Developing a reciprocal teaching/learning system for college remedial reading instruction

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ABSTRACT

In face-to-face instruction of Reciprocal Teaching (RT), students’ reading processes and dialogues with their peers are hardly observed. As a result, the teacher has few clues to identify students’ learning difficulties and provide further scaffoldings. To record students’ reading processes and enhance their comprehension, this study reports on the design of an online reciprocal teaching and learning system to support teachers and students in college remedial reading instruction. A sample of 129 under-prepared college students voluntarily signed up to participate in a remedial reading program. They were encouraged to use multiple strategies such as predicting, clarifying, questioning, and summarizing, which were supported by the functionalities of dialogue box, chat room, discussion forum, and annotation tool in the system. In this study, it was observed that students employed the multiple strategies to enhance their reading comprehension, as revealed by the students’ reading processes recorded in the system. When encountering difficulties in using these multiple strategies, students expressed that they observed and learned from the teacher’s or their peers’ externalization of strategy usage. Students’ reading progress in the remedial instruction incorporating the RT system was also identified by the pre- and post-tests. This study suggests that there may be benefits for teachers in encouraging students to interact with others in order to clarify and discuss comprehension questions and constantly monitor and regulate their own reading.

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1. Introduction

Many students who register for undergraduate study are under-prepared for university education (Dreyer & Nel, 2003). As Chen (2004) points out, under-prepared college students in Taiwan are identified as underachievers whose intelligence is on average but who fail to achieve the basic skills necessary for success in highly demanding college courses. Particularly, with the increase of colleges in the technological and vocational education system (TVES), more students have been able to go to colleges, leading to many colleges finding themselves admitting more under-prepared students than before. It is reported that 71% of students in TVES do not have the required ability for college reading, since their reading proficiency is as low as the level expected of junior or senior high school students (Chen, You, Yang, & Huang, 2004).

When pressed to read, college students often select ineffective and inefficient strategies with little strategic intent (Wood, Motz, & Willoughby, 1998). Often this is due to their low level of reading strategy knowledge and lack of comprehension monitoring engagement (Dreyer, 1998). Another factor might be their inexperience coming from the limited task demands of high school and the focus of traditional reading instruction being on the teacher’s one-way lecture and his knowledge reproduction (Dreyer & Nel, 2003). As a result, some students do not engage in reading strategies or comprehension monitoring unless asked to think about their reading process through activities or instruction.

To enhance under-prepared college students’ reading comprehension, many studies advocate the employment of reading strategies in remedial instruction, such as activating their background knowledge (Dole, Valencia, Greer, & Wardrop, 1991), summarizing the text (Armbruster, Anderson, & Ostertag, 1987), and generating questions to capture the main idea of the passage (Rosenshine, Meister, &
Chapman, 1996). Among studies on the employment of multiple strategies in reading comprehension, Reciprocal Teaching (RT) has emerged as one of the important approaches.

1.1. Reciprocal teaching

Reciprocal Teaching (RT) is “where the tutor and students [take] turns leading a dialogue centered on pertinent features of the text” (Palincsar & Brown, 1984, p. 117). Initially, the instructor demonstrates reading strategies to students. The instructor models the key strategies, thereby demonstrating the strategies in reading a text. Students are then encouraged to choose and practice the strategies useful by themselves; the teacher essentially provides them with “expert scaffolding” (Vygotsky, 1978). Later on, instead of relying solely on the teacher’s expert guidance, students can take turns assuming the role of the expert in demonstrating the correct usage of strategies. This allows students to transfer their language knowledge to their peers and to reflect on their own reading progress.

According to Palincsar and Brown’s study in 1984, RT could lead to a significant improvement in reading comprehension by engaging students in the four strategies of predicting, questioning, clarifying, and summarizing (Fung, Wilkinson, & Moore, 2003; Palincsar & Brown, 1984). As Palincsar (1986) points out, prediction occurs when students hypothesize what topics may be discussed in the text that follows. That is, the strategy of prediction refers to students’ assumption of what will happen in reading. While students are making predictions, they must activate their background knowledge related to the topic. They also need to evaluate their previous prediction, and revise if necessary (Teele, 2004). If a mismatch is found, students will need to revise their previous prediction and continue to make the next prediction. Through practicing the strategy of prediction, students’ ability to monitor their reading comprehension is increased.

