Cognition-Based Interactive Phases and Strategies in Teaching Academic Reading

Zhao Gao, Shan Gao, and Qi Yang

Abstract—Academic English reading requires deeper cognitive involvement in addition to language proficiency and plays a vital role in moulding a critical mindset. However, cognitive progress is seldom targeted in classroom teaching. This study proposed a teaching method of three reading phases in terms of cognitive mechanism and communicative teaching approach. Ninety university freshmen of non-English major participated in the study, who were taking the course of Academic English Reading in the 2nd semester. The data were collected from self-report Research Skills Assessment twice and semi-structured interview, and analyzed with paired sample t test and Pearson correlation. The results showed that 1) “critical thinking”, “organizing ideas”, and “finding information” were believed to improve significantly at the end of the course; 2) reading skill was associated with writing skill and the sense of “big picture” in self perception; 3) the cognition-based interactive reading instruction was acknowledged to be conducive to academic reading. It complements Academic English reading pedagogy by juxtaposing the need for both individual cognition and group interaction in classroom teaching.

Index Terms—Academic reading, English reading strategy, teaching critical thinking,

While English as foreign language (EFL) learners are assumed to smoothly transfer their general reading strategy into academic reading, copious studies indicate otherwise\[9\],[10]\]. English learners in China, even graduated from universities, mainly apply test-based strategies or learning to academic reading\[9\]. However, academic reading is an activity that challenges critical thinking more than mere comprehension of language and content\[6\]. In a situation that English learners in China mainland are widely reported to be inadequate in critical thinking\[7\], a question arises: Is there a way that can facilitate the deeper thinking of Chinese EFL learners in academic reading?

Unlike general second language (L2) reading, to academic L2 readers, not only language proficiency but also background knowledge of a specialized area will be challenged, e.g. complex syntax, sophisticated vocabulary, refined wording, high-dense amount of information, and accumulated background knowledge\[10\],[11\]. Moreover, academic literacy involves higher-order thinking-conceptualizing, inferring, inventing, and testing through analyzing, comparing and contrasting, synthesizing, and evaluating reading information\[11\],[12\]. That is to say, learning to read is not the ultimate purpose of academic reading, but reading to learn, to evaluate, or to create on the level of mind communication are expected. To be a critical reader is one of the most vital aims for academic reading\[6\].

1. Literature Review

1.1 Cognition in Reading Comprehension

Reading is regarded as an integrative and complex learning activity that new meaning is reconstructed in the interactive process between reader’s prior knowledge and writer’s text information\[13\]. Even for L1 readers, “learning to read” is like a musical training, and “requires integration and sequencing in multiple sensory modalities” through years of efforts initiated from one’s childhood\[14\]. Ehri\[15\] pointed it out that such an acquisition is a transition of “phases” rather than “stages”, which did not happen abruptly.

There is research evidence showing that attention, perception, working memory, and central-executive systems in cognition were highly involved into reading\[16\]. From the perspective of attention, it is a comprehension process that needs “both externally-directed attention in reading the words on the page as well as a good deal of internally-directed attention to the mental representation of the text being constructed”\[17\]. Researchers remain a tremendous interest towards the cognitive mechanism and neural networks beneath the act of reading. Many possible models have been posited. For example, dual-route theorists believe that word-level reading only implicates orthographic regions (e.g. Visual Word Fusiform Area, VWFA in brain) through which
language comprehension involves mapping orthography onto phonology whereas the connectionist single mechanism emphasizes joint contribution of multiple brain regions. Jung-Beeman delineated a neural framework for natural language comprehension, which implicates bilateral semantic activation in posterior middle temporal gyrus, semantic integration in anterior temporal lobes, and semantic selection in inferior frontal gyrus on the basis of coarse semantic coding theory. Specifically, left inferior operculum was found sensitive to task difficulty and semantic processing in reading, where cognitive tasks requiring higher load, such as intersentialt consistency relative to word-level processing, might have been fulfilled.

Due to the complex process to generate reading comprehension that may cascade from sentence’s parsing into micro and macro structure identification, EFL readers feel frustrated in word decoding, sentence connection, and information retention. Furthermore, the general language knowledge may not be necessarily transferred from L1 to L2 reading according to threshold hypothesis. To sum up, L2 reading is distinct and more complicated than L1 reading.

