

The Impact of Video-based Materials on Chinese-Speaking Learners' English Text Comprehension

Lu-Fang Lin¹

¹ National Taiwan Ocean University, Taiwan, R. O. C.

Correspondence: Lu-Fang Lin, National Taiwan Ocean University, 2 Pei-Ning Road, Keelung 202, Taiwan, R. O. C. Tel: 886-2-2463-2401. E-mail: annalin2038@gmail.com

Received: July 12, 2016 Accepted: August 15, 2016 Online Published: August 16, 2016

doi: 10.5539/elt.v9n10p1 URL: <http://dx.doi.org/10.5539/elt.v9n10p1>

Abstract

This study investigated whether video-based materials can facilitate second language learners' text comprehension at the levels of macrostructure and microstructure. Three classes inclusive of 98 Chinese-speaking university students joined this study. The three classes were randomly assigned to three treatment groups: on-screen text (T Group), concurrent narration with on-screen text (NT Group), and video with concurrent narration and on-screen text (VNT Group). The data were collected through the macrostructure and microstructure reading comprehension pre- and post-tests and the immediate test. The statistic results of the immediate test and the post-tests showed that the VNT group performed significantly better on the macrostructure comprehension than the T and NT groups. Armed with the perspectives of multiliteracies and the significant results, the study makes instructional recommendations to integrate video in second-language reading comprehension instruction.

Keywords: second language learning, text comprehension, video-based materials

1. Introduction

The technology advancement and the boom of various handheld smart devices allow access to visual support learning tools wherever and whenever. It is common for an individual to expose himself/herself in a visualized surrounding with multiple handheld technological devices. To prepare students well for confronting the rapidly changing and globalized world, the New London Group (NLG) (1996) proposed a multiliteracies pedagogy with the emphasis on multi-dimensions of literacy and claimed that literacy teaching may go beyond written language and further teach students to interpret meanings of text through other modes, such as visual representation, audio representation, tactile representation, gestural representation, and spatial representation (Kress, 2003). Video, a kind of visual support, can be used to enhance second language (L2) learning.

Multimedia instructional environments are widely recognized as having great potential for improving the way that people learn (Mayer, 2005; Plass & Jones, 2005). The term "multimedia environment" refers to settings in which information is presented in more than one format, such as in both a verbal and nonverbal form or in an audio and visual form (Mayer, 2005; Moore, Burton, & Myers, 2004). Multimedia material saturated with video plays an essential role in assisting L2 learning. Using video as a teaching tool, some researchers have found that it can foster L2 vocabulary learning, as well as listening and reading comprehension (Chun & Plass, 1996a, 1996b; Jones & Plass, 2002), and the results of these studies further support Paivio's dual coding theory (DCT) of cognition (2007). In defining DCT, Paivio (2007) explained that "cognition involves the cooperative activity of two functionally independent but interconnected systems, a nonverbal system specialized for dealing with nonlinguistic objects and events, and a verbal system specialized for dealing directly with language" (p. 33). In this way, video can promote L2 learning when used in ways that are consistent with the dual-code assumption.

However, the information displayed through multimedia, such as video, audio, and captions, may result in the learner's cognitive overload. Due to limited working memory capacity (Baddley, 2007), the learner may not be able to simultaneously process the information in different modalities. The effect of input modality (video, audio, and captions) on L2 learning needs further investigation with respect to different levels of comprehension.

The major purpose of this study is to examine whether video-based materials can foster L2 learners' abilities to understand L2 text in terms of the macrostructure and microstructure levels of comprehension. The cognitive

processes related to comprehension range across the entire spectrum of mental representations (Caccamise, Snyder, & Kintsch, 2008). Multiple levels of proposition representations may exist, ranging from the micropropositions expressed in the text itself to various levels of macropropositions constructed by the learner (Kintsch, 1998). The present study assumes that comprehension occurs on both macro- and micro-levels. The benefit of dividing comprehension into levels is that each level can be further subdivided into specific skills, and this approach can make comprehension instruction seem concrete and manageable (Robinson & McKenna, 2008). Comprehension interpreted from the aspect of macrostructure and microstructure levels has not been fully considered in previous L2 multimedia research. With the advance of technology, video-based materials have been widely uploaded on the Internet and used in the L2 context. Further investigations of the effects of video-based materials are needed to address L2 learners' text comprehension.

2. Literature Review

2.1 Dual-Code Processing

As Plass and Jones (2005) indicated, an integration of text with pictorial cues fosters L2 learning. The positive effects of a combination of pictorial and verbal cues can be explained from a dual-code processing perspective (Paivio, 2007). Paivio's DCT (2007) assumes that there are two subsystems processing incoming verbal and nonverbal stimuli. Humans' mental structures are associative networks of verbal and nonverbal representations. The verbal representations include "visual, auditory, articulatory, and other modality-specific verbal codes" (Clark & Paivio, 1991, p. 151), while the nonverbal representations contain "modality-specific images for shapes, environmental sounds, actions, skeletal or visceral sensations related to emotion and other non-linguistic objects and events" (Clark & Paivio, 1991, p. 151). The assumption of DCT implies that the learner is capable of dealing with incoming verbal and image information simultaneously when viewing video materials.

