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Medical College Students' Use of Metacognitive Strategies in English Online Reading

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Abstract

Combined with the ubiquitousness of internet, technological gadgets and digital tools, mobile assisted language learning is undergoing rapid development and online reading has become an integrated part of college English education, especially in medical colleges, which requires students to get corresponding reading skills and strategies in their daily study. Metacognitive strategies, as one of language learning strategies, has been a heated topic in students' English reading, but the awareness and use of them in online English reading haven't been emphasized. Since metacognitive strategies are of great help to effective online reading and autonomous learning, it is essential to know whether they have been used or to what extent they have been employed and then to explore some suggestions for college English teaching and learning. Based on 296 questionnaires and six students' think-aloud sessions, this study focused on the use of metacognitive online reading strategies by medical college students, aiming to explore the frequency of metacognitive online reading strategies employed by college students and to know the differences in the use of metacognitive online reading strategies of college students with different English proficiency, then to search for effective ways to help students become autonomous language learners.

Keywords

metacognitive strategies, online reading, college students, difference

1. Introduction

Reading as one of the four language skills is quite significant for EFL learners because of the deficiency of authentic language learning environment in China. As for medical college students, their reading purposes are not only for tests, but also for information and understanding. The skills of medical knowledge acquisition through English reading are significant for medical college students.

Owing to the Internet technology, mobile assisted language learning goes viral among college students, and digital reading or online reading are popular with them which satisfied their needs of being exposed to vast amounts of reading materials (Goodwyn, 2014). Medical college English teaching should focus on teaching students what to learn and how to learn, thus improving their autonomous learning ability. As the key to achieve autonomous learning, language learning strategy has been a heated research field in recent years, among which, the use of metacognitive strategies in the reading process were emphasized to promote effective reading. Reading is a complicated mental process during which the brain has to use multiple language systems such as morphology, syntax and phonology and employ one's other background knowledge at the same time. According to Cross and Paris (1988), reading is a powerful activity, which requires the coordination of multiple cognitive strategies to decode, understand and learn from reading materials. Oxford and Crookall (1989) defined it as a complex process of constructing meaning during which readers use strategies to facilitate their comprehension. Similarly, in Goodman's (1997) definition, reading is an active process, in which readers use effective strategies to extract meaning from a text. These definitions all point out the need of strategies in the process of reading.

Adjusting reading speed based on the flow of the text, guessing the meaning of some unknown words or using some background knowledge to help comprehension are all cognitive strategies used during reading; but according to Anderson (1991), being aware of these cognitive strategies is not enough to achieve reading comprehension. What is more important is that students know when and how to employ these strategies and more further, students need to evaluate the effectiveness of these cognitive strategies. The thinking processes involved in these cognitive strategies are defined as metacognitive reading strategies (Anderson, 2003; Mokhtari & Reichard, 2002; Mkohtari & Sheorey, 2002). Metacognitive reading strategy is a process of self-monitoring and self-regulation that readers choose among various reading strategies based on certain specific context and purpose. These processes enable the reader to consciously decide whether the chosen cognitive strategy is conducive to understanding or needs to be changed (Guo & Roehrig, 2011). By and large, metacognitive strategies play a vital role in the reading process.

2. Literature Review

2.1 Metacognitive Strategies

Brown(1983) defined Metacognitive Strategies as "high-level executive skills, including planning, monitoring and evaluating the success of learning activities" and he also distinguished metacognitive strategies from metacognitive knowledge, and the former are some general skills through which students manage, direct, regulate and guide their language learning, while the latter refers to information that language learners acquire about their learning. Wenden (1998) defined it as

"self-management strategies", that is, the management skills learners use to supervise and manage their learning. According to Ellis (1994), metacognitive strategies are learners' using knowledge about cognitive process and regulating their language learning process by planning, monitoring, and evaluation. Cohen (2000) pointed out that "metacognitive strategies involve pre-assessment and pre-planning, on-line planning and evaluation, and post-assessment of participants' language learning activities and language use events". Coskun (2010) noted that Metacognitive Strategies contain reflections on learning process, making one's learning plan, monitoring one's learning behavior and self-evaluation. According to O'Malley and Chamot (2001, p. 137), Metacognitive strategies include thinking about the learning process, planning learning, monitoring learning in the learning process or self-assessment after the completion of tasks. Although there are slight differences among these definitions, planning, monitoring and evaluation are always included in these definitions.

