

Efficacy of Supplementary Image Schemes on Reading Motivation and Comprehension

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This study examines the efficacy of three teaching methods, namely, passive supported image pedagogy, active supported image pedagogy, and traditional instruction, in increasing the reading motivation and comprehension of students. 116 fourth-grade students participated in the study and were evenly assigned, according to their pre-test performance, to one of three groups: “Passive Supported Group” (PSG), “Active Supported Group” (ASG), and “Text-only Group” (TOG). The PSG was asked to read a text with images; the ASG was asked to read the text and reconstruct the main ideas through image selection; and the TOG was asked merely to read the text. After eight weeks of reading-training, the three groups were asked to complete post-tests. Following this, independent-samples *t*-test and paired-samples *t*-test were used to analyze the results. Based on the results, active supported image pedagogy was found to be the most effective method for improving the reading motivation and comprehension of students.

Keywords: reading motivation, reading comprehension, passive supported image pedagogy, active supported image pedagogy

INTRODUCTION

In the era of knowledge-based economy, the limited amount of knowledge covered by school-based education is insufficient to satisfy individuals' needs. Therefore, they must develop their capabilities and habits in life-long learning in order to be more competitive. Reading is one of the essential basic skills of learning (Alfassi, 2004). Learning through reading enables one to learn beyond the scope of school-based education and absorb different kinds of required knowledge in the fast-changing environment. Childhood is a critical period for children to make rapid

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progress in learning. If they fail to establish a solid foundation at this stage, not only their school performance (Blankenship, Ayers, & Langone, 2005) but also their daily lives may be affected. This state of reading difficulty could then continue throughout adulthood making it difficult for them to progress (Rapp, van den Broek, McMaster, Kendeou, & Espin, 2007).

The current educational program is designed largely based on the developmental process of children's reading comprehension abilities and the fourth grade is often used as a watershed year (Chall, 1995). Prior to that, the main teaching goal is to develop and train students' basic reading skills, such as word identification, fluency in reading, and other skills. Starting from the fourth grade, students are taught how to use their previously acquired skills they have acquired to understand the content of texts, from which to learn or acquire new knowledge and enjoy the fun of reading (Mullis, Kennedy, Martin, & Sainsbury, 2006). However, if those students who make slow progress in reading comprehension ability fail to catch up to the required level of reading in the fourth grade, they may encounter one difficulty after another in absorbing and comprehending the content of the heavy course load; thereby, some might even reject reading and learning. This may further increase the disparity between them and other students in terms of reading and academic performance, gradually forming the Mathew Effect, whereby the poor get poorer and the rich get richer (Stanovich, 1986). Therefore, it is an immediate and urgent task to effectively raise the reading comprehension ability of fourth grade students above the standard level within a limited number of teaching hours.

In teaching students how to read, a mere increase in the amount of reading time and quantity of reading materials will not be sufficient to effectively strengthen their reading comprehension abilities (Block, Parris, Read, Whiteley, & Cleveland, 2009). Enhancing the reading motivation of students is one of the most effective ways to strengthen their reading skills (Guthrie et al., 2004). With an increase in the level of reading motivation, students may like to read both actively and continuously (Wang & Guthrie, 2004). When students encounter more difficulties in reading materials, they can solve these problems with appropriate strategies (Otis, Grouzet, & Pelletier, 2005; Ratelle et al., 2007), and subsequently, they can have joy and confidence in this process. Nonetheless, many students experience a gradual reduction in their reading motivation due to the heavy course load, pressure to achieve academically, expectations from parents and teachers, as well as other factors (Wigfield et al., 2004; Kirby, Ball, Geier, Rauno, & Wade-Wooley, 2011), which may only further reduce their learning effectiveness (Deci & Ryan, 2008). Thus, if a teaching method

State of the literature

- When students have a stronger reading motivation, they may like to read both actively and continuously and can effectively strengthen their reading comprehension abilities.
- Fourth-grade is a critical period for children to make rapid progress in reading learning. If they were training with the method which was designed to suit their learning habits and preferences, their reading comprehension abilities will be effectively promoted.
- This study explored how passive supported image pedagogy and active supported image pedagogy influence the reading motivation and reading comprehension abilities of fourth grade students.