2.2 A Pedagogy of Multiliteracies

Second language learners can be trained with a multiliteracies pedagogy to expand their text comprehension ability. The multiliteracies pedagogy developed in 1994 by the NLG aims to integrate a wide range of cultural, linguistic, communicative, and technological diversity into classroom teaching to help students to prepare themselves well for a rapidly changing, globalized world. The NLG (1996) claimed that "how negotiating the multiple linguistic and cultural differences in [the] society is central to the pragmatics of the working, civic, and private lives of students" (p. 60). A pedagogy of multiliteracies emphasized the conception of multimodality, which refers to all forms of representation and language learners design meaning by means of different modes, such as written and oral language, visual representation, audio representation, tactile representation, gestural representation, and spatial representation (Kress, 2003). Cope and Kalantzis (2009) indicated that many modes were encouraged to be used in different forms of expression and further assumed that "where writing is found, visual supports allow a simplified syntax for the writing itself, in the form, for instance, of a decreasing clausal complexity" (p. 15). Visual supports hence may facilitate text comprehension.

People across the world may use different technological devices and communication channels to express themselves and communicate with others. To be successfully involved in such a globalized changing world, the language educator may not only focus on teaching linguistic knowledge of English but also pay attention to cultural, communicative, and technological diversity. Judging from the perspectives of the multiliteracies pedagogy, English learners may comprehend English text successfully when the text is supported with visual images. The present study intended to integrate video, a kind of visual support, with verbal information and further examine the effects of video-based materials on the learners' English text comprehension in the EFL context.

2.3 Effects of Videos on Second Language Learning

Language instructors and researchers have long been interested in using images and pictures to enhance L2 learning (Al-Seghayer, 2001; Chun & Plass, 1996a, 1996b; Sydorenko, 2010). This is probably because the construction of "propositions and of mental models require[s] simultaneous availability of corresponding text information and picture information in working memory" (Schnotz, 2005, p. 61). In general, verbal information associated with pictorial images can be learned more successfully than are those without such additional information.

Video-based materials have been examined and shown significant positive results. For example, videos have been found to aid vocabulary learning (Chun & Plass, 1996a, 1996b; Jones & Plass, 2002; Lin, 2010; Sydorenko, 2010), as well as listening and reading comprehension (Chapple & Curtis, 2000; Herron, et al., 2006; Plass, Chun, Mayer, & Leutner, 1998; Winke, Gass, & Sydorenko, 2010). For example, using video advanced

organizers, Chun and Plass (1996a, 1996b) found that visually and verbally annotated words resulted in better general text comprehension than those with only verbal annotation and those without any annotation. With English-speaking college students enrolled in a German course as the participants, the results of Plass, Chun, Mayer, and Leutner's (1998) study revealed that students remember word translations better in the condition of visual (i.e., picture or video) and verbal (i.e., text translation) annotations than in the conditions of written annotations alone, pictorial annotations alone, or with neither form of annotation. Examining the effects of the four listening treatments on the university students' comprehension of the aural passage, Jones and Plass (2002) further found that the participants selecting both written and pictorial annotations outperformed those in the other three treatments (i.e. only written annotations, only pictorial annotations, or no annotation). Herron et al. (2006) conducted a study to compare a video instructional package and a text-based instructional package, and verified that intermediate-level college French students in the video-based course significantly improved not only their grammar knowledge but also their listening skills. Some studies have also proved that video may not only enhance L2 learners' four language skills, grammar knowledge but also critical thinking ability. For example, with 31 Cantonese tertiary-level students in Hong Kong as the participants, Chapple and Curtis (2000) stated that the participants had improved their English analytical and critical thinking.

More recently, researchers confirmed that video-based materials could enhance second language learning. For example, Sydorenko (2010) examined the effects of video, audio, and captions on the learning of written and aural words. The results showed that the group receiving video, audio, and captions (VAC), and the group receiving video and captions (VC) scored higher than the group receiving video and audio (VA) on the written recognition of word forms. These results suggest that the VAC combination including verbal and nonverbal information is more suitable than the VA combination including verbal information for learning the meanings of new words. For a specific examination on L2 vocabulary acquisition, Lin (2010) designed a video-based CALL program for a Taiwanese university. The results revealed that video-based materials significantly improved less-proficient participants' incidental vocabulary acquisition and text comprehension; both proficient and less-proficient participants' vocabulary acquisition was positively related to their video comprehension (Lin, 2010). In general, the studies on the effects of pictorial cues provide evidence for Paivio's DCT (2007), assuming that memory for verbal information can be improved if a corresponding visual is simultaneously presented or if the learner can imagine a visual image to go with the verbal information.

However, another path of research draws attention to whether adding videos to the material can hinder L2 learning due to the learner's working memory (WM) capacity. WM acts as "the temporary storage of information that is being processed in any of a range of cognitive tasks" (Baddeley, 1986, p. 34). However, WM is limited in its capacity to store and maintain input information and may not successfully handle different input modalities of information simultaneously, and therefore the learner may experience cognitive overload and fail to comprehend the text successfully. The contradiction between the learner's cognitive load caused by the presentation format and the learner's limited WM capacity can be a considerable challenge for multimedia learning. To investigate the manifestations of this challenge, the present study intended to compare the effects of different presentation conditions which differed in verbal and nonverbal input modalities.