Researches on Metacognitive strategies can help students to learn how to learn and to become the guider of their own learning by cultivating the habit of setting goals, making learning plans, selecting specific strategies, self-monitoring, self-evaluating, and self-adjustment. Compared with cognitive strategies, metacognitive strategies belong to a higher level and it is about "knowing about one's knowing". According to Oxford's (1990) classification, language learning strategies contain cognitive strategies, compensation strategies, metacognitive strategies, memory strategies, affective strategies and social strategies. In her definition, metacognitive strategies are strategies used for centering, arranging, planning and evaluating one's learning process and the main purpose of metacognitive strategies is to control and monitor the learning process. So she categorized it into centering, arranging, planning and evaluating and the sub-categories are shown in the Table 2.1. To explore more details, Oxford also listed some specific strategies of each category. In the category of Centering one's Learning, learners need to connect what they have already known to the present materials and focus on their target materials at the same time. In the category of Arranging and planning one's learning, language learners need to understand and organize their language learning process, that is to say, they must have a holistic view of their own learning. And it requires general purpose and specific language tasks in this process. In the category of Evaluating one's learning, it includes self-monitoring and self-evaluating through which language learners monitor their learning process and assess their learning processes and results.

According to O'malley and Chamot's (2001) classification, metacognitive strategy, cognitive strategy and affective strategy are contained in language learning strategies. At first they divided metacognitive strategies into four categories, they are, selective attention, planning, monitoring, and evaluation. After think-aloud interviews, they put forward the above classification, which shows seven categories of metacognitive strategies. They are planning, directed attention, selective attention, self-management, self-monitoring, problem identification, and self-evaluation. Among them, self-monitoring includes

monitoring one's comprehension, production, auditory, style, strategy, plan and double-checking. Self-evaluation includes evaluating one's production, performance, ability, strategy and language.

Another classification of metacognitive strategies which is generally accepted by researchers classified metacognitive strategies into three components: planning, monitoring, and evaluating/regulating (Purpura, 1997, pp. 289-325). Planning refers to the selection of appropriate strategies and the allocation of attention resources. For example, allocating attention and time selectively and setting a goal for a certain task. It is a preparation before language task. Monitoring means monitoring the process of the whole language task with the purpose of improving the efficiency of an organization or a project or keeping track of one's attention. In reading, it can help students to adjust their reading speed, to self-question about the reading material, to check whether their previous understandings are right, to make sure whether their reading goals have been achieved. The third one, evaluating/regulating is based on previous monitoring and it evaluate one's production, performance, ability, strategy and language.

The three different classifications also share some similarities. They all include planning and evaluation and emphasize attention. The difference is that O'malley and Chamot's classification mentioned selective attention and problem identification which reflect more details of the learning process. This paper is prone to choose the classification of Metacognitive Strategies that is generally accepted by researchers.

According to Anderson, metacognition in the process of reading contains five parts: 1) preparing and planning for effective reading, 2) deciding when to use specific reading strategies, 3) knowing how to monitor the use of reading strategies, 4) learning how to arrange various reading strategies and 5) evaluating the use of reading strategies. Metacognition is not any of the five isolated elements and these five metacognitive strategies interact with each other in the reading process.

There are many studies about metacognitive strategies in EFL/ESL learners' online reading (Chen, 2015). Mokhtari and Sheorey (2002) identified three main Metacognitive Strategies in reading: global reading strategies, problem-solving strategies, and support strategies. Based on this classification, they designed Survey of Reading Strategies (SORS) as an instrument to measure English learners' metacognitive reading strategies. Anderson (2003) developed the Online Survey of Reading Strategies (OSORS) based on Mokhtari and Sheorey' SORS to investigate readers' use of metacognitive strategy in online reading. He conducted a preliminary survey on reading strategies employed by 247 EFL and ESL readers, and explored the influence of different L2 contexts on online reading strategies used by L2 learners. The results show that there is no significant difference in the use of online reading strategies between EFL and ESL readers. The three main metacognitive strategies in reading are shown below. Global reading strategies are strategies that enable readers to plan, monitor and manage their reading process. During reading, the readers control their cognition from a general and broad

perspective. That is to say, global reading strategies are "upper" strategies with which readers can have a deeper understanding of the reading material. Some strategies such as determining the purpose for the reading, previewing the text and using background knowledge to read belong to global reading strategies. Problem-solving strategies are strategies that enable readers to work directly with the text to solve problems while reading, like adjusting the speed of reading, guessing the meaning of unknown words, understanding the text with the help of pictures or forms and repeating the sentences when the text become difficult to understand. Support strategies are strategies that enable readers to find support mechanisms, such as using dictionaries, highlighting information and taking notes during the reading process.