Contribution of this paper to the literature

- Active supported image pedagogy was proved to be the effective method for improving the reading motivation and comprehension of students.
- Passive supported image pedagogy might cause fourth grade students to become over-dependent on images when obtaining information and reducing their opportunities in the reading text.
- In addition to improving participants reading motivation and reading comprehension skills, active supported image pedagogy could improve their learning performance in other course and help them to display greater participation in the classroom.

can be designed to suit students' learning habits and preferences, their learning motivation will be effectively promoted and learning effectiveness will be enhanced.

Children's learning development can be divided into three stages of cognition (Bruner, 1966): (1) enactive representation stage: the operational thought of infants must be completed by operating on a physical object; (2) iconic representation stage: children perform thinking and learning activities via imagery; (3) symbolic representation stage: children acquire knowledge using symbols or words. Of these, the transition from iconic representation stage to symbolic representation stage is the most crucial in the fourth grade of elementary school. During the early development of the symbolic representation stage, students often fail to comprehend the content of a passage due to their incorrect interpretation of words and vocabulary. This may cause them to feel defeated, thus reducing their reading motivation. On the other hand, if it is possible to learn in the reading mode of images with supplementary text, not only can students' reading motivation be increased (Carney & Levin, 2002), but also their reading comprehension abilities (Karapantsios, Boutskou, Touliopoulou, & Mavros, 2008), with the help of dual coding and organization (Paivio, 1991), to form coherent mental representations and organized content (Ametller & Pintó, 2002). Furthermore, it will strengthen the training of students' capabilities in analyzing the known conditions in passages or questions, and help them to enhance their recollection, thereby increasing the effectiveness of learning.

There are two types of teaching method where iconic representations with supplementary text are used for learning: (1) Passive supported image pedagogy, and (2) Active supported image pedagogy. Passive supported image pedagogy is mostly applied among pre-school or elementary school children. As the learners in this age group can only understand a small amount of vocabulary, they cannot understand the texts completely. One solution is to use images to depict text content in a more concrete way, while training learners to read images and text concurrently. By using the content of images as clues, students can understand the meanings conveyed by the vocabulary, phrases, and short stories. Apart from strengthening students' text comprehension, their ability to infer and memorize can also be improved (Pike, Barnes, & Barron, 2010). Research results from Norman (2012), Yu (2012), Mason, Tornatora, and Pluchino (2013), Fehr et al. (2012), and other researchers all illustrate the effectiveness of this teaching method. On the other hand, active supported image pedagogy is more often applied among students at seventh grade level or above. After text content analyzing, students were asked to select/hand-draw reference images/elements that match the main idea of the passage, the results were then used to compare with the outcomes in text comprehension (Leopold & Leutner, 2012). This teaching method has a number of advantages: improving learners' reading comprehension abilities, encouraging students to think actively and strengthen their performances in problem-solving (Ainsworth, Prain, & Tytler, 2011), and further increasing their curiosity and attentiveness (Risko, Walker-Dalhouse, Bridges, & Wilson, 2011). It can even stimulate students' imagination (Ainsworth et al., 2011). This teaching method has been proven effective by relevant studies (Ainsworth et al., 2011; Leopold & Leutner, 2012).