2.4 Macrostructure and Microstructure Comprehension

Cognitive science researchers have attempted to describe the various processes involved in reading comprehension. In fact, comprehension is a continuous process, demanding control of mental connections from the learner's memory representations. To manipulate the reading comprehension studies empirically and to implement instruction concretely and manageably, some researchers have categorized comprehension as dual-level. This dual-level concept of comprehension obtained its name in a variety of ways. For example, viewing reading as a paradigm of cognition processes, Chun and Plass (1997) regarded comprehension as the interaction of bottom-up processes (vocabulary acquisition) with top-down processes (activating prior knowledge). Bottom-up approaches assume that "the written text is hierarchically organized on the letters, words and word groups, and that the reader first processes the smallest linguistic units, gradually compiling the smaller units to decipher and comprehend the higher unit" (Lin, 2004, p. 31). On the other hand, top-down approaches assume that "reading begins with knowledge and hypotheses in the mind of the reader" (Lin, 2004, p. 33); the reading comprehension process is driven by concepts. Other paired terms used in previous studies include *general* versus *local* (Block, 1986), *deep* versus *shallow* (Graesser, 2008), *higher* versus *lower* (Pressley, 2000), and *macrostructure* versus *microstructure* (Kintsch, 1998). These dichotomies refer to the same range of information processes from local, meaning operation in the text itself, such as decoding word meanings and identifying syntactic relations, to overall meaning operation, such as establishing coherent memory representation of the text, or arriving at an overall impression of the content of the text.

Following the work of van Dijk and Kintsch (1983) and Kintsch (1998), the present study focused on comparing the learner's ability to understand linguistic information in the text from smaller to larger linguistic units, such as words, phrases, and sentences up to the whole text. The assumption that comprehension is processed at micro- and macro-levels may be attributed to text organization which contains individual local and global structures that yield two types of mental representation structures: micro- and macro-propositions (Kintsch, 1998). According to Kintsch (1998), text mental propositions are generated from words and phrases in the text itself, and are connected together. Micropropositions refer to the interconnection of some propositions with their previous and subsequent propositions, and the formulation of local meaning relationships (or the microstructure connections). For example, the individual propositions expressed by the words, phrases, and sentences of a text can be regarded as micropropositions (Kintsch, 1998). Regarding reading comprehension, the process in which readers rely on micropropositions to understand the text can be regarded as MICS comprehension. Kintsch contrasted microstructure connections with macrostructure connections. Macropropositions refer to the interaction of some propositions with higher-level concepts in the activated knowledge net, and the revealing of more global relationships in the text. A summary of the text is one type of macrostructure connection. When readers tend to make a macrostructure connection during the process of reading, such type of comprehension can be regarded as MACS comprehension. Both MACS and MICS comprehension plays an essential role in reading comprehension.

From the reviewed literature related to reading comprehension and multimedia instruction, some gaps exist in the investigation of MACS and MICS comprehension. First, the text comprehension model developed by Kintsch and van Dijk has been well investigated in recent years as it relates to first language (L1) reading comprehension (Kintsch & Yarbrough, 1982), and it is currently one of the most widely accepted scientific models of text comprehension in the literature (Nassaji, 2006). However, it appears that its full potential application in L2 text comprehension in multimedia environments has not yet been explored. The second gap is that the aforementioned video research examined general comprehension rather than the macrostructure and microstructure of comprehension. The present study therefore investigated the effects of video on L2 learners' MACS and MICS comprehension.

The third gap is the study of video-based materials in the EFL context. That is, the need exists to use authentic videos as the research material. Authentic videos are video material produced for native speakers of a language. Reviewed literature verified that videos are useful for visualizing processes, and can clarify complex ideas and make them easier to remember; moreover, videos can enhance understanding of those concepts that are difficult to explain verbally (Ciccone, 1995; White, Easton, & Anderson, 2000). In most EFL classrooms, there are not many native English speakers. In such situations, video seems to be an ideal medium for introducing L2 learners to authentic input. Plass and Jones (2005) pointed out that one of the limitations of existing studies on second language acquisition with multimedia is the limited number of empirical studies that use authentic videos from the target culture to evaluate L2 learning outcomes. This study was therefore conducted to examine how authentic videos can support or complement reading comprehension in the EFL context.

2.5 Research Questions

The results of this study may help us understand whether video-based materials can effectively facilitate L2 learners' ability to comprehend written text. If Yes, the present study will go on to examine which level of comprehension can be fostered through the use of video-based materials. To achieve the aims of this study, the following research question is addressed:

Among the three presentation conditions 1) pure text, 2) narration and text, and 3) video, narration, and text, which presentation condition significantly improves L2 learners' MACS and MICS comprehension in terms of the immediate test and the reading comprehension post-tests?

3. Method

3.1 Research Design

This study was a pre- and post-test research design. The treatment was conducted in five sessions over five weeks. Three presentation conditions were designed to test the differences: (1) the group instructed with on-screen pure text (T Group), (2) the group instructed with concurrent narration with on-screen text (NT Group), and (3) the group instructed with video accompanied with concurrent narration and on-screen text (VNT Group). During the treatment, an immediate test was conducted right after each session. Reading comprehension (RC) pre- and post-tests were conducted before and after the treatment.

3.2 Participants

The pool of participants was a total of 98 undergraduate university students recruited from three English courses. Their ages ranged from 20 to 22, and their native language was Mandarin. The three classes were instructed by the same teacher. The number of participants in each group was as follows: the T group, $n = 30$; the NT group, $n = 32$; the VNT group, $n = 36$.