In the strategy of questioning, students are encouraged to generate questions with the focus being on the main idea of the text (Palincsar & Brown, 1984), and to view their peers’ perspectives on the same issue. In questioning, some studies (e.g., El-Komy & Abdel, 1996) require students to master supporting information; others (King, 1993; Millis & Cottell, 1998) require students to infer new information from the text. Owens (1976) contends that questioning is one of the most effective approaches to enhance reading and understanding of a text. Palincsar and Brown (1984) further state that by asking questions concerning the gist of a text, students are able to improve their comprehension in a subject area.

Clarification is defined as clarifying any misunderstanding concerning the text (Palincsar & Brown, 1984). In the strategy of clarification, students are asked to clarify their own comprehension and to identify whether the text is difficult to comprehend (e.g., new vocabulary, unclear reference words, and unfamiliar and perhaps difficult concepts). As they identify the information that obstructs their comprehension of the text, they are alerted to the effects of such impediments on comprehension and have to take remedial actions to discover the meaning of the text (e.g., reread or ask for help). The purpose of clarification is to ensure students’ comprehension in reading the text.

The final strategy of RT in reading comprehension is summarization. Irwin (1991) states that summarization is a process which involves “deleting unimportant information, and identifying or constructing general or main idea statements that summarize many details” (p. 4). Duffy (2003) defines summarization as a strategy students use to create “a brief retelling of an entire text” (p. 125). Summary construction is commonly considered a hard task for students since they do not know what information should be kept and what should be left out (Duffy, 2003; Jones, 1999).

In other words, RT provides students with explicit instruction, extensive modeling, and repeated practices of the four strategies (Palincsar & Brown, 1984; Rosenshine & Meister, 1994). It is an ongoing dialogue between an instructor and students and among students themselves. The dialogue leader, who can be an instructor or an expert student, provides scaffolding such as demonstrating the strategies and providing guided questions to raise students’ comprehension monitoring. That is, the more capable one explains his thinking process to foster others’ comprehension monitoring. The scaffolding process is overt and explicit. Gradually, the scaffolding fades out when students in the group become more familiar with the strategies and the procedure (Rosenshine & Meister, 1994) or when students are taking the responsibility of reading (Palincsar & Brown, 1984).

A great number of studies have been conducted to examine the effectiveness of RT in face-to-face instruction (Alfassi, 1998; Hart & Speece, 1998; Le Fevre, Moore, & Wilkinson, 2003; Lysynchuk, Pressley, & Yye, 1990). Some studies found RT to be a practical method to teach reading strategies and enhance the comprehension of poor readers (Brown & Palincsar, 1985; Le Fevre, 1996). However, several problems have been noted concerning previous studies that focused on the effectiveness of reading strategies. First, the methods used to document students’ reading process in face-to-face instruction have been mainly naturalistic observation, interviews, or think-aloud protocols (Schacter, Herl, Chung, Dennis, & O’Neil, 1999). These methods are usually time consuming and labor intensive. The reading process has been loosely defined when using these methods. As a result, the teacher has few clues to identify students’ reading difficulties and provides further scaffolding. Second, students’ collaborative small-group discussions have been hardly observed. How students receive support from the teacher or their peers, how they start to help their peers as they progress in reading, and how they modify or reselect their strategies through their peers’ suggestions has not been revealed.

1.2. Background of this study

This study reports on the design of an online reciprocal teaching and learning system to support teachers and students in college remedial reading instruction. Students’ practices in using the multiple strategies of predicting, clarifying, questioning, and summarizing were supported by the four functionalities of dialogue box, discussion forum, chat room, and annotation tool in the system. By utilizing the four strategies, students were encouraged to exercise metacognition in monitoring and regulating their own reading.

As mentioned in Potelle and Rouet’s (2003) study, a computer assisted learning environment is shown to greatly support students’ engagement in reading strategies and comprehension monitoring because it provides explicit modeling and individualized scaffolding by representing reading problems visibly in verbal or written forms, displaying each step of a problem-solving task, offering group discussion and collaboration across distances, and providing feedback for monitoring and evaluating students’ progress (Gress, Fior, Hadwin, & Winne, 2010; Kinnunen & Vauras, 1995; Loard & Lomicka, 2004; Martindale, Pearson, Curda, & Pilcher, 2005; Timmers, Valcke, Mil, & Baeyens, 2008).