2.2 Mobile Assisted Language Learning

Mobile assisted language learning is a subsidiary of mobile learning (Huang, Jeng, & Huang, 2009). Mobile learning refers to the use of mobile technology to acquire any knowledge and skills at anytime and anywhere, resulting in changes in behavior (Geddes, 2004). Owing to the advent of information technology and mobile technology, mobile devices are popular and indispensable among students, such as mobile phones, laptop, tablet PC, pads, and pods. Mobile Assisted Language Learning (MALL) came into being with the combination of mobile devices and language learning. Mehrak and Seyed (2014) defined MALL as any language learning that happens with the help of portable devices. Jarvis and Achilleos (2013) maintain that "MALL is an alternative abbreviation to CALL (Computer Assisted Language learning), which appears in people's perception of the internet". Different from Jarvis and Achilleos' views, A. Kukulsak-Hulme and L. Shield (2008) maintain that the feature of individualization and portability across varying learning context embodied in MALL makes it different from CALL. Mobile assisted language learning overcame some defects of CALL and has the advantages of more availability, more flexibility, more functionality, cheaper cost, smaller size, and so on. Among the mobile devices, mobile phones and pads are most common. Nowadays, smartphone has become the most popular mobile device on which any Apps can be installed. Apps installed on the mobile devices such as YLYK, KEKEnet, BBC news, Baici zhan, Shanbei, Quora, YouTube, can provide authentic audio-visual and reading materials to learners. Mobile assisted language learning become increasingly popular among college foreign language learners with the features of mobility of learning environment, variability of learning content and the extendibility of learning time.

According to Constructivism Learning Theory, learners are the center of their own learning, and only the knowledge that learners construct themselves can be transformed into a part of the learner's knowledge structure. Mobile learning highlights the learner's dominant position in their learning and in other words, learners themselves decide what to learn and when to learn and control their own rhythm thus becoming autonomous learners in the process.

Table 2.1. Oxford's Classification of Metacognitive Strategies

	Categories	Sub-categories
Metacognitive strategies	Centering one's learning	Reviewing and linking with prior knowledge
		Paying attention to targeted materials
		Delaying one's production to focus on listening
	Arranging and planning one's learning	Understanding one's language learning
		Organizing one's language learning
		Setting one's objectives and goal
		Identifying the purpose of a specific language task
		Planning for a specific language task
		Seeking the practice opportunity of achieving one's specific goals
	Evaluating one's learning	Self-monitoring
		Self-evaluating

3. Results and Discussion

3.1 Metacognitive Strategies used in Online Reading

3.1.1 Metacognitive strategies used by college students in online reading

Table 3.1. Reported Use of College Students' Metacognitive Strategies in Online Reading

Categories	Strategy Item	Mean	SD	Frequency Level
Global reading strategies	1	2.86	1.15	M
	2	1.74	0.854	L
	4	3.03	1.151	M
	5	2.7	1.126	M
	7	2.86	1.147	M
	9	**2.57**	1.096	M
	13	3.09	1.115	M
	16	2.6	1.131	M
	17	2.84	1.083	M
	19	**3.24**	1.038	M
	22	3.03	1.11	M
	23	2.72	1.101	M
	25	3.08	1.085	M
	26	**3.22**	1.084	M
	29	2.98	1.075	M

	31	3.05	1.162	M
Problem-solving strategies	8	3.11	1.045	M
	10	**3.25**	1.095	M
	12	3.13	1.035	M
	15	3.04	1.105	M
	18	2.99	1.033	M
	21	2.86	1.084	M
	27	**3.22**	1.1	M
	30	**3.17**	1.109	M
	32	2.6	1.1	M
	33	2.75	1.046	M
	34	**2.35**	1.092	L
Support Strategies	3	2.55	1.151	M
	6	**2.07**	1.071	L
	11	2.87	1.249	M
	14	**3.34**	1.186	M
	20	2.77	1.095	M
	24	2.86	1.07	M
	28	**2.45**	1.059	L
	35	3.16	1.183	M
	36	**3.2**	1.101	M

Notes: M stands for moderate use of strategy. L stands for low use of strategy.