RC MACS and MICS pretests were administered and their scores submitted to a one-way ANOVA analysis to test for possible differences among groups. Regarding MACS comprehension, the mean scores were 66.83 ($SD = 9.24$), 65.94 ($SD = 9.45$), and 67.22 ($SD = 11.68$) for the T group, NT group, and VNT group, respectively. Regarding MICS comprehension, the mean scores were 64.67 ($SD = 14.32$), 65.93 ($SD = 13.65$), and 65.56 ($SD = 14.63$) for the T group, NT group, and VNT group, respectively. The results revealed no significant differences across the three groups in either MACS comprehension or MICS comprehension. These results suggest that all three groups were statistically similar in their MACS and MICS comprehension abilities before receiving the treatments.

3.3 Instruments

3.3.1 Reading Comprehension (RC) pre- and Post-tests

The pre- and post-tests were used to investigate whether the participants made progress in their ability to understand written text at the MACS and MICS levels and also compare whether there were significant differences among the three conditions. Each test contained five passages, which were irrelevant to the contents of the five video-based materials in the treatment. The passages were directly adopted from the reading comprehension textbook Pauk (2000) at an introductory level. Each passage contained six question items. To answer the research questions, the author further divided the six items into MACS and MICS categories. The MACS comprehension questions required the students to get the gist of the text and provide responses that were not stated directly in the assigned material. In contrast, the MICS comprehension questions required the students to read phrase by phrase or sentence by sentence and provide answers that were clearly stated somewhere in the target material. Each passage contained four MACS questions and two MICS questions. The four MACS comprehension strategies were coded as follows: identifying main ideas (MI), synthesizing the subject matter of a passage (SM), drawing conclusions from a passage (CON), and identifying the writer's devices (DEV). The two MICS comprehension strategies included searching for supporting details (SD) and decoding the meaning of vocabulary (VOC).

The pre- and post-tests respectively include the scores of MACS and MICS comprehension. Participants received one point for each correct answer; each passage had a possible total of four points for MACS comprehension and two points for MICS comprehension. The maximum scores of MACS comprehension and MICS comprehension in the pre-test were thus twenty and ten, respectively. The maximum scores of MACS comprehension and MICS comprehension in the post-test were the same. For each group, the participants' correct responses on both the MACS and MICS comprehension items were summed and converted into their respective correct percentage scores. Cronbach's alpha inter-item reliability estimates for the pre- and post-tests were .81 and .83 respectively.

3.3.2 The immediate RC Tests

The immediate test focused on testing the participants' ability to understand the assigned video immediately after viewing it. After viewing one video, the participants in the three groups took an immediate test. Because the treatment included five sessions of video viewing, five immediate tests were constructed. The tests also included MACS and MICS comprehension questions. The format of the immediate comprehension tests was multiple-choice questions with four options. The items were designed by the author by following Pauk's categories (2000). An immediate test included ten question items: three MACS comprehension questions (that is, an SM question, a CON question, and a DEV question) and seven MICS comprehension questions (four SD questions and three VOC questions). Cronbach's alpha inter-item reliability estimates for the five immediate tests ranged from .75 to .81.

The immediate test included the scores of MACS and MICS comprehension. Participants received one point for each correct answer; the maximum score for each immediate test was ten. In each immediate test, a total of three points was possible for the MACS comprehension questions and seven points for the MICS comprehension questions. For the five tests, the maximum scores of MACS comprehension and MICS comprehension were 15 points and 35 points, respectively. See Appendix for a sample of questions designed for a video. For each group, the participants' totaled correct responses on the MACS and MICS comprehension items were converted into the

respective percentage scores.

3.4 Treatment Materials

The video materials were selected from an online learning program developed by LiveABC Interactive Corporation (2007), a language learning magazine company in Taiwan (see the detailed introduction in Lin's (2011, 2014) studies). The videos were television news programs of the Cable News Network (CNN) featuring live scenes, referents, and interaction between the journalist and the interviewee. The titles and the sequence of the video materials used in the five sessions were as follows: (1) Grapes in the Gas Tank, (2) Survival of the Cutest, (3) Rules of Devotion, (4) Life Everlasting, and (5) Robo Surgeons.

In this study, three types of treatment material were designed for the three groups, each of which was displayed on the students' individual computers. The T group read only on-screen text. The NT group read on-screen text and listen to narrations simultaneously. The on-screen text used in the T and NT conditions was presented in the middle of the screen while the text presented in the VNT condition at the bottom of the screen. The on-screen text for the T and NT groups included an indication of who was speaking at each point; different speaker's lines were presented in different colors. The VNT group read on-screen text, listened to aural narrations and additionally viewed video images appearing in the middle of the screen.

3.5 Data Collection Procedure

The full procedure of the study completed in a three-month duration. Three groups of participants were randomly assigned to the three presentation conditions: the T group, the NT group, and the VNT group. First, three groups of participants completed a RC pretest. The instructor led the participants to practice using the equipment in the language lab and gave each group the instructional direction. Second, the five-week treatment began. The treatment procedure consisted of five consecutive weekly sessions of 100 minutes each. During the treatment section, the participants read, viewed, or listened to a total of five treatment materials at the rate of one per week. In each session, the instructor started by reading aloud the title of the assigned material and its Chinese equivalent. Afterwards, the participants watched/read/listened to the treatment material as many times as they wanted. They received no grammar or vocabulary instruction from the instructor, but they were permitted to use online dictionaries to look for the meanings of unfamiliar vocabulary. As soon as they finished practicing with the treatment material, they completed an immediate test. Third, two weeks after the treatment, all participants completed a RC post-test.

