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Enhancing Reading Comprehension through Cognitive and Graphic Strategies: A Constructivism Approach.

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Abstract

Graphic Strategy and several Cognitive Strategies (Story Structure, Questioning, Synthesizing, Visualizing and Inferencing) are used on narrative texts, following constructivism principle, to discern the increase in students' reading comprehension. A quasi-experimental study involved 45 students (experimental group) receiving treatment via graphic and cognitive strategies and another 45 students (control group) using classroom's common practice (conventional method). Paired T-test Analysis shows significant difference for both groups. However, mean score and effect size (eta square value) are larger in the experimental group (M=59.63, 0.78) than the control group's (M=55.34, 0.31). This indicates that the implemented strategies increased students' reading comprehension effectively compared to conventional method.

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Keywords: Reading Comprehension; Cognitive Strategies; Graphic Strategy; Constructivism Approach.

1. Introduction

1.1 Reading Comprehension from Constructivist Perspective.

Reading activity merely involves decoding printed patterns into words and understanding the meaning, but reading comprehension is a complex deciphering meaning process which is very much influenced by the reader and their ability to accomplish the reading tasks (Bursk & Damer, 2007). Thus, the constructivist viewed reading comprehension as a dynamic and constructive meaning making process, involving reader-text interaction. The effectiveness of this meaning making process are heavily depends on readers' self-characteristic and their active role in the meaning making process. However, the contextual factor (why,

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when, where a text is read) and the text genre, difficulty level and style of writing will also determine the reading comprehension output (Gunning, 2008; Bursk & Damer, 2007). Readers approach text with their prior knowledge (schemata), strategies used and other self-characteristics such as world view, beliefs, attitude, motives, values, motivation and linguistic ability (Gunning, 2008). The whole process engaged reader on a complex thinking process; recognizing, decoding, arranging, analysing, assessing, generalizing (Marohaini, 1999; Reutzel & Cooter 2004) and structured into the language used with the help of strategy. Therefore, the constructivist regarded readers as autonomous individuals integrating schemata and new information from text in producing meaning, where they actively select, create and refine hypothesis made in synthesizing information and interpreting meaning (Bruner, 1966)

Constructivism basic principle encourages students' self-exploration and learning control, incorporated with their existing knowledge (Koochang, 2009). Teachers are thus challenged to create conducive environment for students to think and explore, concurrently offer their guiding role (as facilitators, mentors and scaffolding provider) to support students' active roles in meaning making and constructing new knowledge (Murphy, 2002). In a reading comprehension process, constructivists stress on teachers' supportive roles to encourage the build of concept, values, activate schemata and to encourage students' active participation in high cognitive level activities. These high cognitive level activities, for instance problem solving, deep understanding, and metacognition (Murphy, 2002), help improve students' cognitive structure. The constructivism basis emphasizes on knowledge mobility in accommodating these cognitive activities (Bruner, 1966). This resulted in transferral to several thinking levels during the reading comprehension process. The thinking levels, also known as the cognitive reading strategies, aid the reading comprehension process (Chamot & O'Malley, 1996) and thus help enhance performance.

2. Review of Literature

2.1 Reading Comprehension Strategies

Numerous studies on reading comprehension conducted over the decades have highlighted the importance of reading comprehension strategies. Studies finding also seemed to indicate a linear relationship between strategy use and reading comprehension performance. Students using strategies applied by efficient readers had performed better than those who did not (Fauziah, 2003). A strategy is viewed as a flexible plan or technique used by readers in the attempt to get information or make meaning from a text (Pearson, Roehler, Dole & Duffy, 1992). Graves et al. (2007) opined that efficient readers will use selective strategies intentionally to represent the reading process, develop comprehension and facilitate in achieving its objectives (Gunning, 2008; Fauziah, 2008). Yopp and Yopp (2006) reported on several researches resulted in comprehension increment when students are engaged with reading strategies used by efficient students. These strategies need to be learned, trained and gradually become a reading habit. Generally, the reading comprehension strategies could be divided into three main categories; metacognitive, cognitive and affective. This paper, however, only focuses on cognitive strategies, parallel to constructivism approach.