1.2 Scaffolding Phase in Academic Reading

From tacit reading to explicit questioning, the academic readers, particularly the L2 academic readers, need a strategy to facilitate such a cognitive phase of information computation. Novel ideas or questions require a period of incubation, which may involve dopamine in particular and the engagement of some brain regions. Yet the limited capacity of working memory that has been recruited to process L2 word recognition and semantic association might expose inadequacy to complete information computation while reading. Thus, poor academic readers are usually confined to meaningful comprehension rather than deeper analysis. While to generate a question is proved as an effective metacognitive strategy to monitor reading, how to release part of working memory and simultaneously enhance propositions’ connection becomes a key issue.

A mind organizer, Mind Map, which encourages brainstorming by visualizing ideas and their relations, may reduce cognitive load and spare room for critical thinking. Moreover, the curved lines and seemingly loose structure provide an opportunity for brain to resuffle all the facts and opinions, creating a temporary detachment from the logic that had been constructed by authors. Probably it is just the “relaxing” and “independent” period leaving room for different ideas to occur.

1.3 Instructions to Teach Reading

Mounting studies suggest that ineffective L2 readers could improve reading performance by learning some cognition-based reading strategies, such as top-down reading strategy, self-reflection, or think-aloud technique. For example, the schemata theory, which emphasizes the activation of topic-related background knowledge prior to reading, provides theoretical explanation for top-down reading instruction. Thus various pedagogies have boomed in the past three decades, e.g. collaborative strategic reading (CSR), reciprocal teaching (RT), transactional strategies instruction (TSI), etc. TSI aims to “help learners internalize strategic processing through the interaction of group discussion and teacher scaffolding” while other instructions focus on individual cognitive process.

Likewise, classroom setting requires an expansion of reading activity design from individual to interaction. A large number of classroom factors need considering, such as socio-cultural attributes of a community, e.g. negotiation of meaning through interpersonal communication; motivation of activity participation; and individual’s psychological perception, e.g. anxiety-free supportive classroom environment, etc. It becomes an issue of group action rather than mere individual’s internal cognition. According to the communicative approach, the overarching goal of study is to meet the demand of interaction among a group of people through the means of interaction. However, most instructions tend to either overemphasize the individual cognitive strategy but inappropriate for classroom interaction, or teach reading through writing, which might weaken the focus on reading. Hence, a comprehensive teaching method is proposed in this study to encourage both individual cognitive processing and interpersonal interaction in classroom. That is to say, English academic readers are expected to transfer from merely comprehending information to raising critical questions through multiple means of interaction in classroom learning. Finally, a question is explored on how EFL learners evaluate their own progress in academic abilities after being instructed with such a new method.

2. Methodology

2.1 Participants

Ninety first-year undergraduates (age M=18.43, SD=0.79; 7 women) from the Honor College at University of Electronic Science and Technology of China (UESTC) participated the study by taking the course of Academic English Reading during the 2nd semester. The Honor College at this university aims to cultivate young scientists who are enthusiastic about research in a long run and thus expects the undergraduates to continue postgraduate study immediately after graduation. Only comprehensive courses rather than discipline-related courses were included for the first two years in the teaching scheme. They all passed National College English Test Band 4 at the end of the first semester (M=547.08, SD=45.07).

2.2 Teaching Strategies and Phases

The course of Academic English Reading is the first two sessions of a series of EAP curriculum. It is specially designed for Honor College students, followed by other two sessions of
Academic Writing and Conference Communication. All four sessions are to start from the beginning of the 2nd semester and complete at the end of the 3rd semester, with 32 teaching periods per session. In fact, the academic reading session for experiment lasted for no more than 3 months at the pace of 4 periods per week. Despite extracurricular reading projects across the whole course, the teaching method discussed in this study was a primary instruction for classroom reading activities.

Reading materials were largely electronic and authentic texts from online magazines, research institute homepages, and mainly e-journals. The key papers were all from peer-reviewed journals with various topics, ranging from campus life to personality. For example, “Relationships of Personality and Lifestyle with Mobile Phone Dependence among Female Nursing Students” published in Social Behavior and Personality in 2009, and “‘Cycle Thieves, We Are Watching You’: Impact of a Simple Signage Intervention against Bicycle Theft” in PLoS ONE in 2012.