Table 3.1 illustrates the 296 participants' use of different metacognitive strategies with varying degrees of frequency in online reading. The Mean of overall metacognitive strategies is 2.87 and the Means of each strategy item range from 1.74 to 3.34. Anderson's scale stated that moderate use of strategy is 2.5 to 3.4 and low use of strategy is 2.4 or lower. From the Table we can see that only four Means of strategy items are below 2.5. Item 2 has the lowest Mean I chat with other learners of English about reading materials (M=1.74). This strategy was followed by Item 6 When on-line text becomes difficult, I read aloud to help me understand what I read (M=2.07) and Item 34 When reading on-line, I look for sites that cover both sides of an issue (M=2.35) and Item 28 I ask myself questions I like to have answered in the on-line text (M=2.45). They all covered the three categories of metacognitive strategies —global reading strategies (Item2), problem-solving strategies (Item 34) and support strategies (Item 6 and Item 28). The Means of the other 32 items are all belong to moderate use of strategy and there is no Means belong to high use of strategy. Generally speaking, the frequency of

college students' overall metacognitive use is at moderate level.

Table 3.2. Means of the Three Categories of Metacognitive Strategies in Online Reading

	Mean	SD	Frequency level
Global strategies	2.85	0.70	M
Problem-solving strategies	2.95	0.68	M
Support strategies	2.80	0.67	M
Total	2.87	0.65	M

Notes: L stands for low use, M stands for moderate use, H stands for high use

Table 3.2 shows that the Mean of global strategies is 2.85, the Mean of problem-solving strategies is 2.95 and the Mean of support strategies is 2.80, which means that the frequency of college students' use of these three categories metacognitive strategies in online reading is nearly the same level. College students don't show preference to a certain category strategy in their use of online reading strategies. The most employed metacognitive online reading strategies by college students is Strategy Item 14 I use reference materials (e.g., an on-line dictionary) to help me understand what I read on-line, which belongs to Support Reading Strategies. The least employed metacognitive online reading strategies by college students is Strategy Item 2 I chat with other learners of English about reading materials, which belongs to Global Reading Strategies.

3.1.2 Difference of students' use in the three categories metacognitive strategies when reading online

Table 3.4. Statistics of the Three Categories Metacognitive Strategies

		global reading strategies	problem-solving strategies	support strategies
N	Valid	296	296	296
	Missing	0	0	0
Mean		2.8514	2.9533	2.8086
Median		2.9700	3.0000	2.8900
Std. Deviation		.70062	.68320	.67610
Variance		.491	.467	.457

Statistically, as we can see from the Table 3.4, the Means of the three categories metacognitive strategies are at the same level which belongs to moderate use of strategy. It indicates that college students utilize the three categories of metacognitive strategies at almost the same frequency and college students don't pay special attention to one certain category of strategy.

3.2 Difference in the Use of Metacognitive Strategies with Different English Proficiency

3.2.1 Difference in the use of overall metacognitive strategies with different English proficiency

Table 3.5.1. ANOVA of Metacognitive Strategies with Different English Proficiency

I: ANOVA					
Metacognitive Strategies					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	23.506	2	11.753	33.383	.000
Within Groups	103.156	293	.352		
Total	126.663	295			

According to one-way ANOVA, P<0.05, it indicates that there is significant difference among the three level English proficiency college students in their use of metacognitive strategies when reading online. However, it is important to know where the difference is. In order to get more details, Post Hoc Tests are showed below.

Table 3.5.2. Multiple Comparisons of their Differences

II: Multiple comparisons of their differences						
Dependent Variable: overall Metacognitive Strategies						
LSD						
					95% Confidence Interval	
(I) English proficiency	(J) English proficiency	Mean Difference (I-J)	Std. Error	Sig.	Lower Bound	Upper Bound
Level C	Level B	-.19276*	.09269	.038	-.3752	-.0103
	Level A	-.78148*	.10682	.000	-.9917	-.5713
Level B	Level C	.19276*	.09269	.038	.0103	.3752
	Level A	-.58873*	.08343	.000	-.7529	-.4245
Level A	Level C	.78148*	.10682	.000	.5713	.9917
	Level B	.58873*	.08343	.000	.4245	.7529

*. The mean difference is significant at the 0.05 level.

