needs. This could mean that the students responded positively to using online texts with appropriate strategies that suited their reading purposes. Indeed, the internet plays a major role in determining academic sources, retrieving information, assisting students with problem-solving strategies, and offering instant connection and interactivity to enable them to read online texts effectively (Cao, et al., 2020; Coiro, 2018; Ruan, et al., 2018). The effectiveness and

efficiency of digital reading should be improved by formal training on reading online comprehension texts effectively (Brun-Mercer, 2019) to achieve better results.

d. Usage of MORCS to Read Online Text at Support Strategy Stage

The SS was placed as the last stage for being a support component in MORCS. The SS items focused more on the online support tools or apps that the students could utilise for reading the online texts. Besides reading skills, the selected tools or apps that were used as items in SS involved a keyword button to click on, an online notebook to jot essential points, a translation button to get meaning, a thesaurus button, Google translation to paraphrase sentences, references like visual aids or pictures, and videos. As mentioned in previous studies, the need for reading comprehension and the widespread use of laptops, mobile phones, and the internet have broadened the role of reading literacy (Ahmadi, 2017; Caverly al. et., 2019). The MORCS items in the SS component could affect the students' online reading experiences and enhance the effectiveness of reading online texts. As displayed in Table 5, the students used the SS items better after the intervention than before the intervention.

Table 5. Usage of SS Items Before and After Intervention

No.	Item	Before Intervention		After Intervention		Difference
		M	SD	M	SD	M
35	When reading online, I look for materials in English	3.70	.88	3.73	.78	0.03
36	When online text becomes difficult, I read aloud to help me understand what I read	3.70	.70	3.93	.73	0.23
37	When I read online, I click on the key word to help me understand the text	3.50	.73	3.87	.82	0.37
38	While reading online, I take notes to help me understand what I read online	3.53	.78	3.87	.78	0.34
39	When reading online, I translate from English into my native language	3.83	.91	3.93	.91	0.10
40	I use reference like thesaurus to help me understand what I read online	3.80	.71	3.90	.89	0.10
41	I paraphrase (restate ideas in my own words) to help me better understand what I read online	3.73	.74	3.93	.83	0.20
42	I go back and forth in the online text to find relationships among ideas in it	3.63	.72	3.87	.78	0.24
43	I ask myself questions I like to have answered in the online text	3.60	.86	3.77	.86	0.17
44	I use reference materials (e.g., visuals, pictures) to help me understand what I read online	3.77	.73	4.00	.89	0.23
45	I use references like e-dictionary to help me understand what I read online.	3.80	.71	3.87	1.00	0.07
46	I print out a hard copy of the online text, then underline or circle information to help me remember it	3.47	1.00	3.57	.89	0.10
	Valid N (listwise) 30	3.67	0.79	3.85	0.85	0.18

The results showed that item 37 in SS scored the highest difference in mean scores of the student's responses, where M=0.37, item 38 was M =0.34, item 42 was M=0.24, item 36 was M=0.23, and item 44 was M=0.23. Apart from that, Support Strategy items that showed the students' usage had a little increase were item 45, where M=0.07, item 35 was M=0.03, and item 41 was M=0.02. Other items that displayed

results with the least difference in mean score were item 39, item 40, and item 46 with M=0.01. As seen from the results, many students used to click (item 27), visuals and pictures (item 34) and use videos or audio for meaning and better understanding of the online texts. The students used support strategy items to improve their ability to read hypertext (online texts). Previous studies motioned that students could utilise metacognitive strategies and ICT development (tools or apps) that help to support online academic reading and improve online reading comprehension using a variety strategy including support strategies (Zhang et al., (2021).

4.3 Effect of MORCS on Students' Online Comprehension Achievement

The results showed an improvement in reading comprehension test achievement on students' post-tests compared to the pre-test. The use of MORCS could be one of the tools that improve the students' comprehension achievement in the test. Table 6 shows the students' results for the pre-test and post-test.

Table 6. The results of the pre-test and post-test.

		Treatment group (TG)			
No	Question	Pre-test		Post-test	
		M	SD	M	SD
1	As used in paragraph 1, the word invisible means…	3.20	0.71	4.00	0.00
2	Which choice correctly describes how sounds are heard?	3.40	0.62	3.60	0.97
3	Why does the author of this passage mention a pool?	2.03	1.03	1.27	0.64
4	According to the passage, what is the name of the most famous echo chamber in the world?	1.90	0.80	2.07	0.37
5	Using the passage as a guide, which sound has the highest frequency?	2.77	0.97	2.97	1.25
6	The passage discusses each of the following aspects of sound EXCEPT,	3.23	0.82	2.90	0.40
7	Where is Marty going?	3.70	0.65	4.00	0.00
8	Which is NOT a reason for bringing a good pair of boots?	3.30	0.47	3.00	0.00
9	What is the second important thing Marty talks about?	3.33	0.66	3.63	0.81
10	In the middle of the passage, Marty says, "You could hike into a river, you could hike up a mountain, or you could even hike off a cliff!" Why does he say this?	2.90	0.84	2.07	0.45
11	According to the passage, a compass gives information about…	1.77	1.07	1.63	1.10
12	How does Marty explain to Paul how a compass works?	2.73	0.91	2.87	0.68
13	The writer wrote this passage to _____.	2.43	1.36	3.50	1.14
	N = 30	2.82	0.84	2.89	0.60