4. Results

In total, 98 participants of the three groups completed the RC pre- and post-tests and the immediate test. The collected data were analyzed from the quantitative standpoint to address the research question. Descriptive statistics (means, and standard deviations) were computed first, and ANOVA tests were further conducted to examine the differences between the three groups. Mean scores are correct percentage scores. Mean differences in the dependent measures were tested for significance at the 0.05 level.

4.1 The Immediate Test of MACS and MICS Comprehension

To examine presentation condition differences in MACS and MICS comprehension, a one-way ANOVA was conducted on the immediate test. Table 1 displays the mean scores, and the SDs on the immediate MACS and MICS comprehension tests. Regarding MACS comprehension ability, the one-way ANOVA results showed a significant main effect for Group, $F(2, 95) = 4.85, p = .01$. A post hoc Scheffé test revealed that there were significant differences between the VNT and T groups, and between the VNT and NT groups. However, there was no significant difference between the T and NT groups. From comparisons of the mean scores, the VNT group achieved a significantly higher MACS comprehension score ($M = 59.03$) than the T group ($M = 51.83$), $r = .33, p = .037$, and the NT group ($M = 51.72$), $r = .32, p = .029$.

Regarding MICS comprehension ability, the one-way ANOVA results also showed a significant main effect for Group, $F(2, 95) = 7.19, p = .001$. A post hoc Scheffé test also revealed that there were significant differences between the VNT and T groups, and between the VNT and NT groups. There was no significant difference between the T and NT groups. From comparisons of the mean scores, the VNT group achieved a significantly higher MICS comprehension score ($M = 55.28$) than the T group ($M = 48.45$), $r = .36, p = .009$, and the NT group ($M = 48.13$), $r = .38, p = .005$. The results summarized above suggest that different presentation conditions appeared to have differential effects on L2 learners' MACS and MICS comprehension abilities right after they received the different treatment materials. The findings suggest that participants exposed to video-based materials have better MACS and MICS comprehension of the content than their counterparts receiving treatment without video.

Table 1. Descriptive statistics for the immediate MACS and MICS tests

Dependent variable	Group	<i>n</i>	Mean	SD	Std. Error
MACS	T	30	51.83	9.87	1.80
	NT	32	51.72	12.42	2.20
	VNT	36	59.03	10.88	1.81
MICS	T	30	48.45	8.87	1.62
	NT	32	48.13	8.54	1.51
	VNT	36	55.28	8.99	1.50

4.2 RC MACS Pre- and Post-Tests

Presentation condition differences in MACS comprehension of the passages were first examined. A repeated measures ANOVA was conducted on the RC MACS pre- and post-test scores. Table 2 presents the mean scores and the SDs on the RC MACS comprehension pre- and post-tests. In Table 3, the results of a repeated measures ANOVA on the RC MACS pre- and post-tests [Test (Pre and Post) x Group (T, NT, and VNT)] show significant main effects for Group, Test, and the interaction of both. Figure 1 visually displays these results. Furthermore, the one-way ANOVA analysis of the RC MACS post-test reveals a significant main effect of Group, $F(2, 95) = 11.07, p = .000$. A post hoc Scheffé test shows that the main effect of Group was due to significant differences between the VNT group ($M = 77.78$) and the T group ($M = 65.50$), $r = .53, p = .000$, and between the VNT group ($M = 77.78$) and the NT group ($M = 70.46$), $r = .31, p = .022$. However, there was no significant difference between the T and NT groups. The VNT group of participants outperformed the other two groups in MACS comprehension when they read the passages in the post-test.

Table 2. Descriptive statistics for the RC MACS and MICS pre- and post-tests

Dependent variable	Group	<i>N</i>	Pretest			Posttest		
			Mean	SD	Std. Error	Mean	SD	Std. Error
MACS	T	30	66.83	9.24	1.69	65.50	9.68	1.77
	NT	32	65.94	9.46	1.67	70.46	12.01	2.16
	VNT	36	67.22	11.68	1.95	77.78	10.03	1.67
MICS	T	30	64.67	14.32	2.61	70.00	12.59	2.30
	NT	32	65.94	13.65	2.41	75.63	15.64	2.77
	VNT	36	65.56	14.63	2.44	75.56	13.62	2.27

Moreover, paired *t*-tests were further conducted to examine whether there were significant improvements in terms of the three groups' pre- and post-tests. Among the three groups, only the VNT group showed a significant difference between their MACS pre- and post-tests (VNT: $t = -8.10, p = .000$; NT: $t = -1.85, p = .07$; T: $.614, p = .54$). That is, the VNT group achieved a significantly higher score on the MACS post-test ($M = 77.78$) than its scores on the pretest ($M = 67.22$), $r = -0.44$. The finding suggests that participants in the VNT group make significant improvement in their MACS comprehension ability.

Table 3. The results of repeated-measures ANOVA on the RC MACS pre- and post-tests

Source	SS	<i>df</i>	MS	F	<i>p</i>
Group (T, NT, and VNT)	1399.40	2	699.70	4.86	.010*
Test (Pre and Post)	1024.01	1	1024.01	13.51	.000*
Interaction (Group x Test)	1160.61	2	580.305	7.66	.001*

Note. * $p < .05$.