The Table above shows that there is significant difference among Level C and Level B, Level C and Level A, Level B and Level A. It means that college students with different English proficiency use metacognitive strategies divergently in their online English reading.

However, when tested in Tukey HSD and Bonferroni method, the results are a little different. The results are shown in the following tables.

Table 3.5.3. Multiple Comparisons of their Differences in Tukey HSD

III: Multiple comparisons of their differences

Dependent Variable: overall Metacognitive Strategies

	(I) English proficiency	(J) English proficiency	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	Upper Bound
Tukey HSD	Level C	Level B	-.19276	.09269	.096	-.4111	.0256
		Level A	-.78148*	.10682	.000	-1.0331	-.5299
	Level B	Level C	.19276	.09269	.096	-.0256	.4111
		Level A	-.58873*	.08343	.000	-.7853	-.3922
	Level A	Level C	.78148*	.10682	.000	.5299	1.0331
		Level B	.58873*	.08343	.000	.3922	.7853

*. The mean difference is significant at the 0.05 level.

Table 3.5.3 Multiple Comparisons of their Differences in Bonferroni

IV: Multiple Comparisons of their differences

Dependent Variable: overall Metacognitive Strategies

Bonferroni

(I) English proficiency	(J) English proficiency	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	Upper Bound
Level C	Level B	-.19276	.09269	.115	-.4159	.0304
	Level A	-.78148*	.10682	.000	-1.0387	-.5243
Level B	Level C	.19276	.09269	.115	-.0304	.4159
	Level A	-.58873*	.08343	.000	-.7896	-.3878
Level A	Level C	.78148*	.10682	.000	.5243	1.0387
	Level B	.58873*	.08343	.000	.3878	.7896

*. The mean difference is significant at the 0.05 level.

From both the two tables, we can see that P>0.05 when comparing the metacognitive use of English proficiency Level B and Level C. P=0.096>0.05 and P=0.115 >0.05in the two tables which show that there is no significant difference between Level B and Level C in their metacognitive strategies use. The same with analysis mentioned above, in terms of proficiency Level A and Level B, Level A and Level C, statistically, there exists significant difference among them. This shows that college students with higher English proficiency utilize metacognitive strategies in a higher level when reading online and there is no significant difference between the middle English proficiency students and the lower

English proficiency students in their use of online reading metacognitive strategies.

3.2.2 Difference in the use of the three categories metacognitive strategies with different English proficiency

3.2.2.1 Difference in the use of global reading strategies with different English proficiency

Table 3.6. Descriptives of Global Reading Strategies with Different English Proficiency

Global reading strategies				
	N	Mean	Std. Deviation	Std. Error
Level C	54	2.5437	.71368	.09712
Level B	170	2.7371	.62770	.04814
Level A	72	3.3519	.60340	.07111
Total	296	2.8514	.70062	.04072

The Table 3.6 shows the Descriptive statistic for global reading strategies of the three different English proficiency students. As it is presented, the Means of them are 2.54, 2.73 and 3.35. Judged from the Means of the three English proficiency, all of them belong to moderate strategy use frequency.

Table 3.7. 1. ANOVA of Global Reading Strategies with Different English Proficiency

I: ANOVA					
Global reading strategies					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	25.372	2	12.686	31.122	.000
Within Groups	119.433	293	.408		
Total	144.806	295			

Table 3.7 I shows that P=0.000<0.05, which indicates that, statistically, there is significant difference among the three level students in their use of global reading strategies when reading online. In order to explore more details, multiple comparisons was conducted below.

Table 3.7. 2. Multiple Comparisons of Global Reading Strategies's Differences in LSD

II: Multiple Comparisons of their differences				
Dependent Variable: Global reading strategies				
LSD				
(I) English proficiency	(J) English proficiency	Mean Difference (I-J)	Std. Error	Sig.
Level C	Level B	-.19341	.09973	.053

	Level A	-.80824*	.11493	.000
Level B	Level C	.19341	.09973	.053
	Level A	-.61483*	.08977	.000
Level A	Level C	.80824*	.11493	.000
	Level B	.61483*	.08977	.000

*. The mean difference is significant at the 0.05 level.

The above Table shows the Post hoc tests of the differences of the three different English proficiency students' use of global reading strategies. When comparing Level C and Level B, it indicates that statistically, there is no difference between the two different English proficiency students in their use of global reading strategies(P=0.053>0.05). In terms of Level C and Level A, statistically, it shows that there exists difference between the two different English proficiency students in their use of global reading strategies(P=0.00<0.05). As for Level B and Level A, there is significant statistical difference between the two different English proficiency students in their use of global reading strategies(P=0.00<0.05).