Based on the research purpose which was to design a reciprocal teaching and learning system to support teachers and students in college remedial reading instruction, three research questions were addressed in this study: (1) How do under-prepared college students develop
their reading processes in the RT system? (2) What are the problems and solutions that under-prepared college students have in using the multiple strategies of RT in the system? (3) What is under-prepared college students’ progress in remedial instruction that incorporates the RT system?

2. Method

2.1. Participants

A sample of 129 college students who learn English as a Foreign Language (EFL) voluntarily signed up to participate in a remedial reading instruction in a university of science and technology in central Taiwan. These 129 TVES students are from different departments and colleges and have to meet the college requirement of passing a standardized test such as Test of English as International Communication (TOEIC). None of the participants attended a special education program in their past schooling. They were randomly assigned to one of 5 classes, with class sizes ranging between 20 and 30 students. Before the remedial reading instruction began, the participants took an online simulated version of the TOEIC test to identify their reading proficiency. The maximum score that can be attained in reading on this version of the test is 250. The participants’ mean score and standard deviation on the pre-test was 82.77 and 31.84 respectively. Based on their mean score, these 129 participants were identified as under-prepared college students in reading.

2.2. System development

The reciprocal teaching/learning system is a web-based system that includes a teacher interface and a student interface (Fig. 1). In the teacher interface, the teacher can manage his class and posts texts for students to read. He could also view each student’s actions in the system as the students read texts by using the four strategies. Both the teacher and students are invited to join the discussion in the RT system. The discussion can happen in the students’ native language (in this case being Chinese), because as Fung et al. (2003) suggest ESL or EFL learners can use their native language to facilitate the development of reading and comprehension skills in their target language (in this case being English).

2.2.1. The student interface

Since one of the ultimate goals of RT is to encourage students to use the strategies and become independent readers, students can choose which strategies they would like to use when engaging with the readings in this system. For the strategy of predicting, a dialogue box listing statements such as “What will you read in the text?” and “What would happen next? Why?” are presented to help students make their predictions. For the strategy of clarifying, students could ask for help in a chat room when encountering unknown words, sentences or concepts. Instant messages would be sent and received by the teacher and students. For the strategy of questioning, students could generate questions in the discussion forum. In the discussion forum, questions for the main issues in a text are posted and replied by students or the teacher. For the strategy of summarizing, students could take notes by using an annotation tool in the system (Fig. 2). The system will then automatically keep a record of the students’ highlighting of key words, topic sentences, and other important sentences in “My Notebook” (Yeh & Lo, 2009). Based on the annotation in the notebook, students can then compose a summary.

2.2.2. The teacher interface

The teacher could monitor students’ reading process through the trace result in this system (Fig. 3). He will obtain a report presenting which articles the student has read, and which strategies the student has employed. The system also provides the teacher with overall statistics of the actions that students have taken in the system. In the chat room and discussion forum, the teacher could also respond to students’ questions and join their discussion.

2.3. Procedure of data collection

In this study, the remedial reading instruction incorporating the RT system lasted for twelve weeks, 4 h per week, from September 29th, 2008 to January 9th, 2009. The four strategies for reading comprehension were introduced during the first four weeks. Students learned how to predict, clarify, generate questions and finally summarize the text. Other strategies necessary for composing a summary were also instructed, such as learning how to identify the topic and supporting sentences and how to paraphrase sentences. In the two weeks thereafter, students learned how to use the RT system and practiced the reading process with the four strategies. Students were randomly assigned user identifications (i.e., P1–P129) in order to keep their anonymity in the online system. To ensure that each student understood
the introduction, a list of guidelines and examples was developed and posted for students to follow (Huang, Chern, & Lin, 2009). Students were encouraged to practice their reading strategies in the RT system 4–6 h per week in and after class.