There are three levels of interaction for each of three phases (Table 1). When reading an academic paper, every student starts from pre-reading activation of topic-related schema to post-reading evaluation by participating three levels of interactions each phase. Specifically, the three levels of interactions are: 1) intrapersonal communication between individuals and reading materials completed by each student alone; 2) interpersonal interaction within a group to clarify individual questions; 3) class-level interaction in which students share comments or questions with the whole class. However, the communicative task varies for each phase.

Table 1: Purposes and main tasks of three phases and three levels

<table>
<thead>
<tr>
<th>Phases</th>
<th>First phase</th>
<th>Second phase</th>
<th>Third phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading depth</td>
<td>From schemata activating to predicting</td>
<td>From reading to mapping</td>
<td>From questioning to evaluating</td>
</tr>
<tr>
<td>Primary aim</td>
<td>Surface</td>
<td>Deep</td>
<td>Deeper</td>
</tr>
<tr>
<td>Intrapersonal interaction</td>
<td>To understand</td>
<td>To abstract &amp; synthesize</td>
<td>To question &amp; critique</td>
</tr>
<tr>
<td>Intrapersonal interaction</td>
<td>Reference books/dictionary: terms, basic background information, theoretical hotspot</td>
<td>Mind map/table: compare and contrast, analyze, synthesize, summarize, etc.</td>
<td>Reliability/validity of paper: Cohesive and coherent? Logically convincing?</td>
</tr>
<tr>
<td>Classlevel interaction</td>
<td>Topic-related background, speculation on interesting research topics</td>
<td>Key propositions and their connections</td>
<td>Evidential adequacy?</td>
</tr>
<tr>
<td>Teacher’s work in class</td>
<td>Supplementary explanation</td>
<td>Instant support</td>
<td>Open-ended discussion and feedback</td>
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First phase: From schemata activating to predicting

There are multiple purposes of this phase: to stimulate L2 readers’ topic-related schema through various pre-reading activities, to motivate reading, and to clear away lexical and theoretical obstacles. The instrument can be psychological questionnaire or documentary video. For instance, before reading a published academic paper around language classroom anxiety, students measured their anxiety level by completing the Foreign Language Classroom Scale developed by Horwitz et al.[50]. Moreover, the title, abstract, and key words of a target paper are given to students in advance. The students’ tasks for three-level interaction are distinct: 1) searching topic-related reading materials prior to class; 2) understanding terms and background theories through within-group discussion in class; and 3) sharing with the whole class the group conclusion in terms of reading comprehension and conjecture about potential interesting studies. Indeed, this is a warming-up activity for academic reading.

Second phase: From reading to mapping

This phase underlines visualizing thoughts and organizing information. Students are required to draw mind maps while reading target passages for the first time and highlight unknown words, difficult expressions, or opinions when necessary. After reading, association among opinions or facts is checked. In other words, every student maps out the main ideas and their relations separately, then takes his/her “map” to discuss with group members, and verifies his comprehension without referring to the original paper, thereby authentic communication is created with information gap among groups. Finally, one of group maps is selected as an example for the whole class to make comments.

Third phase: From questioning to evaluating

This phase is specifically set for critical thinking. Students are encouraged to consider such questions at an intrapersonal level as inferential logic, semantic coherence, content redundancy on skills of arguing and writing as well as confusing terms and theories related to text understanding. Then they learn how to pose a critical question by filling in a question table of critical thinking (CT), in which all the relevant questions are listed for the reference of learners. For instance, the reliability of paper, validity of findings, significance, and a new research question that can be extended based on the limitation in current study[51]. Group discussion at this level fits the need to complete and polish questions. Finally, the profound questions that promote the ability of evaluation are expected to come up with. During class interaction, all comments or critiques are encouraged to target at 1) the paper itself or 2) classmates’ comments.