Most of the existing studies related to this field have only explored the degree of improvement in learners' learning effectiveness when passive supported image pedagogy or active supported image pedagogy were used. These studies, however, did not examine how the two teaching methods impact on students' reading motivation, or comparison with the effectiveness of the two methods in improving learners' reading comprehension abilities. Moreover, the majority of research on passive supported image pedagogy as an instructional tool used children below

third grade in elementary schools as their study subjects, while studies on active supported image pedagogy as an instructional tool selected students in seventh grade or above as study subjects. However, few studies examine the effect of the two teaching methods on fourth grade students at the same time. Given the above, this study will explore how the two teaching methods influence the reading motivation and reading comprehension abilities of fourth grade students. The students taught in the traditional text-only teaching method will be treated as a control group in order to compare variations in effectiveness between passive supported image pedagogy, active supported image pedagogy, and traditional instruction.

METHOD

Participants

This study included six classes of Taiwanese fourth-grade students (116 students in total; 57 males and 59 females) as research subjects, all of whom are native Mandarin Chinese speakers. The participants completed the pre-test in the first week of the experiment. Based on this test, students from the six classes were divided into three groups with no difference in terms of reading motivation and reading comprehension abilities: the “Passive Supported Group” (PSG) (35 students: 14 males, 21 females), the “Active Supported Group” (ASG) (44 students: 25 males, 19 females), and the “Text-only Group” (TOG) (37 students: 18 males, 19 females). Each group was comprised of two classes. Simultaneously, 31 fifth-grade students, none of whom had previously participated in a similar experiment, were invited to take part in a reading comprehension test, which formed the baseline to compare the extent of improvement in the reading comprehension abilities among the three groups.

Instructions

In the eight-week teaching experiment, the participants used computers to conduct their reading practice, and received identical educational materials, a total of 24 articles and reading tests. The task given to participants in each group is illustrated as follows:

PSG: Participants had to read article and images simultaneously. There were four paragraphs in the article and beneath each paragraph was an image that corresponded to the main idea of the paragraph. A reading test was administered immediately after the participants had finished reading.

ASG: Participants first read an article and were then asked to select one image (from a total of eight images) that matched the main idea of each paragraph. After selecting images for the four paragraphs, participants clicked on the “Finish” button to reveal the correct image. Following this, participants were asked to take the reading test.

TOG: Participants had to read the article without the aid of any imagery. A reading test followed immediately after completion of the reading.

All instructions were reviewed before participants began the teaching experiment. Participants from the three groups were reminded to complete the task at their own pace. When they were taking the reading test, they were allowed to read the article and view the images simultaneously (with the exception of the TOG who had no images). Participants were allowed to ask questions if they experienced any problems in operation or execution of the exam.

Instrument

To assess clearly the impact of passive supported image pedagogy, active supported image pedagogy, and traditional instruction on the reading motivation

and comprehension abilities of participants, this study employed a questionnaire on reading motivation and a reading comprehension test as measurement tools. Specifically, reading motivation was measured using the questionnaire first presented by Baker and Wigfield (1999), i.e., Motivation for Reading Questionnaire (MRQ), which consists of 54 questions covering 11 dimensions: self-efficacy, reception to challenge, work avoidance, curiosity, involvement, importance, recognition, grades, competition, sociability, and compliance. A five-point Likert scale was adopted for measurement in the MRQ.

The tool for the reading comprehension test was that used by Taiwan's Ministry of Education to evaluate students' abilities in reading comprehension: the Chinese Reading Comprehension Test (CRCT) (Lin & Chi, 2000). The CRCT is divided into modules A and B. Both modules contain six reading tests (half descriptive and half narrative texts) and 50 multiple-choice questions. Two reading comprehension tests were conducted as the modules of this study. For the pre-test, module A of the CRCT was used. For the post-test, module B of the CRCT was used.

Procedure

All 116 participants received a 10-week experiment. In week 1, all participants were asked to complete the pre-test. Based on the pre-test results, participants were then evenly assigned to the PSG, ASG, and TOG in such a way that the three groups showed no difference in performance in the pre-test.