Along with the remedial reading instruction, the data collected in this study included students’ pre- and post-tests, students’ action details recorded in the trace result, and an open-ended questionnaire. First, students’ reading proficiency level was identified in the pre-test. Second, students’ employment of the four strategies, as shown in the RT system, was examined. In addition, revision or changes that students made after prediction or discussions with their peers were also investigated. Third, a post-test was conducted to investigate students’ progress in reading comprehension after remedial reading instruction in the RT system. Finally, a survey using an open-ended questionnaire was conducted to examine students’ perceptions toward their problems in employing the four strategies and how they solved these problems. Their perceptions toward the online system and the effectiveness of RT were investigated as well.

2.4. Procedure of data analysis

Data in terms of the pre- and post-tests, students’ action details in the trace result, and the open-ended questionnaire conducted in this study were analyzed. First, a t-test was computed to examine students’ progress in the pre- and post-tests. Second, students’ employment of the four strategies was recorded as the trace result in the system. The trace result could reveal what difficulties students encountered and how they overcame them. Finally, the open-ended questionnaire was analyzed by means of content analysis. Content analysis helped the researcher discover and describe the focus of individual, group, institutional, or social attention and allowed the researcher to make inferences (Patton, 1990; Weber, 1990).

Four steps of content analysis were conducted in this study: coding, categorization, description, and interpretation. Based on students’ records in the trace result and the open-ended questionnaire, the researcher and research assistant first coded meaningful statements from participants with highlights while reading their statements (coding). Next, the meaningful statements were assigned into categories with the identity of participants (categorization). Then, the researcher and the research assistant described the statements by presenting and summarizing the main ideas (description). Finally, the researcher interpreted the main ideas by offering explanation, drawing conclusions, and making inferences (interpretation). The inter-rater reliabilities of students’ statements in the trace result and questionnaire were 0.86 and 0.81 respectively. The disagreement between the two raters was resolved by discussion. Data interpretation driven by these research methods is further explained in the following sections.

3. Results

The results of this study are shown in three ways: (1) a student P78 with a pseudo name, John, is randomly selected to represent students’ reading process in the RT system; (2) students’ practice in using the multiple strategies is shown to illustrate how they overcome the
difficulties in reading texts; (3) students’ progress in the remedial instruction incorporating the RT system is also shown to examine the effectiveness of the RT system. These data are to understand students' self-monitoring and self-regulation in reading comprehension.

3.1. John's reading process in the RT system

As an example, John's usage of the four strategies recorded in the trace result was randomly selected to illustrate how he comprehended the text. John first read the title of the text “The Hummingbirds that Unexpectedly Changed My Career” (see Appendix) and then made a prediction about the text “It might be about something happening and it changed his career and his life” (Table 1). After he read the first paragraph, he disapproved his previous prediction by stating “Incorrect! There was nothing happening. It was just about his interest in his leisure time. He was interested in taking pictures.” In making prediction, John used the chat room to clarify his unknown words and marked a main idea in the text with the annotation tool. He also joined the discussion forum to generate questions to view his peers’ perspectives. That is, John used the annotation tool, chat room, and discussion forum to monitor his own reading process in confirming or disproving his previous prediction.

For the strategy of clarifying, John used the chat room (Table 2). He answered a peer’s question in clarifying the word “invite”. He then not only asked his teacher “What does ‘fall in place’ mean?” but also clarified the unknown word “hummingbirds”. That is, John not only received support but also helped his peers by clarifying his comprehension questions. In annotation, John marked the topic sentences in each paragraph (Table 3).

For the strategy of questioning, John generated one question “In what kinds of circumstance he decided to give up his original work?” for their peers to discuss (Table 4). Two peers stated their perspectives toward John’s question. Finally, John’s own annotations served as hints when he wrote his summary. In the first draft of his summary, he just copied the topic sentences from his previous annotation. After his peers provided a suggestion by stating “The subject is confusing for readers when you used ‘I’ indicating the author and ‘you’ indicating the author’s friends”, he reviewed his annotations and revised his first draft into a shorter and better summary. From the reading process recorded in the trace result, John’s improvement in reading comprehension was made by practicing the reading strategies.