2.3 Instrument and Data Analysis

Both quantitative and qualitative data were collected. A self-reported research skills assessment questionnaire with
5-point Likert scale (1=“no ability” to 5=“expert ability”) was used to collect learners’ self-perception on their research skills twice respectively at beginning and end of the course. Twelve research skills in questionnaire were investigated, such as “Critical thinking”, “Organizing ideas”, and “Ability to collaborate with others” (Table 2). And two questionnaires — Foreign Language Classroom Anxiety Scale (FLCAS) and What Is Happening in the Classroom (WIHIC) — were administered as well. The FLCAS was back translated into Chinese in order to improve its reliability and validity (Cronbach’s α=0.939, all subscale α>0.7). The questionnaire WIHIC was Chinese version with a high reliability and validity (Cronbach’s α=0.911, Nitem=33). Since nearly half participants were the best students newly recruited from other colleges to join Honors College in the third week of the semester, some of them missed the first-time data collection. Eighty-nine questionnaires were handed out with 97.75% returning rate. Four students were excluded due to their statistically different perception on classroom environment or anxiety, i.e. beyond 3 standard deviation. Another 18 participants were excluded because they failed to provide valid questionnaires or both copies of pre-course and post-course. Finally, only 65 copies of questionnaires were analyzed by SPSS 21.0. Paired sample t test was used to compare self-perceived research skills between pre- and post-course. Pearson correlation was used to examine the association between the implied research skills and reading skill in learners’ belief.

Additionally, qualitative data is derived from teacher’s weekly reflection journal and semi-structured interview on students. Teacher’s weekly reflection journal was free writing about what she observed or felt in classroom, which could be a moment of confusion, frustration, excitement, or inspiration during teaching. Sixteen students volunteered to participate 40-minute interview at the end of course and introduced their reading strategies used and impression for the course. The semi-structured interviews were recorded and transcribed into written words.

### Table 2: Paired sample t test for twelve research skills between pre- and post-course (N=65)

<table>
<thead>
<tr>
<th>Research skills</th>
<th>Time</th>
<th>M</th>
<th>SD</th>
<th>t</th>
<th>degree of freedom (df)</th>
<th>Sig. p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical thinking</td>
<td>Pre-Post-</td>
<td>3.29348</td>
<td>0.6310533</td>
<td>-2.112</td>
<td>64</td>
<td>0.039 *</td>
</tr>
<tr>
<td>Organizing ideas</td>
<td>Pre-Post-</td>
<td>3.03327</td>
<td>0.5950627</td>
<td>-2.743</td>
<td>62</td>
<td>0.008 **</td>
</tr>
<tr>
<td>Finding information</td>
<td>Pre-Post-</td>
<td>3.17343</td>
<td>0.8760637</td>
<td>-2.421</td>
<td>64</td>
<td>0.018 *</td>
</tr>
<tr>
<td>Writing skills</td>
<td>Pre-Post-</td>
<td>2.80289</td>
<td>0.6660687</td>
<td>-0.948</td>
<td>64</td>
<td>0.347</td>
</tr>
<tr>
<td>Reading skills</td>
<td>Pre-Post-</td>
<td>3.17320</td>
<td>0.6566671</td>
<td>-0.341</td>
<td>63</td>
<td>0.735</td>
</tr>
<tr>
<td>Ability to work with numbers and graphs</td>
<td>Pre-Post-</td>
<td>3.10317</td>
<td>0.7970708</td>
<td>-0.608</td>
<td>62</td>
<td>0.546</td>
</tr>
<tr>
<td>Oral communication skills</td>
<td>Pre-Post-</td>
<td>2.91298</td>
<td>0.7850760</td>
<td>-0.778</td>
<td>64</td>
<td>0.439</td>
</tr>
<tr>
<td>Ability to ask questions</td>
<td>Pre-Post-</td>
<td>2.95278</td>
<td>0.8560673</td>
<td>1.374</td>
<td>64</td>
<td>0.174</td>
</tr>
<tr>
<td>Methodological knowledge</td>
<td>Pre-Post-</td>
<td>2.61284</td>
<td>0.9010727</td>
<td>-1.786</td>
<td>56</td>
<td>0.079</td>
</tr>
<tr>
<td>Sense of “big picture”</td>
<td>Pre-Post-</td>
<td>3.30323</td>
<td>0.7150668</td>
<td>0.683</td>
<td>60</td>
<td>0.497</td>
</tr>
<tr>
<td>Time management</td>
<td>Pre-Post-</td>
<td>3.38320</td>
<td>0.8450694</td>
<td>1.745</td>
<td>63</td>
<td>0.086</td>
</tr>
<tr>
<td>Ability to collaborate with others</td>
<td>Pre-Post-</td>
<td>3.58358</td>
<td>0.6100610</td>
<td>0</td>
<td>64</td>
<td>1.000</td>
</tr>
</tbody>
</table>

*Pre-“ and “Post-” refer to the two times when Research Skills Assessment was administrated at the beginning and end of course. *: p<0.05, **: p<0.001, two-tailed.