2.2 Cognitive Strategies

Williams and Burden (1997) described cognitive strategies as mental processes concerned with processing information applied for obtainment, storage, retrieval or use of information while Chamot and O'Malley (1996) defined such strategies as strategies that aided students in accomplishing the reading task. Oxford (1999) further explained that the strategies are note taking, summarizing, inferencing, using prior knowledge, predicting, analysing and using context clues. Dymock and Nicholson (2010) found that efficient readers utilize between five to nine cognitive strategies. The five major strategies are activating

schemata, constructing and asking questions (prior and during reading), analysing text structure or story structure, visualizing and summarizing. Simultaneously, research findings by Reading Panel of America revealed seven major strategies employed by efficient readers are; using graphic organizers (GO), monitoring comprehension (a metacognitive strategy), inferencing, identifying text structure (for expository text) and story structure (for narrative text), constructing and answering questions (for expository text), synthesizing, and finally summarizing (retelling/rewriting the ideas precisely) (Cooper, 2006; Pressley, 2000).

Parallel to constructivism emphasis on cognition, we chose five cognitive reading strategies and five stages of cognitive activities to be embedded in the reading comprehension process. The Story Structure Strategy was chosen as the main cognitive strategy because a narrative text was used for the comprehension process. This strategy was integrated with the Graphic Strategy via Graphic Organizer (GO) called The Story Structure Map which contained story elements such as setting, characters, plots and themes as the subtopics. Based on the skeletal framework and the subtopics given, students are to complete the GO. Story elements or also known as story structure are defined as a set of rules developed for each story in which it creates a hierarchy and help students comprehend better (Dymock, 2007). Rajeswary (1998) also found that students with story structure knowledge are able to understand a story better despite of the story lacking ideal structure. Therefore, teaching story structure is an important aspect of narrative text comprehension (Reutzel & Cooter, 2004).

Second cognitive strategy employed is Questioning Strategy, upon completion of Story Structure Strategy and GO construction by students. Teachers are encouraged to ask questions to facilitate students' mastery of basic story elements, implicitly teaching the students to generate questions via information integration (Cooper, 2006). These are the first stage questions and are to be answered in one sentence, similar to Question Answer Relationship (QAR) method (Bursck & Damer, 2007).

The third cognitive strategy, synthesizing, a high cognitive level strategy, needs to be employed simultaneously with the previous two. This strategy helps readers to have an in-depth understanding on the story structure namely the setting, characters, characters' issues, resolutions and the ending of the story (Cooper, 2006). Synthesizing strategy aids reader to evaluate information from the text and thus helps students achieve the third cognitive level in Barret's Taxonomy

The next strategy, Visualization Strategy, is used to achieve comprehensive understanding and global coherence of the text. This is parallel to Cooper's view where he believed that this technique is able to assist students' mental image development (visualizing strategy) based on their schemata and text information extract. Visualization becomes the medium for ideas representation in both narrative and expository texts (Pressley, 2000). This strategy involves assessment, summarizing and drawing conclusion from the text.

Finally, the fifth strategy employed is Inferencing Strategy. Inferencing, the second thinking level in Barret's Taxonomy is also regarded as a high thinking level. This strategy is significant in the meaning making process as it help support information required by students in text understanding. Inferential comprehension occurs when a reader is able to read between the lines (the ability to blend the text literal content with prior knowledge, intuition and imagination for conjecture or to make hypotheses) (Pennel, 2002). Prior to this, Barret (1974) had identified 8 types of inferences; a) supporting details, b) the main idea, c) sequence, d) comparisons, e) cause-and-effect relationships, f) character traits, g) predicting outcomes and h) figurative language. Grasser et al. (1994) also founded twelve inference types evolve from the meaning making (reading comprehension) process using constructivism approach. The steps are making references, the role of structural case, cause, goal, themes, reaction towards character's emotions,

consequences, pronoun initializers, instrumentation, the goal motives, situation and reader's emotion. Types 1 to 6 of the inferences were sparked during the reading comprehension process. The remaining six are generated after the process.

2.3 Graphic Strategy

Since this study uses narrative text which comes in hierarchal point, GO is the most appropriate material that can aid in hierarchical concept understanding. The use of this Graphic Strategy (through Graphic Organizer-GO) is integrated with the main cognitive strategy, the Story Structure Strategy.