The training program for the three groups started in week 2 and lasted for eight weeks, with 40 minutes of training per week. The participants used computers to conduct their reading practice. The weekly training materials included three articles and reading tests. The PSG was given a reading test after reading an article and viewing images that presented the main ideas of every paragraph of the article. The ASG took a reading test after reading the article and selecting images that corresponded with the main points of each paragraph of the article. The TOG completed a reading test after finishing reading the article.

In the tenth week, the three groups were given the post-test. Subsequently, a comparison was made between the effectiveness of the three approaches in increasing learners' reading motivation and comprehension abilities.

RESULTS

To explore the effectiveness of passive supported image pedagogy, active supported image pedagogy, and traditional instruction, this study performed a series of teaching experiments, a pre-test, and a post-test. Both the pre-test and post-test were administered to measure changes in students' reading motivation and comprehension. The experimental results have been analyzed through an

Table 1. Comparison of the PSG, ASG and TOG in the pre-test

Test	Group	N	Mean (%)	SD	t	95%CI		p-value (2-tailed)
						LL	UL	
MRQ	PSG	35	71.94	13.89	.93	-3.00	8.21	.36
	ASG	44	74.55	11.13				
	PSG	35	71.94	13.89	.72	-3.86	8.18	.48
	TOG	37	69.78	11.68				
	ASG	44	74.55	11.13	1.88	-.29	9.82	.06
	TOG	37	69.78	11.68				
CRCT	PSG	35	65.49	23.56	.33	-7.94	11.06	.75
	ASG	44	67.05	18.86				
	PSG	35	65.49	23.56	1.02	-4.81	14.80	.31
	TOG	37	60.49	17.92				
	ASG	44	67.05	18.86	1.60	-1.63	14.75	.12
	TOG	37	60.49	17.92				

independent-samples *t*-test and paired-samples *t*-test to confirm the effectiveness of the three pedagogies.

To understand the differences in the performance of all three groups in terms of reading motivation and reading comprehension abilities in the pre-test and post-test, an independent-samples *t*-test was conducted on the pre- and post-test results of each group. The analysis, as presented in Table 1, indicated that there was no significant difference in the performance of MRQ and CRCT among the PSG, ASG, and TOG in the pre-test (all groups' $p > .05$).

After the experiment, the ASG performed significantly better than the PSG and TOG in both the MRQ and CRCT in the post-test ($p=.04<.05$; $p=.01<.05$; $p=.00<.05$; $p=.00<.05$, respectively) (Table 2). Furthermore, there was no significant difference in the MRQ and CRCT scores between the PSG and TOG ($p=.56>.05$; $p=.43>.05$, respectively). Therefore, in terms of training learners in reading skills, active supported image pedagogy is shown to be the most effective of the three pedagogies in improving reading motivation and reading comprehension abilities.

In order to examine the differences in reading motivation and reading comprehension abilities of the three groups before and after the teaching experiment, the three groups' scores in the pre-test and post-test were analyzed through paired-samples *t*-test (Tables 3, 4, and 5). Results from the analyses

Table 2. Comparison of the PSG, ASG and TOG in the post-test

Test	Group	N	Mean(%)	SD	t	95%CI		p-value (2-tailed)
						LL	UL	
MRQ	PSG	35	71.54	12.50	2.06	.18	10.46	.04
	ASG	44	76.86	10.45				
	PSG	35	71.54	12.50	.59	-4.19	7.70	.56
	TOG	37	69.78	12.76				
	ASG	44	76.86	10.45	2.75	1.95	12.21	.01
	TOG	37	69.78	12.76				
CRCT	PSG	35	66.46	24.41	3.49	6.84	25.07	.00
	ASG	44	82.41	16.13				
	PSG	35	66.46	24.41	.80	-6.00	14.05	.43
	TOG	37	62.43	17.93				
	ASG	44	82.41	16.13	5.28	12.44	27.51	.00
	TOG	37	62.43	17.93				