As displayed in Table 6, the mean score results showed improvement for questions 'Q7-Where is Marty going?' M (3.70) to M (4.00), 'Q2- Which choice correctly describes how sounds are heard?' M (3.40) to M (3.60), 'Q9-What is the second important thing Marty talks about?' M (3.33) to M (3.63), 'Q13-Why did the author most likely write this passage?' M (2.43) to M (3.50) and 'Q1 – As used in paragraph 1, the word invisible means' M (3.20) to M (4.00). It was found that the total mean score for the pre-test and post-test results of students was increased from M (2.82) to M (2.89) with a difference of M (0.07). The results showed that students provided correct answers for most of the questions in the post-test

compared to the pre-test. It was found that the students performed well, especially on questions that required them to get the meaning of words, for example questions 1 and 2.

5. Pedagogical Implication

In a digital era, teaching students to employ MORCS could help increase students' understanding on the complexity of the texts and improve the usage of reading online strategy, implement them when necessary, and develop processes for improving comprehension and learning. This study found that MORCS should be implemented to integrate the new literacy of reading online comprehension texts besides teaching how to read on paper. Furthermore, most teaching and learning are delivered online via Microsoft Teams, Google Classroom, Cisco Webex, and Zoom apps, which require upgrading teaching knowledge in using digital applications, especially in learning the English language with appropriate online reading strategies. Norman and Furnes' (2016) discovered that students use tools and apps to support their understanding while reading online texts. The findings of this study highlight the need to help students expand their knowledge by using appropriate strategies like "click on keywords to help understand texts", "use appropriate online reference materials like e-dictionary, visuals, images, videos or sound", and "scroll or highlight the words or phrases online" to gain practical online reading experience. This is because the usage of MORCS could affect the students' ways of reading online texts, and students used MORCS items differently to suit their needs to achieve their reading goals. This is a positive sign as students must prepare for digital literacy in the 21st century to practise self-directed skills towards lifelong learning. Nauman & Salmeron, (2016) suggested that when reading online, most young readers need to have self-directed skills in selecting and organising the materials they encounter to achieve their reading purpose. Thus, to read online materials, students need to organise their thinking by planning, predicting, and focusing on strategies that could support what they read to achieve their reading purpose. Nevertheless, several issues remain to be addressed, though there were positive responses among the students involved with the present study. Thus, more studies should involve higher education students in technical skill fields with larger samples to verify the suitability of the approach in more expert web surfers' backgrounds for more beneficial reading experiences in a digital era.

6. Conclusion

In conclusion, metacognitive online reading comprehension strategies(MORCS) are powerful tools to enhance students' comprehension and English language achievement. Though many questions surround the use of MORCS, this study's findings showed an effect of MORCS on the students' comprehension achievement. There were also distinct differences in mean scores between the students' responses while engaged in using MORCS and their responses during the think-aloud intervention. It was also found that most of the students could employ most of the MORCS items that suit their reading needs to solve the tasks' requirements, purposes of reading, and reading goals. This reveals that teaching technical skills to students how to think about their thinking process enables them to equip themselves with the skills necessary to take control of their learning and become independent learners. As TVET students, these skills are necessary for the technical students' academic success and crucial for lifelong learning in the technology world for a better future career.

7. Limitations and suggestions for future research

There were limitations in this study. The sample involves only students with technical skills, and the data focuses on one centre only. Hence, it may not be sufficient to represent students in technical skill institutes located in East Malaysia and West Malaysia. Besides the questionnaire, the method used to collect data was a think-aloud protocol intervention, and the students may alter their behaviour or thoughts to align with what they believe the researcher expects. This can distort the accuracy of the verbalisation and undermine the validity of this study. It may not fully capture participants' cognitive processes, particularly

in complex or real-world scenarios. Therefore, future research could consider larger samples from various similar institutes in Malaysia and various academic settings to obtain more vigorous and transferable findings. Besides that, also consider students of other higher education organisations as samples to verify the suitability of the approach in more expert web surfers' backgrounds for more beneficial reading experiences in a digital era. Additionally, more studies should be done involving the think-aloud protocol intervention in using MORCS among groups of students with different approaches rather than with a no-training group condition to determine the depth effects of the MORCS items when reading online texts. This is because previous studies have proven that online reading strategies can be taught, and once the use of online reading strategies has been developed, students become better readers. Further studies should also be done on how teachers teach the usage of MORCS to students and how this can change the students' reading ability and understanding of the English language in a non-linear environment. This is essential as more studies may help readers explore more online reading strategies for the benefit of language learners and readers in other fields. It is hoped that the findings could contribute to the knowledge and information of the educational sector, such as the policymakers, curriculum designers, educators and stakeholders involved in students' education, for a better understanding of students' current reading trends.

8. Co-Author Contribution

The authors affirmed that there is no conflict of interest in this article. Author 1 carried out the fieldwork, prepared the literature review, and overlooked the whole article. Author 2 worked out the research methodology and procedure in this study. Authors 3, 4, and 5 helped with the data entry, statistical analysis, and interpretation of the results.

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