GO is a text information spatial display that can be used as students study aids. GO communicates both vertical and hierarchical concept relations (Robinson, Katayama, Dubois, & Devaney, 1998) and it also uses two dimensional spaces to communicate conceptual relation and words' relative spatial locus (Katayama & Robinson, 2000). Graphic Strategy application means integrating visual-illustrated concept with information from text where GO's usage gives reader a clearer and substantial understanding. The nature of GO graphic illustration that co-appears with the text contributes to macrostructure understanding of text and enables easy retaining and retrieving information (Van Dijk & Kintsch, 1983; Chang, Sung & Chen, 2002; Xiangjing & Grabe, 2007). This also shows shift of approaches from traditional linear text presentation to graphical concept (Chang, Sung & Chen, 2002).

Researches on reading comprehension and memorization reported significant findings on GO in aiding readers text comprehension (Robinson et. al, 1998); Robinson & Skinner, 1996). Robinson, Katayama, Odom, Hsieh and Vanderveen (2006) also reported on several researches revealing students' better performance when they studied spatial display text information (GO notes) compared to linear text. GO notes not only assist students by directing their attention to important information, but, rather, help them notice important cross-concept relations that are vague when viewing linear notes. Several research reports concluded that self-constructed GO is more effective in the comprehension process (Xiangjing & Grabe, 2007) due to promotion of autonomous learning and enhancing learning depth (Chang, Sung, & Chen, 2001; Katayama & Robinson, 2000). However, GO used on different reading task produce different result (post-reading GO is more effective). The treatment duration and participants' education level also determine the effectiveness.

Those studies reported GO's strong point in representing the discourse structure of the text and therefore helps facilitate comprehension. Additionally, the research results indicated that students comprehend better with the help of GO, as demonstrated by several studies that used GO for pre-reading and a few more that utilized it for post-reading task. However, in our study, GO is used as during reading task and applied simultaneously with the Story Structure Strategy. Thus, the objective of this study is not to measure the effect of using GO alone, but also the effectiveness of all the five cognitive strategies and activities given as an intervention. The effectiveness will be measured through the pre and post-test results of Reading Comprehension Test among the students in experimental group, compared to the control group who did not receive any intervention.

3. Research Methodology

3.1 Participants

The participants were 90 Form Two students from two intact classes from one school in a district in Selangor, Malaysia. The school was selected through Cluster Random Sampling from a number of 39 secondary schools in the same district.

3.2 Design

The study involved 7 weeks of quasi experimental research, covering the administration of pre- and post-tests and also 5 weeks conducting 5 sessions of 350 minutes teaching learning process. The cognitive strategies, namely Story Structure (integrated with a Graphic Strategy), Questioning, Visualization, Inferencing, and Synthesizing, plus the five stages of cognitive activities are embedded in the experimental group reading comprehension lessons. While the control group receive a conventional method (normally practiced in the classroom). The design is quasi experimental with one group non-equivalent pre- and post-tests design. One control group of 45 students and one experimental group consists of 45 students involves in this study. Comprehension Test score is the dependent variable to be measured.

3.3 Materials

Both the experimental and control groups' narrative passage is a short story extracted from the compulsory literature text for Form Two, (for Malaysian Central Zone) as directed by the Ministry Of Education Malaysia (MOE). The length of the narrative text used is approximately 1840 words. One main Graphic Organizer (GO), the Story Structure Map is used by the students to help organize the story structure/elements along the text comprehension process. The skeletal framework of GO is adapted from Idol (1987) and constructed via computer application. The subtopics included in the Story Structure Map GO are setting (place and time), main characters, theme, subthemes, plot (beginning, climax/conflict, and ending) action and effect of characters. These subtopics are constructed from the story elements/structure.

3.4 Measures

Pre- and post-Reading Comprehension Tests administered to the sample of 90 students from two intact classes, 45 students in each class. The Reading Comprehension instrument was self-constructed by researchers based on Barret's Taxonomy (1974). Taxonomy is a hierarchical of cognitive/thinking level involved in a reading comprehension process. In this study, we utilize Barret's Taxonomy (the thinking level starts from literal, inferences, evaluation and the highest level is affective level). Barret's Taxonomy is more appropriate in measuring narratives text comprehension thinking level as it measures affective aspects of the narrative text, namely the aesthetic aspect. This Reading Comprehension instrument was tested for reliability through Kuder Richardson (KR20) formula. The value obtained is 0.649(0.7), which according to Majid (2005) is acceptable.