Table 3.7. 2. Multiple Comparisons of Global Reading Strategies's Differences in Bonferroni

III: Multiple Comparisons of their differences				
Dependent Variable: Global reading strategies				
Bonferroni				
(I) English proficiency	(J) English proficiency	Mean Difference (I-J)	Std. Error	Sig.
Level C	Level B	-.19341	.09973	.160
	Level A	-.80824*	.11493	.000
Level B	Level C	.19341	.09973	.160
	Level A	-.61483*	.08977	.000
Level A	Level C	.80824*	.11493	.000
	Level B	.61483*	.08977	.000

*. The mean difference is significant at the 0.05 level.

Another post hoc test was performed to confirm the results in the above Table. It indicates that there is no difference between the two different English proficiency students in their use of global reading strategies(P=0.16>0.05) when comparing Level C and Level B. When it comes to Level C and Level A, Level B and Level A, the results are the same with the Table 4.3 II. Combining the two multiple comparisons of the exact differences of the three groups, it is confirmed that there exists little difference between middle English proficiency college students and the lower English proficiency

students in their use of global reading strategies when reading online but college students with higher English proficiency utilize global reading strategies much more frequently than the other two groups.

3.2.2.2 Difference in the use of problem-solving strategies with different English proficiency

Table 3.8. Descriptives of Problem-solving Strategies with Different English Proficiency

Problem-solving strategies				
	N	Mean	Std. Deviation	Std. Error
Level C	54	2.6428	.71495	.09729
Level B	170	2.8451	.61833	.04742
Level A	72	3.4418	.55170	.06502
Total	296	2.9533	.68320	.03971

From the Table 3.8, it can be seen that the means of Level C and Level B are 2.64 and 2.85 which belong to moderate use of strategy. When it comes to students' English proficiency of Level A, the mean is 3.44>3.4, which indicates that it belongs to high use of strategy. It can be concluded that students with higher English proficiency tend to employ problem-solving strategies more frequently than students with lower English proficiency.

Table 3.9.1 ANOVA of Problem-solving Strategies with Different English Proficiency

I: Test of Homogeneity of Variances			
Problem-solving strategies			
Levene Statistic	df1	df2	Sig.
3.938	2	293	.021

Table 3.9.2. ANOVA of Problem-solving Strategies

II: ANOVA					
Problem-solving strategies					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	24.378	2	12.189	31.517	.000
Within Groups	113.316	293	.387		
Total	137.695	295			

The above Table shows that P<0.05, which indicates that, statistically, there is significant difference among the three different English proficiency students in their use of problem-solving strategies when reading online. In order to explore more details, multiple comparisons are done below.

Table 3.9.3. Multiple Comparisons of the Three Different English proficiency SS in Tamhane

III: Multiple Comparisons of the three different English proficiency SS				
Dependent Variable: Problem-solving strategies				
Tamhane				
(I) English proficiency	(J) English proficiency	Mean Difference (I-J)	Std. Error	Sig.
Level C	Level B	-.20234	.10824	.183
	Level A	-.79903*	.11702	.000
Level B	Level C	.20234	.10824	.183
	Level A	-.59669*	.08048	.000
Level A	Level C	.79903*	.11702	.000
	Level B	.59669*	.08048	.000
*. The mean difference is significant at the 0.05 level.				

According to the Test of Homogeneity of Variances, it shows that the variances are not equal($P=0.021<0.05$), there is significant difference among these variances. So there Tamhane was used to do the Post Hoc Tests. As Table 4.9 II and III show, although there is significant difference among the three English proficiency level students in their use of problem-solving strategies in online reading, there is no significant difference between Level B and Level C students in their use of problem-solving strategies in online reading. And statistically, there exists significant differences between higher English proficiency college students and the other two groups of students in their use of problem-solving strategies in online reading. The Means plots below also shows it.