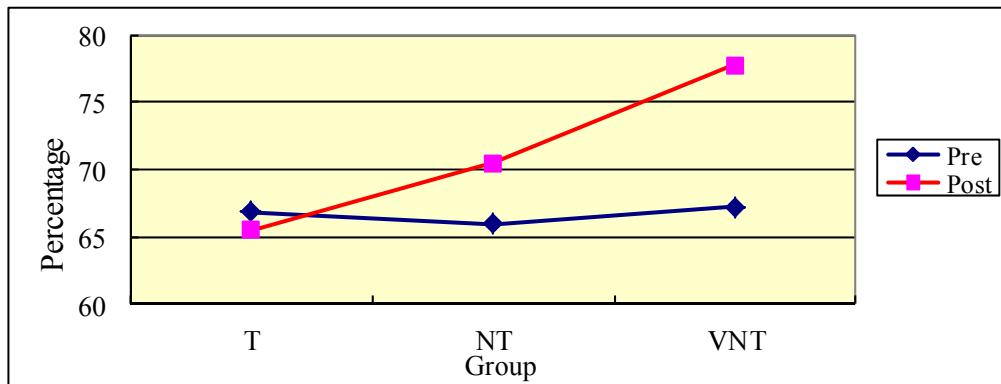


Figure 1. Three groups' RC MACS pre- and post-tests

The results summarized above suggest that different presentation conditions appear to have differential effects on L2 learners' MACS comprehension abilities. Furthermore, they also show a differential effect of Test on VNT participants' MACS comprehension ability, which was fostered after they received the video-based treatment.

4.3 RC MICS Pre- and Post-Tests

To examine the presentation condition differences in MICS comprehension, a repeated measures ANOVA was conducted on the RC MICS pre- and post-test scores. Table 2 presents the mean scores and the SDs of the RC MICS comprehension pre- and post-tests. As shown in Table 4, the results of a repeated measures ANOVA on the RC MICS pre- and post-tests [Test (Pre, Post) x Group (T, NT, VNT)] show a significant main effect for Test and non-significant effects for Group and the interaction of both. Figure 2 visually presents these results. The results of one-way ANOVA analysis of the RC MICS post-test indicate that there were no significant differences in the MICS comprehension ability of the three groups.

Table 4. The results of repeated-measures ANOVA on the RC MICS pre- and post-tests

Source	SS	df	MS	F	p
Group (T, NT, and VNT)	462.95	2	231.48	.922	.401
Test (Pre and Post)	3389.10	1	3389.10	22.96	.000*
Interaction (Group x Test)	213.433	2	106.72	.72	.488

Note. * $p < .05$.

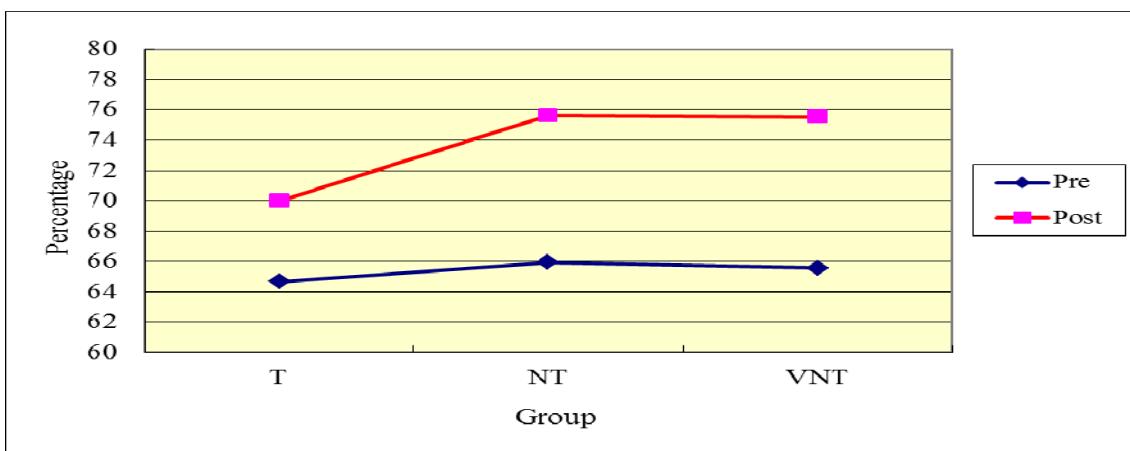


Figure 2. The three groups' RC MICS pre- and post-tests

To further examine the main effect for Test, a series of paired *t*-tests were performed so that possible significant

improvement across the treatments could be measured. The results of the *t*-tests show significant improvements from the pre- to post-tests for the VNT and NT groups (VNT: $t = -5.45, p = .000$; NT: $t = -2.98, p = .006$; T: $t = -1.66, p = .107$). That is, the VNT group achieved a significantly higher score on the MICS post-test ($M = 75.56$) than on the pretest ($M = 65.56$), $r = -0.34$; the NT group also achieved a significantly higher score on the MICS post-test ($M = 75.63$) than the pretest ($M = 65.93$), $r = -0.31$. Judging from the descriptive statistics in Table 2, the participants in the VNT and NT groups made significant progress in their MICS comprehension ability.