3.5 Instruction

Teachers would provide students opportunity and guidance to learn the cognitive strategies for further application in reading various textual types. Assistance should be given until students are skilful to utilize the strategies independently. This is in concordance to Gunning's (2008) idea of teaching strategies. Gunning's (2008) recommended direct explanation and 6 guided steps. The six steps are: a) introducing the strategies and their rationales, b) modelling or demonstrating the application of these strategies, c) conducting guided practice, teacher acts as a facilitator, d) students' self-practice (read various types of narrative texts), e) conducting assessment, and f) remodelling (if necessary). Teachers should observe students' ability to apply the targeted strategies, accompanied by written assessment in the form of graphical document, where students are expected to master the targeted strategies within a month.

The manual constructed is based on Gunning's guideline on teaching the reading strategy. However, only five out of six Gunning's steps were adapted for this study (from Step (a) to Step (e) only). The pre-test was given before the intervention starts. The five-week intervention of a Graphic Strategy, Cognitive Strategies and Activities, involved the running of the experimental manual for five sessions where each session comprises of double teaching periods of 70 minutes (35 minutes for 1 teaching period). The course of the whole manual took altogether 350 minutes.

The Fig. 1 below shows two pyramids. The pyramids are chosen to compare the strategies implemented (Fig. 1 (a)) with the reading comprehension taxonomy (cognitive level hierarchy involved in a reading comprehension process) (Fig. 1 (b)). The students' comprehension level starts from literal cognitive/thinking level, followed by higher cognitive level comprised of inferential and evaluation (a combination of cognitive and affective). The ultimate goal is affective level where students achieve appreciation and deeper understanding towards the text. The implemented cognitive strategies stages also start with easy reading activities (Session 1) and end with a more complex activity when they reach comprehension level (Session 5), as indicated in Fig. 1 (a).



Fig. 1 (a) 5 stages of Cognitive and Graphic Strategies; (b) Barret's Reading Comprehension Taxonomy

Session 1 starts with introduction where the teacher explains the strategy that will be used for text comprehending. Next is the Guided Reading approach that starts with silent reading. This automatically embarks students on cognitive process of the meaning construction, which involved integration of new extracted ideas from text with their existing knowledge (consciously or subconsciously) (Vanides, Yin, Tomita & Ruiz-Primo, 2005). The Story Structure Map GO is introduced during the Guided Reading. This GO will propel students to organize and synthesize story structure/elements information through Story Structure Strategy.

The intervention continues with Post Reading Session (Second Session) with teachers demonstrating Questioning Technique. The questions asked are to check on students' understanding on story structure/elements, prompting them one-sentence answers. At later stage, students will be able to apply this strategy as Self-Questioning Strategy.

In the third session (Deep Discussion), the discussion continues with teachers employing extracting information questions orally to the students (the 'what', 'why' and 'how' questions). This session emphasizes students' self-exploration with teachers' guidance to reinforce students' understanding and ability to define authors' hidden message, thus produce new knowledge and finally interpret the text meaning (Machado, 2010). Students' cognitive abilities will be stimulated through these guided questions, thus develop deeper comprehension. In this session, the Visualization and Inferencing Strategies are used by students to aid the process.

The fourth session (Problem Solving and Closure) displays the teachers' guiding role in leading the students to reflect and think of the problem solving action by the narrative text characters. This reflective

session enables students to evaluate the characters' action and its consequences and how the characters' action affects them as a reader. In this session, the cognitive strategy suggested is the Synthesizing and Inferencing Strategy. This activity can be executed in the form of group discussions

Finally the fifth session (Follow-up Activities), a role play involving students' performance on the role of narrative text characters is suggested. This is to help them appreciate narrative texts hence enable them to comprehend better. Finally, after the five weeks of intervention and the completion of whole activities and embedded strategies, both the experimental and control groups were administered a post Reading Comprehension Test.

4. Findings

A Paired-samples t-test was conducted to evaluate the effect of the Cognitive and Graphic Strategies intervention on students' Reading Comprehension Test score. There was a statistically significant increase on Reading Comprehension Test score in Experimental Group, from Pre-test mean (M=53.260, SD=6.4201) to Post-test (M=59.631, SD=9.1305), $d(t)=44$, $t=12.346$, $p \leq 0.005$ (two tailed). The mean increase was 6.3711, with 95% Confidence Interval (CI) ranging from 7.4111 to 5.3311. The eta square statistic indicated a large effect size= 0.78(78%). Comparing the eta square value obtained (0.780) to Cohen (1988) criteria, 0.01=small effect, 0.06=moderate effect and 0.14=large effect) the magnitude difference in the means was large (0.78), justifying that the intervention is very effective in enhancing reading comprehension performance. Please refer to Table 1.