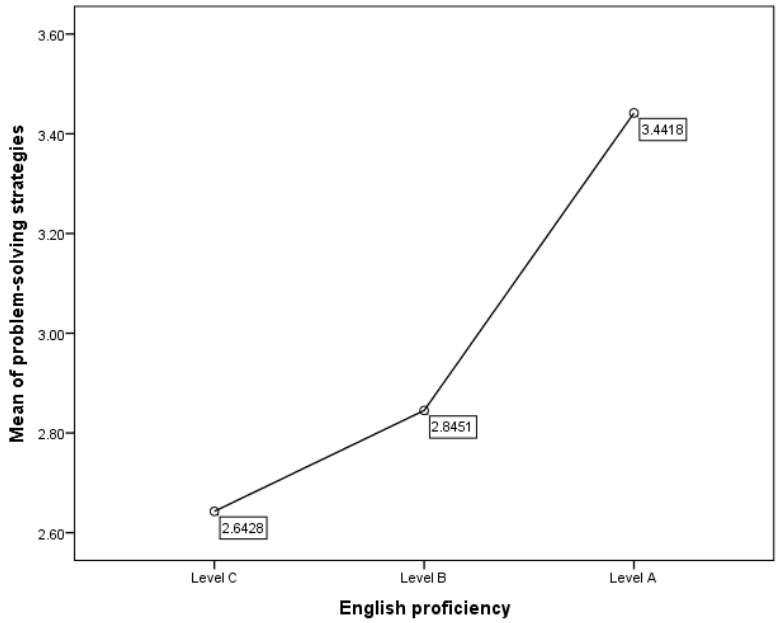

Figure 1. Means Plots of Problem-solving Strategies with Different English Proficiency

According to the Figure4.3, it can also be inferred that there is no significant difference between English proficiency Level B and Level C in their use of problem-solving strategies when reading online, while there is significant difference between Level A and Level B, between Level A and Level C in their use of problem-solving strategies when reading online. By and large, from the said analysis, there is no significant difference between the middle English proficiency students and the lower English proficiency students in the use of problem-solving strategies when reading online and significant differences lie among Level A and Level B, Level A and Level C.

3.2.2.3 Difference in the use of support reading strategies with different English proficiency

Table 3.10. Descriptives of Support Reading Strategies with Different English Proficiency

support strategies

	N	Mean	Std. Deviation	Std. Error
Level C	54	2.5307	.74803	.10179
Level B	170	2.7124	.60401	.04633
Level A	72	3.2442	.58298	.06870
Total	296	2.8086	.67610	.03930

From the Table 3.10, it can be seen that the means of Level C and Level B are 2.53 and 2.71 which belong to moderate use of strategy. When it comes to students' English proficiency of Level A, the

mean is 3.24, which indicates that it also belongs to moderate use of strategy but it is higher than students of Level B and Level C.

Table 3.11.1. ANOVA of Support Strategies with Different English Proficiency

I: Test of Homogeneity of Variances			
Support strategies			
Levene Statistic	df1	df2	Sig.
4.831	2	293	.009

Table 3.11.2. ANOVA of Support Strategies

II: ANOVA					
Support strategies					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	19.404	2	9.702	24.624	.000
Within Groups	115.443	293	.394		
Total	134.846	295			

Table 3.11.3. ANOVA of Support Strategies in Tamhane

III: Multiple Comparisons				
Dependent Variable: Support strategies				
Tamhane				
(I) English proficiency	(J) English proficiency	Mean Difference (I-J)	Std. Error	Sig.
Level C	Level B	-.18161	.11184	.292
	Level A	-.71343*	.12281	.000
Level B	Level C	.18161	.11184	.292
	Level A	-.53181*	.08286	.000
Level A	Level C	.71343*	.12281	.000
	Level B	.53181*	.08286	.000
*. The mean difference is significant at the 0.05 level.				

According to what shows in the Table 4.10, in terms of support reading strategies, the mean and Std. Deviation of the total students are shown, M=2.81, SD=0.68. And the mean of English proficiency Level C ,B and A are 2.53, 2.71, 3.24. The standard deviation of them are 0.75, 0.60, 0.58. From the table 4.11 I:Test of Homogeneity of Variances, it can be concluded that the variances are not equal, so Tamhane Test is used for the Post Hoc Tests. Moreover, there is significant difference among the three

English proficiency students in their use of support reading strategies, according to ANOVA, P=0.000<0.05. In details, as it shown in the Table 4.11 III, there are significant differences between English proficiency Level A and Level B, Level A and Level C, while no significant difference exists between Level B and Level C.