### 3. Results and Discussions

#### 3.1 General Results

Most of research skills have a tendency to increase except for “Ability to ask questions”, “Sense of ‘big picture’”, “Time management”, and “Ability to collaborate with others”. Moreover, “Critical thinking”, “Organizing ideas”, and “Finding information” were reported significantly higher at the end of the course than that in the beginning, t(65)=2.112, p=0.039. See Table 2. It indicates that students hold an overall positive attitude towards the course. As to other skills, e.g. “Writing skills”, they have never been included into reading course syllabus, so the perception may not display striking difference through course training.

The interview data provides potential interpretation for the change between pre-course and post-course. It suggests that students tend to contribute their improvement in idea organization to Mind Map. For example, student LQN reported, “(Mind map) is very helpful... (it can) direct my attention to cross-sentence links rather than every isolated sentence...and help to remember the information much better”. With regard to a low rating score for “Ability to ask questions” at the end of course, one student explained that “I did not know I had such a problem (lack of ability to ask questions) at the beginning of this semester until I studied this course...I must have overestimated my ability to ask a question”. Likewise, student LZ felt less confident in English after taking EAP reading course. He said he had assumed that English was his strength, however in EAP course he found himself only able to use “baby English” rather than “elegant and complex” wording to express his idea. For some excellent students, they obviously discovered their deficit after taking the course. Therefore, their self-confidence has probably been suppressed in post-course self-evaluation.
3.2 Self-Evaluation Change in Reading Skills

The self-evaluation of post-course reading skill is moderately correlated with that of pre-course reading skill ($r=0.388$, $p=0.002$), of post-course writing skill ($r=0.343$, $p=0.005$) and of the sense of “big picture” ($r=0.32$, $p=0.011$). In addition to the baseline reading skill, students’ evaluation on their performance in academic reading might be virtually related to their writing ability and a sense for academic genre. For example, student ZCS described other proficient English learners as “they are good at English, not only in reading but also writing. If only I could write better” when inquired about his feeling to read academic papers. Student ZQ mentioned in his interview that he often made highlights during reading: “(highlight) targets are like, just as those information you always reminded us in class, e.g. the research question, background, etc., and something else like abstract, or something about significance and other critical information about the paper… It is easier for me to read those paper (papers) when I know its (their) basic components.”

The change of reading skill, i.e. the difference of self-evaluated ratings between pre-course and post-course reading skills, was found to be significantly correlated with the difference of self-evaluation on writing skill ($r=0.289$, $p=0.019$) and methodology knowledge ($r=0.287$, $p=0.020$), even though both correlations were weak. The writing skill and knowledge of methods were assumed to increase with the progress in reading skill. The result indicates that L2 learners might attribute their improvement in reading skill to their gain in writing skill and methodology knowledge. Again, the reading-writing connection was acknowledged by learners in this study, which corroborates the previous research findings. However, most interviewees reported confusion for methods in different studies, particularly quantitative statistics. For instance, student SHL evaluated his knowledge about methodology: “I find the discussion in a paper to be difficult to understand if I do not fully understand what methods were used in the study.” Student ZCS still kept puzzled until the interview conversation at the end of semester, “it’s too confusing for me…what is $p$ value and $t$ test?” When student ZYC replied to the interview question of “what do you think was the biggest barrier for your academic reading”, he pointed it out that “how the data were (was) computed and what”. Although the second session for the course syllabus was specifically designed for research methods, it focuses on brief introduction rather than applications due to limited class hours and background of learners. The teacher’s weekly journal reflected the similar frustration that:

“It is not clear if it is necessary to introduce statistical theory, will it be too abstruse?... (June 3rd/ Students do not know how to select method for data analysis. Obviously their knowledge about research methods is weak. (June 10th) / Students feel pretty hard (to learn SPSS), and (I) almost dare not talk too much about ANOVA. Guess next semester, we should read more papers using qualitative method (June 17th)).”