Table 1: Paired T-Test Statistic of Reading Comprehension Test for Experimental Group

Test	N	Mean	SD	T	P
Pre-test	45	53.260	6.4201	12.346	0.005
Post-test	45	59.631	9.1305		

$p \leq 0.05$

A paired-samples t-test was also conducted to evaluate the effect of the conventional method towards students' Reading Comprehension Test score. There was also a statistically significant increase on Reading Comprehension in Control Group, from Pre-test (M=54.144, SD=8.5025) to Post-test (M=55.340, SD=8.9470, $d(t)=44$, $t=4.522$, $p \leq 0.005$ (two tailed). The mean increase however was only 1.1956 with 95% CI ranging from 1.7284 to 0.6627. The eta square statistic indicated a large effect size= 0.31(31%) according to Cohen (1988) criteria, the conventional method also contribute towards the increase of the reading comprehension score among the control group. Please refer to Table 2.

Table 2: Paired T-Test Statistic of Reading Comprehension Test for Control Group

Test	N	Mean	SD	T	P
Pre-Test	45	54.144	8.5025	4.522	0.005
Post-Test	45	55.340	8.9470		

$p \leq 0.05$

However, in determining the effectiveness of either intervention or conventional methods, the attention should be drawn to the value of the eta square. As for the experimental group, the eta square value is (0.78) which means 78% effectiveness of the intervention compared to the control group (0.31), only 31% effectiveness of the conventional method. This shows that the Cognitive and Graphic Intervention is

much more effective in enhancing the Reading Comprehension compared to the use of conventional method.

5. Discussion

Overall result of this study shows that the implemented strategies are able to increase the reading comprehension performance among the students studied. This is synchronized with positive past studies on graphic strategies used in reading comprehension (Chmielewski & Danserau, 1998; Griffin, Malone, & Kameenui, 1995). This is also parallel to those of the studies that support the advantages of the spatially-formatted GO, which lessen cognitive load, revealed easier and faster information retrieval compared to outline text (Katayama & Robinson, 2000) and helps in answering factual and inferential questions (Robinson & Skinner, 1996). Hypothetically, GOs are more searched and computationally efficient than linear displays, thus reducing the amount of search required to draw inferences. Our study has proven that GO has increased students' ability to answer the inference thinking questions.

The finding of this research also seconded the research result reported by Katayama, Odom, Hsih and Vanderveen (2006) who found that providing students with skeletal GO frameworks helped them outline frameworks for learning across-concept connections, therefore increasing their comprehension level. Robinson et al (2006) reported a meta-analysis study result on GO by Moore and Readance, revealed that student-constructed GOs had an effect size of (0.38), compared with (0.15) for teacher-constructed GO. In our study, the effect size value of the intervention is 0.78 (78% effective). This applies to the experimental group Reading Comprehension Score, who constructed their own GO from the skeletal framework given.

In contrast, Katayama and Robinson (2000) indicated that a partial graphic organizer functioned better than a skeletal GO due to less overload, more engaged participation, and more encoding process provided by the partial GO. Katayama and Robinson also concluded that using a skeletal GO was not as effective as using outlines or conventional notes because high level of concentration needed to complete a skeletal framework.

As for the cognitive strategies, our research result shows that the implemented strategies has helped student comprehend better, as signified by the enhancement in the reading comprehension test score. This finding is parallel to Dymock's (2007) and Rajeswary (1998), stating that the utilization of Story Structure Strategy contribute to better understanding thus enhancing comprehension. Finally, our finding on students' ability to answer inferential questions complements Grassers et al (1994) study which showed that constructivism approach used in reading comprehension is able to inculcate the inferential thinking among students, thus heightened their comprehension performance.

6. Conclusion

Every reading comprehension process highly demands the integration of readers' ability, schemata, other self-characteristics, and strategized action to achieve goal. The implemented strategies and deep cognitive activities embedded in the process, are thus able to increase the students' reading comprehension performance. Through students' self-exploration and teacher's guiding role as the main elements in constructivism learning, this study has proven that the graphic strategy, cognitive strategies and activities has resulted in enhancing the Reading Comprehension performance among the students studied.

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