3.2. Students' employment of the multiple strategies

In addition to the trace result in the RT system, an open-ended questionnaire was also conducted to investigate students’ perceptions toward their difficulties in the employment of the four strategies and how they overcame these difficulties (Table 5). By understanding students’ problems and the solutions they generate when practicing the multiple strategies for reading comprehension, the teacher would be able to know when and how to provide students with appropriate scaffoldings.

In making prediction, under-prepared college students encountered some difficulties such as many unknown words, misidentifying contextual clues for prediction, and insufficient background knowledge. Most of them overcame their difficulties by discussing their problems with peers or the teacher. For the strategy of clarification, when students encountered a part of the text which they did not understand, they held a discussion with their peers first. They also asked the teacher to clarify their comprehension questions if they could not solve the problems by themselves. When they looked up an unknown word in the dictionary, they usually found out that there was more than one sense in which the word could be used. As a result, they did not know which meaning of the word that fits the specific context in which the word was being used. Generally, they would ask the teacher or their peers to clarify the meanings of words or sentences.

One of the obstacles students encountered while using the questioning strategy was the writing impediment. Students first needed to overcome the grammatical barrier before trying to convey their message clearly. They would either ask their teacher for help or hold a discussion

<table>
<thead>
<tr>
<th>Pg.</th>
<th>Prediction</th>
<th>Strategies undertaken in the reading process</th>
<th>Confirmation or withdrawal of John’s previous predictions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>It might be about something happening and it changed his career and his life</td>
<td>Clarification: Clarify the meanings of “hummingbirds”, “unexpected”, and “fall in place”</td>
<td>Incorrect! There was nothing happening. It was just about his interest in his leisure time. He was interested in taking pictures.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Questioning: In what kinds of circumstance he decided to give up his original work?</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Annotation: Mark main idea “One of the things that I still love doing to relax and rejuvenate my spirit is gardening”</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>It might be about something happened while he was taking pictures of hummingbirds. He might have important shot and get a reward and everybody talk about his pictures.</td>
<td>Questioning: There are lots of different kinds of birds. Why did the author only take pictures of hummingbirds? Annotation: Mark main idea “I could choose another career in my life- and that also, when I least expected to. Up to that then, I was a tired, lifeless social worker counting down the years to my retirement.”</td>
<td>Incorrect! Because in this paragraph it just mentioned about taking pictures of hummingbird.</td>
</tr>
<tr>
<td>3</td>
<td>It might be about how his hummingbird pictures make everybody like it.</td>
<td>Annotation: Mark main idea “Since the sun was at such a perfect angle to capture the beautiful colors of their feathers, I could hardly wait to get my photos of them developed.”</td>
<td>Correct! The publisher liked his hummingbird photo.</td>
</tr>
</tbody>
</table>

Pg. = paragraph.
with their peers to generate a question. Furthermore, it was challenging for under-prepared college students to generate questions for discussion when they did not understand the reading content or when they could not think of any extended questions to ask their peers. If students could not think of any discussion questions by themselves, most of them would hold a discussion with their peers to resolve this difficulty.

Students also needed to identify the main ideas in a text in order to compose a summary. When students failed to recognize the gist of a text, they held a discussion with their peers or reread the text to better comprehend it. Students also needed to have adequate writing skills to summarize a text. When they were unable to do so, they sought help from their teacher or peers.

From students’ perceptions toward the problems and solutions in using the multiple strategies, it was noticed that students’ solutions toward their problems were limited, so that the teacher intervention was important. Students improved their reading comprehension by observing and learning from the demonstration of peers and the teacher. In this circumstance, the teacher could also provide more alternative strategies for students to solve their reading problems.

3.3. Students’ progress in remedial instruction incorporating the RT system

In addition to the reading process recorded in the system to indicate students’ improvement in reading comprehension, students’ progress was also found in their perceptions toward their usage of strategies and the post-test. Reflecting on strategy usage, students re-monitored and re-evaluated their reading in the remedial instruction that incorporated with the system.

Students’ perceptions toward their progress are shown in Table 6. Some students thought that the annotation tool enhanced their comprehension when they composed their summary. This tool also synthesized their main idea for each paragraph in reading a text. It also served as a scaffold to help them generate their summary. Some students thought the discussion forum facilitated their reading comprehension since they could view their peers’ different perspectives on the same issue. Similarly, the chat room also enhanced their reading comprehension.