The results suggest that exposure to different presentation conditions does not appear to have a differential effect on L2 learners' MICS comprehension. The results showed, however, a differential effect of Test on the participants' MICS ability, which was facilitated after a period of five weeks for the VNT and NT groups, but not for the T group.

5. Discussion

This study examined whether video-based material could foster L2 learners' MACS and MICS comprehension abilities. The present study demonstrates the positive impact of video-based materials. Compared to the materials presented with concurrent narrations and on-screen text, or text alone, the material supplemented with video and narrations could facilitate L2 learners' comprehension at both the micro- and macro-levels in terms of the immediate test. The results fill the gaps found in earlier multimedia reading comprehension studies which only focused on learners' general text comprehension ability when examining the effectiveness of various different multimedia conditions. In general, the results of this study suggest a positive effect of video on fostering L2 learners' MACS and MICS comprehension abilities in terms of the statistical results of the immediate tests. Similarly, this result supports Jones and Plass' (2002) assumption that pictorial information provided in addition to text may "help support micro- and macro-level processing in L2 computer-based reading activities" (p. 548). The positive educational effects of video-based materials were concluded from this study, confirming the earlier research result that videos can be "a powerful addition to second language acquisition" (Lin, 2014, p. 24). The positive effects of video may be attributed to DCT (Paivio, 2007). Consistent with earlier research, these results reveal the positive effects of video on L2 learners' reading comprehension, confirming the assumption of DCT that adding pictures to text tends to improve text comprehension because students in the VNT group had access to verbal codes (subtitles, narrations) as well as nonverbal codes (images). In the VNT presentation condition, the material was presented visually and textually so the participants seemed to be able to construct verbal and nonverbal mental representations simultaneously in their verbal and nonverbal working memory systems. With the interconnected verbal and nonverbal systems, the two representations in the participants' minds seemed to be able to "be accessed, compared, and used for whatever purpose is relevant in a given situation" (Paivio, 2007, p. 32). After instructed with video-based materials, the participants likely could manipulate verbal and nonverbal information.

It should be noted that the VNT group outperformed the other two groups in the immediate MICS test. The possible reason is that the video (i.e., visual images) presented concrete images of referents, and the learner could build mental connections between corresponding words and images or supporting details and images. In this way, the VNT participants probably remembered the words and details and had more successful MICS comprehension than the T and NT participants. According to Kintsch's (1998) CI model, this may well be the reason that the participants who received input presented in the form of text, sound, and video likely constructed various mental representations, including visual, acoustic, and semantic codes. These representations of the same concept repeatedly integrated with the participants' prior knowledge, and hence probably reinforced their impression of the detailed information in the text. MICS comprehension included the acquisition of vocabulary. Lin (2010) indicated that video-based materials had positive effects on L2 vocabulary acquisition and explained that this was probably because video lent itself to sufficient visual portrayals of verbal information. Similarly, the participants in the present study likely learned vocabulary through both aural and visual sensory channels and as well had the opportunity to connect the target vocabulary with concrete visual images through the video. As a result, the VNT participants were likely able to memorize the target words immediately and gained high scores on the immediate MICS tests.

Based on the significant results of the RC MACS pre- and post-test, it can be noted that after the treatment, the participants in the VNT group changed their comprehension pattern, tending to comprehend the text at a macro-level. In this study, the finding suggests that video plays an essential role in fostering L2 learners' MACS comprehension ability. This may attribute to the logogen concept in DCT. DCT may be extended to explain the macro-structure of mental representations. In addition to smaller language units such as phonemes and words, DCT indicates the importance of imagery and concreteness for the comprehension of larger textual units, such as sentences, paragraphs, and whole texts. Paivio (2007) adopted the term *logogen* and regarded it as a variant of

the widely used concept of lexical representation and assumed that logogen reflected “the internal organization and variable size of language units as perceived and produced” (p. 37). More specifically, the DCT logogen is assumed to build up in a hierarchical structure in which “larger units are composed of different combinations of smaller units” (Paivio, 2007, p. 37). Whenever things are remembered as a chunk, a representational unit beyond the word level is thus constructed (Paivio, 2007). In this study, it is possible for the VNT group to construct a representational unit beyond the word level and “to include stock phrases, idioms, and sequences as long as memorized poems, plays, bibles, and oral histories (p. 38)”. With the support of images, large language units can be remembered effectively. The findings of the current study offer evidence for DCT and suggest that L2 learners are able to successfully handle incoming verbal and nonverbal information simultaneously. Paivio (2007) suggested that this instructional technique be designed to teach learners “how to concretize text using imagery and dual coding as they read” (p. 446).

Take the VNT presentation condition as an example. In the video-based presentation condition, video accompanied with verbal information was presented in a dynamic, rapid way. In just a brief moment, the video conveyed a great amount of meaning. The same meaning could be equally produced through a series of words. In such a situation, it appears that the VNT participants could not completely rely on the words to interpret the meaning of the text. Instead, they needed to synthesize the information across sentences. In this way, the VNT group made significant progress in constructing macrostructure connections in the text. The finding of this study suggests that verbal material integrated with video leads to a greater scope of text comprehension than when the material is processed through words alone. The results may also provide support to the multiliteracies pedagogy (the NLG, 1996). In the VNT condition, video likely offered a simplified syntax for the narration and the caption, and decreased clausal complexity of written and oral text. The finding suggests that these multiple models of representations are neither discrete nor mutually exclusive; rather, they are supplementary.