The common frustration revealed in this study about academic reading corroborates the opinion that academic reading is not an isolated cognition that requires mere language comprehension. In addition to background knowledge, L2 readers still need method knowledge. In the future, EAP teachers should consider methodology when selecting academic papers for L2 learners to read.

3.3 Change of Reading Strategies and Habits

By applying the cognition-based and interactive reading instruction in class, the majority of interviewees reported that in order to grasp the main idea of a study, they were urged to shift their attention from word-based comprehension to passage-based connections. For example, student LQN described his previous reading strategy as “word-sensitive style” that unknown words always attract his first attention. Without looking them up in dictionary, he could not even start to understand the meaning of whole sentence. “Now I would rather know the main idea of a paper for the first scanning and postpone those strange words afterwards,” he added, “mind map helped a lot to link the meaning between each sentence”.

Moreover, they learned to ask questions and evaluate opinions. Student ZYC pointed it out that “In high school, when we read English passages, we only targeted the answers ABCD to the five questions afterwards. But what I have to do now is to find out on what opinions I agreed or disagreed besides understanding information…. I like current reading way because I can add in my thoughts rather than be stuffed.”

Last but not the least, they came to realize how the metacognitive strategy can facilitate their reading, e.g. prediction for the content in each part of an academic paper. It might provide a possibility that reading skill was associated with writing skill in a sense. That is, a good academic writer may be able to make a good prediction for writing structure. When student YZJ recalled his panic at the beginning of this semester, he emphasized “too difficult” and how “stressful” he felt in that “the (passage) meaning was chaotic although every word or structure could be understood”. He also attributed his initial maladaptation to his “little attention to reading strategy” and “(being) ignorant about the paper structure”, now he felt much relaxed in reading academic papers because “the writing pattern is almost fixed and I know where to find the information I need”. Likewise, student SQJ who claimed to have been confident in English reading skill relative to other skills described his transition in L2 academic reading:

SQJ: “At beginning, it was rather difficult for me to adapt because the reading task was too demanding.”

Researcher (R): “What do you mean by demanding? Why?”

SQJ: “Literature. It was demanding when reading the
first paper. It was the first time for me to read a paper more than 10 pages long. I have zero experience in reading any academic paper before.”

…

SQJ: “I felt better later after reading quite a few such kinds of papers and trying the three steps of reading.”
R: “What is the characteristics of such kind of paper compared with other reading materials?”
SQJ: “Not much different except that they are longer and more academic.”
R: “How to define your ‘more academic’?”
SQJ: “I mean, the papers we read, all very…just very…every part is very clear. Thanks to the subheadings, every part is much clearer. Then (we) can easily grasp the main idea of the paper.”

The interview transcripts show that the students in the EAP reading course have experienced a transitional period from being “unsecured” to “secured”. More than an English learner, they come to know that they read English for academic findings and opinions. Nevertheless, a longitudinal study should be done for a full coverage of transition for learners of different proficiency, especially those who might need longer time.

4. Limitations and Conclusions

There are some limitations in this study. Firstly, the study mainly adopted the descriptive self-report method to demonstrate the result of cognition-based interactive reading instruction. It is a more holistic but indirect method to examine its effect involving reading attitude, metacognitive awareness, and reading skill. In the future, the change of reading ability should be measured through direct reading tests. Secondly, the students interviewed were all volunteers, which might lead to participant’s homogeneity. For example, the English proficiency of most of the interviewees was above average. However, those who felt difficult in academic reading may probably think differently.

Overall, given whatever proposal for a universal reading model, both social and physiological attributes of human beings should be premised, i.e. cognition and interpersonal communication. Exploring from the perspectives of nature and nurture, the cognition-based interactive EAP reading instruction is perceived to be able to facilitate the transition of EFL learners from general reading to academic reading. It converts ideological concepts, such as the importance to cultivate learners’ critical thinking, the necessity to develop appropriate metacognitive strategies, etc. into applicable actions instructed in classroom. Therefore, an alternative is provided for EFL teachers to put into practice of academic reading pedagogy.

References


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