<table>
<thead>
<tr>
<th>Participants</th>
<th>Conversation among John, his peers, and the teacher</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mary</td>
<td>How do we say “邀請” (Chinese) in English?</td>
</tr>
<tr>
<td>Mary</td>
<td>invist?</td>
</tr>
<tr>
<td>John</td>
<td>invite</td>
</tr>
<tr>
<td>The teacher</td>
<td>invite</td>
</tr>
<tr>
<td>John</td>
<td>What does the word “hummingbirds” mean?</td>
</tr>
<tr>
<td>Mick</td>
<td>I want to know too.</td>
</tr>
<tr>
<td>Mick</td>
<td>please?</td>
</tr>
<tr>
<td>John</td>
<td>What does the “The Hummingbirds that ‘Unexpectedly’ Changed My Career” mean?</td>
</tr>
<tr>
<td>John</td>
<td>teacher please!</td>
</tr>
<tr>
<td>Mary</td>
<td>Unexpectedly means 不預期地 (Chinese).</td>
</tr>
<tr>
<td>Mary</td>
<td>Hummingbirds means 蜂鳥 (Chinese).</td>
</tr>
<tr>
<td>The teacher</td>
<td>Good!! you all get the answers from your classmates.</td>
</tr>
<tr>
<td>John</td>
<td>What does “fall in place” mean?</td>
</tr>
<tr>
<td>The teacher</td>
<td>When things are organized well in your life, You will feel like everything “falls in place”.</td>
</tr>
</tbody>
</table>

Table 2

John’s clarification in the chat room.

<table>
<thead>
<tr>
<th>Paragraph</th>
<th>Topic sentence marked</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>One of the things that I still love doing to relax and rejuvenate my spirit is gardening</td>
</tr>
<tr>
<td>2</td>
<td>I could choose another career in my life- and that also, when I least expected to. Up to that then, I was a tired, lifeless social worker counting down the years to my retirement.</td>
</tr>
<tr>
<td>3</td>
<td>Since the sun was at such a perfect angle to capture the beautiful colors of their feathers, I could hardly wait to get my photos of them developed.</td>
</tr>
<tr>
<td>4</td>
<td>In the end, however, I sold my photos to Apex publishers where I am now working full-time as a nature photographer.</td>
</tr>
</tbody>
</table>

First Draft of Summary

Something in the world is not your think about and not to grasp for you. For example, social workers with other people’s problems all day long, I was finding it very difficult to remain good mood. One day, I bring my camera because I want to get a picture of the hummingbirds that had been appearing around the flowers. To my surprise, a magazine publisher wants to buy the picture and now I am a nature cameraman.

Peer’s suggestion

The subject is confusing for readers when you used “I” indicating the author and “you” indicating the author’s friends. I think it would be much better for readers to understand if you use the third person singular to refer to the author.

Final Draft of Summary

This article is mainly about interest of taking pictures in his leisure time. The author mentioned that taking pictures of hummingbird’s ecosystem change his boring working life. The author also found a new career after retirement.
because they could get immediate feedback or answers. However, students also expressed suggestions for the RT system. The practice of monotonous strategies in the system can cause them to lose their interests after they are familiar with the usage of strategies. They also noticed that the usage of the same strategies over times was inappropriate since each text genre might require them to use different strategies.

Students reported that they were able to better understand the main ideas in a text after remedial reading instruction with the RT system. They recognized the effectiveness of using multiple strategies in reading and concluded that they could read more fluently after the instruction.

At the end of the remedial reading instruction, a post-test, a simulated TOEIC test, was conducted to evaluate participants’ reading proficiency. A paired-sample t-test, used to identify participants’ progress, showed there was a significant difference ($t = -8.42, p < .05$) between the pre-test ($m = 82.77, sd = 31.84$) and post-test ($m = 116.49, sd = 25.16$), indicating that participants improved their reading comprehension after the remedial reading instruction that incorporated the RT system.