Table 3. PSG's MRQ and CRCT in the pre-test and post-test

Test	Pre-test		Post-test		t	p	95%CI		p-value (2-tailed)
	M(%)	SD	M(%)	SD			LL	UL	
MRQ	71.94	13.89	71.54	12.50	.23	.00	-3.16	3.96	.82
CRCT	65.49	23.56	66.46	24.41	-.74	.00	-3.63	1.69	.46

Table 4. ASG's MRQ and CRCT in the pre-test and post-test

Test	Pre-test		Post-test		t	p	95%CI		p-value (2-tailed)
	M(%)	SD	M(%)	SD			LL	UL	
MRQ	74.55	11.13	76.86	10.45	-1.38	.00	-5.71	1.07	.16
CRCT	67.05	18.86	82.41	16.13	-8.76	.00	-18.90	-11.83	.00

Table 5. TOG's MRQ and CRCT in the pre-test and post-test

Test	Pre-test		Post-test		t	p	95%CI		p-value (2-tailed)
	M(%)	SD	M(%)	SD			LL	UL	
MRQ	69.78	11.68	69.78	2.10	.00	.00	-2.91	2.91	1.00
CRCT	60.49	17.92	62.43	19.93	-1.45	.00	-4.68	.78	.16

indicated that the PSG made no significant different in either MRQ or CRCT ($p=.82>.05$; $p=.46>.05$, respectively). ASG's scores for MRQ showed no significant different ($p=.16>.05$). Instead, ASG's scores for CRCT indicated significant progress ($p=.00<.05$). TOG made no significant different in either MRQ or CRCT ($p=1.00>.05$; $p=.16>.05$, respectively). These results showed that in the eight-week teaching experiment, the three pedagogies did not significantly raise the level of reading motivation among the test participants, while the improvement in reading comprehension abilities was significant only for active supported image pedagogy.

DISCUSSION AND CONCLUSION

This study aimed to analyze the efficacy of three different methodological teaching methods, namely, passive supported image pedagogy, active supported image pedagogy, and traditional instruction, on the reading motivation and comprehension abilities of fourth-grade students. The results indicate that participants in the ASG displayed greater post-test reading motivation and superior reading comprehension abilities compared with the PSG and TOG, and only the ASG had significant improvement in reading comprehension abilities in the pre-test and post-test, illustrating the effectiveness of active supported image pedagogy over passive supported image pedagogy or traditional instruction.

The results from the analyses revealed that the reading motivation of the ASG in the post-test was significantly superior to that in the PSG and TOG. However, ASG made no significant different in reading motivation in the pre-test and post-test. This might be due to the use of a five-point Likert scale in the MRQ; the small number of points in the scale might explain the small difference between the two scores before and after the teaching experiment (pre-test: 74.55%; post-test: 76.86%).

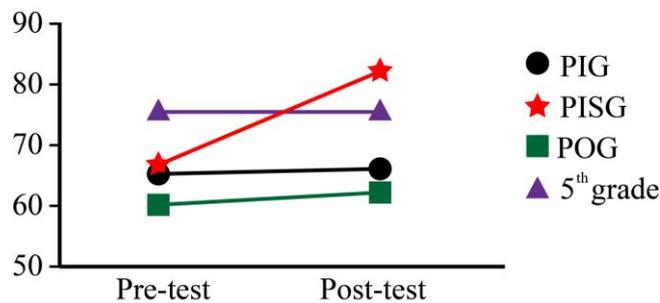


Figure 1. The reading comprehension levels of the three groups and 5th grade students in the pre-test and post-test.