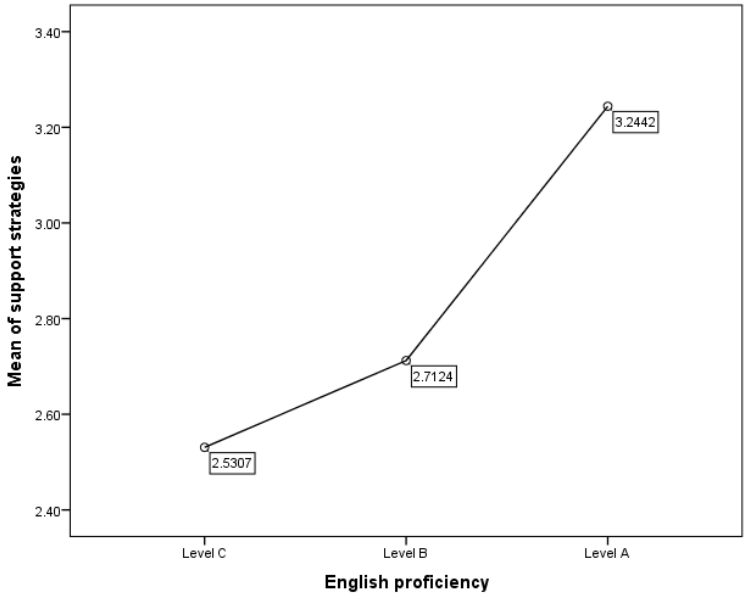

Figure 2. Means Plots of Support Strategies with Different English Proficiency

According to the Figure4.4, it can also be inferred that there is no significant difference between English proficiency Level B and Level C in their use of support reading strategies when reading online, while there is significant difference between Level A and Level B, between Level A and Level C in their use of support reading strategies when reading online. By and large, from the said analysis, there is no significant difference between the middle English proficiency students and the lower English proficiency students in the use of support strategies when reading online and significant differences lie among Level A and Level B, Level A and Level C.

4. Conclusion

This study investigated college students' metacognitive strategies use in their English online reading through questionnaires and Think-aloud protocols. It is found that almost every college online readers use metacognitive strategies when reading online and among them, global reading strategies, problem-solving strategies, support strategies are employed by all the college students and the average frequency is at moderate level. For the second research question, online college readers with higher English proficiency tend to be strategic readers. Students of higher English proficiency employed

metacognitive strategies more frequently than students of middle and lower English proficiency.

In details, firstly, college students use all the metacognitive strategies which include global reading strategies, problem-solving strategies, support strategies in their online English reading and the average frequency is 2.87 which belongs to the moderate strategy use level. The average frequency of the three categories metacognitive strategies are all at the moderate strategy use level. And college students employed Strategy Item 14 I use reference materials (e.g. an on-line dictionary) to help me understand what I read on-line most frequently and the least employed metacognitive strategy when reading online is Strategy Item 2, which belongs to Global Reading Strategies.

Moreover, college students with different English proficiency employ metacognitive online reading strategies at different frequency level. Students with higher English proficiency utilize metacognitive strategies at a higher frequency level. The frequency Means of MS(metacognitive strategies) of Level A students are much higher than that of Level B and Level C students and it shows no difference between students of Level B and Level C in their frequency of strategy use when reading online. In terms of the three categories metacognitive strategies, this survey shows that there exists difference between Level A and Level B, Level A and Level C students in their use of global reading strategies, problem-solving strategies, and support strategies, but there is no difference between Level B and Level C students in the frequency of using global reading strategies, problem-solving strategies, and support strategies when reading online.

Thirdly, the data of this study showed that college students employ metacognitive strategies at a moderate frequency in their English online reading and there exist differences among three English proficiency level students. Students at a higher English level have a high use of metacognitive strategies compared with students at middle and lower English proficiency level. Based on these results, some implications and suggestions for college EFL learning and teaching are offered. First of all, college English teachers and students should be aware of the significance of metacognitive strategies in their language teaching and learning. English teachers should update their understanding of language learning strategies and emphasize the importance of metacognitive strategies which will make students' learning more effective.In terms of metacognitive strategies, students need to know what are metacognitive strategy and how to use metacognitive strategies in their online reading. The least employed metacognitive strategy in college students' online reading implies that interactions among online readers need to be emphasized. In addition, English teachers should train students' metacognitive strategies through think-aloud method and learner autonomy should be emphasized throughout the college education.And college students themselves should train their metacognitive strategies consciously when reading online.

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