4. Discussion

From the results of this study, some findings are explored. First, different from previous studies (e.g., Alfassi, 1998; Cotterall, 1990; Dashwood & Mangubhai, 1996; Hart & Speece, 1998; Le Fevre et al., 2003; Lysynchuk et al., 1990; Spörer, Brunstein, & Kieschke, 2009) that investigated the effectiveness of a single strategy or a combination of different strategies in face-to-face instruction of RT, the results of this study showed that individual students’ reading comprehension was enhanced by remedial instruction incorporating different functionalities of the RT system. That is, under-prepared college students had different perceptions in using strategies with the functionalities to meet their individual needs. Some students believed that annotation was the most useful tool when they summarized the text since it

<table>
<thead>
<tr>
<th>Participant</th>
<th>Issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>John</td>
<td>Dec. 20th, 9:28 The Hummingbirds that Unexpectedly Changed My Career In what kinds of circumstance he decided to give up his original work?</td>
</tr>
<tr>
<td>Linda</td>
<td>Response I think he found taking pictures kept his attention and interests. Therefore, he was thinking about changing his career after he retired from his original work.</td>
</tr>
<tr>
<td>Anna</td>
<td>Response At first, the author was a “tired, lifeless social worker”. He found ways to relax himself, which is gardening. During the time of gardening, he also took pictures, too. He found good scenes and sold those pictures to publisher.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Statement</th>
<th>Frequency</th>
</tr>
</thead>
</table>
| Predicting  | If there are too many unknown words, I would ask the teacher, discuss with peers, or look them up in the dictionary.  
If there is no connection between what I have predicted and what the text is about. Through discussing with peers or asking the teacher, I can get more ideas for prediction.  
I do not have sufficient background knowledge toward some topics. I would discuss with peers to get more background knowledge and correct my previous prediction. | 55 25 20 |
| Clarifying  | If I could not comprehend the text, I would discuss with my classmates first. If we still could not find out the answer, we would ask the teacher.  
As I looked the word up in the dictionary and found out there are more than one meaning. I do not know which one I should select. I would ask the teacher to verify the meanings of words or sentences. | 50 30 |
| Questioning | I do not know how to form a sentence in English, mostly because of my limited vocabulary size and knowledge of English grammar. I would discuss with my peers, my teacher or look up words in the dictionary.  
When it is hard to come up with discussion questions by myself, I would ask my peers.  
I do not know how to generate questions. I would read questions generated by my peers and then come up with my own ones. | 45 40 20 |
| Summarizing | It is hard for me to compose a summary since I have small vocabulary size and limited grammatical knowledge. I would discuss with my teacher or with my peers while writing a summary.  
It is hard to summarize a text when I do not know the main ideas in the text. I would then discuss with my peers before I summarize the text.  
When I do not know how to identify the main ideas in a text, I would reread the text before I summarize it. | 25 15 15 |
recording the main ideas and key words they highlighted during reading. Some students perceived the discussion forum as an effective tool to view peers’ different perspectives on the same issue. Some students favored the online chat room because they could clarify their comprehension and receive feedback from peers immediately. It is seen in this study that individual student’s comprehension is scaffolded by various means. The online RT system allows students to select which way they would like to get help. The comparison of strategies alone in terms of reading comprehension or frequency reported in previous studies of RT, seems unclear for they do not release the criteria in comparing the effectiveness of strategies, such as students’ confirmation or withdrawal of the previous prediction, clarifying and questioning their own comprehension, and drafting and revising the summary. Further, the comparison of strategies alone seems to be unnecessary as the effectiveness of strategy usage in RT depends on students’ different reading goals and needs.

Second, previous studies hardly address students’ reading processes in identifying and solving their own reading problems. Process data are rarely found to indicate how students confirm or disprove their prior predictions, how they select and reselect key words and topic sentences, how they use what they have understood in annotation to draft and revise a summary. These important data are not even reported back to the teacher and the individual student. The teacher gets no chance to monitor his students’ reading process in detail and identify his students’ reading difficulties. As a result, the teacher has few clues to provide appropriate scaffoldings. Similarly, the students have no opportunity to monitor and regulate their own reading process (Yang & Hung, 2008).