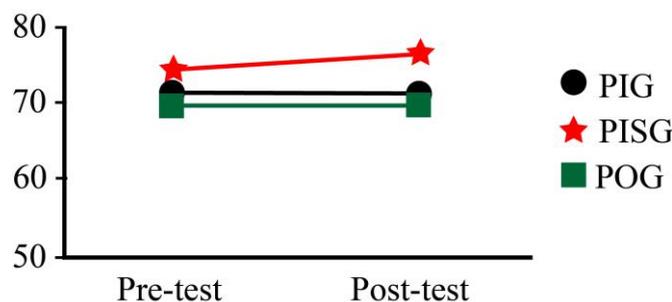


Figure 2. The reading motivation levels of the PSG, ASG, and TOG in the pre-test and post-test

In comparing the reactions of the three groups during the course of the experiment, participants in the ASG showed a more active and positive attitude when reading. When the schedule of the experiment had to be adjusted to accommodate activities in the school calendar, the majority of the ASG expressed concern at the possible impact of such an adjustment on the experimental program. This attitude was in contrast with that of the majority of the participants in the PSG and TOG, whose enthusiasm for the experiment was largely guided by the researchers and instructors. This indicates that as compared to passive supported image pedagogy and traditional instruction, learning through active supported image pedagogy can significantly increase students' reading motivation.

In addition, Carney and Levin (2002) pointed out that students' learning motivation can be effectively strengthened with the help of supportive images. Nevertheless, this study presented a similar effect of PSG and TOG on reading motivation. It meant that participants' reading motivation couldn't be strengthened by the images. Since the participants had just entered the symbolic representation stage and they faced changes in the school curriculum from image-based to text-based, the academic pressure on them had increased sharply. Although in the experimental learning environment, images seemed to be able to increase their interest in learning, the results of our analysis demonstrated that images were less effective in strengthening PSG participants' reading comprehension abilities. As a consequence, students' study burden could not be eased and hence their reading motivation was not effectively strengthened.

When comparing the reading comprehension abilities of the three groups to the fifth-grade students, all three groups lagged behind the fifth-grade students in the pre-test (See Figure 1). After the experiment, however, the score of the ASG in the reading comprehension of the CRCT (82.41) was higher than that of the fifth-grade students (75.8). This indicates that the eight-week training in active supported image pedagogy can improve a learner's reading comprehension abilities by more than the equivalent of one academic year in a standard school classroom.

The results of this study have demonstrated that passive supported image pedagogy had a limited effect in increasing participants' reading abilities, contrary to the conclusions by Tare, Chiong, Ganea, & DeLoache (2010) and Yu (2012). Since images facilitate students' recall performances (McCrudden, Magliano, & Schraw, 2011), the aforementioned studies all proved that images could strengthen students' performances in the course reading test. However, this learning pedagogy might cause students to become over-dependent on images when obtaining information (Risko et al., 2011), thus reducing their opportunities in the reading text. As a consequence, the efficacy of images in aiding students in text content comprehension may decline as students' age increases (Pike et al., 2010), resulting no significant difference in the PSG's CRCT (text only) pre-test and post-test results. On the other hand, active supported image pedagogy aims at training participants' ability to analyze text content, so that they can locate the image matching the message of the article, and subsequently their understanding of texts can be effectively strengthened. Furthermore, Mason et al. (2013) found that when learners frequently browsed back and forth between text and images, their training in text content analysis was sharpened and this helped improve their performances in reading comprehension. These results illustrated that the effectiveness of active supported image pedagogy was significantly superior to passive supported image pedagogy.

Therefore, the progress in reading motivation and reading comprehension abilities of the three groups between pre-test and post-test (Figures 1 and 2), as well as the positive correlation between reading motivation and reading comprehension abilities proposed by Becker, McElvany, and Kortenbruck (2010), clearly demonstrate the importance of reading motivation in the learning process.

Two instructors of the ASG later expressed in an interview that, in addition to improving reading motivation and reading comprehension skills, the participants of the ASG went on to showcase greater participation in the classroom. In interviews aimed at tracking progress in the year following the experiment, aside from further confirming the effectiveness of the active supported image pedagogy, the instructors were also actively recommending it to other teachers as an effective pedagogy for teaching reading skills.

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