In summary, the significant results of the VNT group lend some support to the notion of video-based L2 comprehension instruction. The VNT presentation modality formulated a comprehension level similar to Kintsch’s (1998) text comprehension model assumed by Caccamise, et al. (2008), that “if reading is unproblematic, what readers mainly remember is the gist of the text, that is, the main ideas, topics, and theme of an expository text or the plot of a story (p. 84).” Kintsch (1998) indicated that processing at this level requires logical thought, formal argument, deduction, and quantification not tied directly to the environment (i.e., the words or sentences in the text). Moreover, MACS comprehension constructs “a multidimensional meaning representation that may include visual, spatial, temporal, and emotional aspects, as well as abstractions implied by the text” (Caccamise, et al., 2008, p. 84). In this study, video-based materials deliver the information in video, audio and caption modalities. It appears that the participants integrated these sources to construct a macro-structure representation of the text. The results of the present study contribute to facilitating L2 text comprehension through the use of video-based materials.

6. Conclusion

In general, video-based material can be regarded as a valuable addition to L2 reading comprehension instruction. With this kind of material, language learners may immediately comprehend the content of a text at both the micro and macro levels well. Specifically, the instruction which is integrated with video-based material gradually builds up language learners’ MACS comprehension ability to help them distinguish between the main idea and the details of the text, pay attention to the theme of the text, train them to identify the devices the writer has used, and draw or predict a conclusion from the text. Armed with the perspectives of multiliteracies and the significant results, the current study makes the following instructional recommendations to integrate video in L2 reading comprehension instruction.

First, comprehension should be taught through a curriculum of multiliteracies. That is, the learners can be encouraged to interpret the meanings of text through different modality, such as visualizing and verbalizing. Cope and Kalantzis (2000) indicated that L2 learners’ meaning-making resources may be found in representational objects, patterned in [various] familiar and ... recognisable ways” (p. 10) and further emphasized that students can become “fully meaning-makers and remakers of signs and transformers of meaning” (p.10). When reading a passage, the teacher may ask learners to connect text segments (i.e., words, phrases, sentences, and texts) with images by drawing a picture or describing their images for text segments. When using video, learners view the video for a couple of seconds and recall the content of the video by looking at the scene where the clip is stopped, and further compare what they recall with the original script. In addition, after viewing the video, the teacher may ask learners to describe the content of the clip and illustrate it by showing a couple of scenes chosen from the clip for their comprehensibility. To help learners comprehend video effectively, the instructors may consult two teaching resources: what methods instructors use to effectively teach a second

language through videos (Sherman, 2003) and what strategies learners use to understand video (Lin, 2011).

Second, MACS comprehension should be noticed. Higher order comprehension can be regarded as an important part of successful comprehension (Pressley, 2000). Higher order comprehension involved in cognitive processes of prediction, inference, and evaluation deals with synthesizing the broad scope of information in the text. As reviewed in this study, the task of MACS comprehension is closely related to that of higher order comprehension and thus it plays an essential role in text comprehension. van Dijk and Kintsch (1983) analyzed L1 readers' discourse strategies and indicated that there existed overwhelming evidence of a significant role played by macrostructure strategies in L1 text comprehension. In the case of L2 text comprehension, the instructor should pay attention to this aspect and foster the learners' MACS comprehension ability. At the end of this study, VNT participants were trained with better ability to undergo MACS comprehension than their counterparts in the T and NT groups. Given the importance of macrostructure comprehension in L1 learning and the promotion effect of video-based multimedia on L2 learners' MACS comprehension, multimedia materials integrated with on-screen text, narrations, and video are recommended for L2 comprehension instruction.

At present, these research-based conclusions will initiate the next phase in research on the use of other types of multimedia materials in L2 learning contexts to further confirm the effects of pictorial images. However, there are some limitations. First, these results are intended to reflect group tendencies and do not apply with equal consistency to every participant. In the future, self-reports or one-on-one interviews may be added to explore individual perspectives. Second, the present study adopted Pauk's (2000) model to examine six types of reading comprehension strategies. However, the exact strategies that contribute to MACS and MICS comprehension could be greater in number and could not be disentangled in this study. Future studies are needed to analyze other MACS and MICS comprehension strategies further. Third, the test instruments used in this study were in written form rather than aural form. In order to reach a complete understanding of the effect of video-based material, listening comprehension tests will be incorporated into future research.

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APPENDIX

Five Sample Questions from an Immediate RC Test

The title: Grapes in the Gas Tank

Answer the questions based on the information provided in the material.

1. In general, this article is about _____. (Subject Matter)
a. the winemaking industry in southwestern France
b. gasoline resources in Tuscany
c. a solution to the over-production of wine in France
d. cutting vines yields profits in France
2. Why does the writer say that the “wine-tasting atmosphere is like a funeral”? (Clarifying Devices)
a. A third of wine production will be distilled.
b. Candles and gloom are the setting of a funeral.
c. Something must be put to death.
d. Wine consultant rejects to taste the wine.
3. The word designated means _____. (Vocabulary)
a. appointed b. approved c. planned d. entered
4. Where is Gibelin’s wine sent after it is tasted by a consultant? (Supporting Details)
a. The winery. b. The market. c. The distillery. d. The vineyard.
5. The passage suggests that turning wine into gasoline is _____. (Conclusion)
a. a trend b. an alternative c. a profit d. a disaster

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