Third, after the identification of reading problems and solutions, students could monitor and regulate their own reading in the remedial instruction incorporating the RT system. Some students identified the strategy of questioning as a chance to re-monitor their comprehension. On the one hand, by generating questions, students assumed the role of the teacher who usually generates questions for students to understand the main idea of the text. In questioning, students also recognized the needs to fully clarify their comprehension of a text before they proceeded to generate questions for discussion. On the other hand, by answering questions in the discussion forum, students looked back at the passage, found out the information that the question referred to, and then reflected on how the information fit in the text. Some students preferred to use the annotation tool to solve their reading problems since they could review what they had understood and integrate into their newly acquired information. In taking notes while reading, students could also pinpoint the important concepts in a text. Other students distinguished the practice of reading strategies in different text genres. It was important for them to be aware of using different strategies to support their reading comprehension.

The results of this study also point out the importance of the teacher’s role in demonstration. The teacher’s leading role can fade out as some students become skillful and independent in guiding and demonstrating strategies to their peers. Reciprocally, students benefit from the encouragement and support of each other in reading instruction. In addition, the teacher should encourage students to practice their multiple strategies in different contexts to solve their reading problems. For example, students might use strategies in reading and acquiring domain knowledge in the subjects of physics, accounting, or history. Some limitations are also found in this study. First, students’ annotations on key words, topic sentences, and important sentences should be automatically and statistically analyzed by the system. This will provide important information for the teacher to design assessment and follow-up remedial instruction for his students. Second, tools provided in the online system might not be sufficient to facilitate or scaffold students’ reading comprehension to their full potential. Better tools are recommended, e.g., tool that allows students’ revisions of their own annotations. Finally, an open-ended questionnaire should be conducted on teachers to understand their needs and their perceptions concerning the impact of the RT system on their students’ reading comprehension.

Appendix

The hummingbirds that unexpectedly changed my career

There are times in life that everything seems to fall in place. People that believe in astronomy would say that the stars were aligned. People that believe in a higher power would say the gods were smiling down at me. No matter how you phrase it, I was very fortunate that I could choose another career in my life- and that also, when I least expected to. Up to that then, I was a tired, lifeless social worker counting down the years to my retirement.

Like most social workers dealing with other people’s problems all day long, I was finding it extremely difficult to remain optimistic. One of the things that I still love doing to relax and rejuvenate my spirit is gardening. Through the years, I’ve always kept my camera around my

<table>
<thead>
<tr>
<th>Scaffolding</th>
<th>Statement</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>System</td>
<td>In the system, the chat room facilitates my reading the most. I can ask questions and solve my reading problems by discussing with peers and the teacher in the chat room. I can get their feedback or answers immediately.</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>In the system, the annotation tool facilitates my comprehension the most because it helps me comprehend a paragraph by finding out its main idea and key words. It records main ideas and key words I have found. This record is very useful when I write the summary.</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>In the system, the discussion forum enhances my comprehension the most because reading peers’ generated questions is thought-provoking. From reading the questions, various perspectives of the text are presented.</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>The system helps me using the reading strategies to read English textbooks in different subjects.</td>
<td>30</td>
</tr>
<tr>
<td>Strategies</td>
<td>It is easier and faster for me to identify the main ideas or important concepts in an article now.</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>I have improved my reading ability.</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>I am motivated to read other English articles online or in the magazines.</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>With the reading strategies, I could read English texts more fluently and faster now.</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>I have learned how to predict the content when I read. It helps me to activate my background knowledge.</td>
<td>30</td>
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Table 6
Students’ perceptions toward their progress.
neck when I am in my garden because there are many opportunities to take pictures of hummingbirds and other creatures attracted to the flowers.

One day, two years ago, I was sitting on a small stool pulling weeds. I had my camera around my neck because I was hoping to get a picture of the hummingbirds that had been flying around the flowers. I do not know if it was because I was sitting down or what, but a hummingbird landed very close to me and sat on one of our bushes. I slowly raised my camera and was able to take several pictures of it resting on a branch. Another hummingbird then began feeding on the flowers of the bush; I was so close I could hear its wings. Since the sun was at such a perfect angle to capture the beautiful colors of their feathers, I could hardly wait to get my photos of them developed.

Once I had taken all the photos, I paid a visit to the camera store nearby. To my surprise, a magazine publisher called me a few days later about selling my pictures. After that call, several others followed. In the end, however, I sold my photos to Apex publishers where I am now working full-time as a nature photographer.

References


