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Bilingual Dual-Coding and Code-Switching: Implications for the L1 in L2 Learning

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Abstract

The use of L1 in L2 learning (and teaching) is a controversy of long history which typically appears as a debate between the audio-lingual and the cognitive-code approaches to L2/FL instruction. The Paivio-Desrochers bilingual dual-coding model has spawned a number of empirical studies involving both European and Asian languages largely supporting the latter. This article adopts the Paivio-Desrochers model and re-interprets data collected for a study on bilingual code-switching between English and Chinese among primary school children in Singapore where young children learn two languages concurrently within the school context. High correlations were obtained for scores of monolingual and bilingual tests based on the same content. Implications for the use of L1 in L2 instruction are discussed.

1 Introduction

The teaching and learning of second or foreign languages has, over decades, been plagued by debates, sometimes rather heated, about the advantages and disadvantages of different pedagogies. The controversy has been variedly phrases in different contextual frameworks which can be subsumed in the following questions:

- Should the audio-lingual or cognitive-code approach be used?

- Should code-switching (or code-mixing) be encouraged or discouraged?
- Should the L1 be permitted or disallowed in the L2 classroom?
- Is the direct or indirect teaching of L2 more effective?
- Can translation be an effective teaching strategy in L2 instruction?
- Does translation help in the learning of L2?
- Are there two separate storages for the two languages in the mind of bilinguals?
- Is the L1 a help or hindrance in L2 learning?

These questions are raised with reference to different disciplines with some of them being more theoretical, the others being more pragmatic. While those in favour of a bilingual approach generally emphasize its advantages and benefits, language purists see using the L1 in L2 learning as a cause of sub-standard L1 and inter-language, and ungrammatical utterances are attributed to interference between languages, although it is well know by now that intra-lingual errors outnumber inter-lingual ones. The audio-lingual approach is regarded as superior in bringing about native-like spoken language, and the use of the language lab has its own attraction, while the role of written language is played down or even ignored in the discussion. Then, code-switching is perceived as the bilingual's strategy to cope with or cover up poor vocabulary development (Soh 1985). Thus, monolingual instructional orientation dominates many second or foreign language programmes and in some cases has assumed the status of a dogma (Cummins 2005). On the other hand, Cummins cited evidence that translation is beneficial and that, while the extensive use of the L2 is clearly a useful instructional strategy, it should not be rigid nor exclusive. As the examples in his paper illustrate, the L2 learner's L1 is a powerful resource for learning and is a usefully complement to monolingual strategies to promote more cognitively engaged learning.

Notwithstanding the varied phrasings of the issue, the common underlying concern is

(a) whether what a L2 learner has learned in L1 is available in L2 and

(b) whether L1 knowledge helps or hinders solving problems posed in L2 and vice versa.

While participants in the debates have used different sets of terminologies in their discussions, possibly because of their different theoretical persuasions, training backgrounds, and professional or academic practices, there is in fact only one underlying concern, i.e. that of the possible inter-connection and interaction between L1 and L2. In this context, Paivio & Desrocher's (1980) bilingual dual-coding model may offer some reconciliation to the debate.

The bilingual dual-coding theory of Paivio-Desrochers (1980) represents a derivation of Paivio's (1971) dual-coding theory expanded to bilingual learning (and, by extrapolation, to multilingualism). It is, therefore, logical and useful to summarize the main tenets of the two models.

In his original conceptualization, Paivio (1971) posits that cognitive activity be mediated by two independent, but interacting symbolic systems, those of the *imagery system* which processes perceptual information and generates mental images on the one hand and the *verbal system* which processes linguistic information and generates speech on the other. This conceptualization entails several assumptions, among which the one which regards levels of processing and their relation to meaning is the most relevant assumption for this paper.

The three levels of processing are: *representational, referential*, and *associative*. At the representational level, words activate verbal representations and objects (and their pictures) activate imaginal representations. At the next, referential, level representations in one system activate those in the other system, as words incite relevant mental images, and vice versa. At the associative level, representations are interconnected with many other representations within the same system and between the systems *probabilistically*, depending on the contexts and past experiences. Figure 1 below shows a simplified schematization of Paivio's dual-coding model.

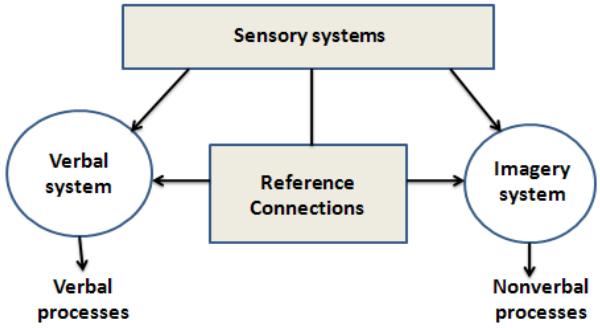

Figure 1. Dual –Coding Model

While Paivio's (1971) original conceptualization remains *within* one language, Paivio-Desrochers's (1980) extension allows for two (or more) languages. In the bilingual dual-coding theory, there are now two independent but interconnected verbal systems both linked to a common imagery system. For this bilingual case, certain assumptions are made with regard to the independence and interconnectedness of the three systems. Of much relevance to the present paper are the following:

1. The image systems functions independently from the two verbal systems: This extends the assumption of the original monolingual dual-coding theory.
2. The three systems are interconnected at the referential level such that either the verbal system can be influenced by the imagery system or vice versa.
3. The two verbal systems have referential connections to the imagery system and are partly shared and partly independent. This implies that (a) a referential overlap between languages is a matter of degree and (b) the imagery system provides a means of indirect access from one language to the other.
4. The two verbal systems of bilinguals are independent, yet partly interconnected. This implies that, with a change in the language input (or a contextual cue of the nature of the audience), code-switching can occur.

Ever since their first appearances, with 10 years apart, both these dual-coding theories have received much empirical supporting evidence though criticisms are not totally absent.

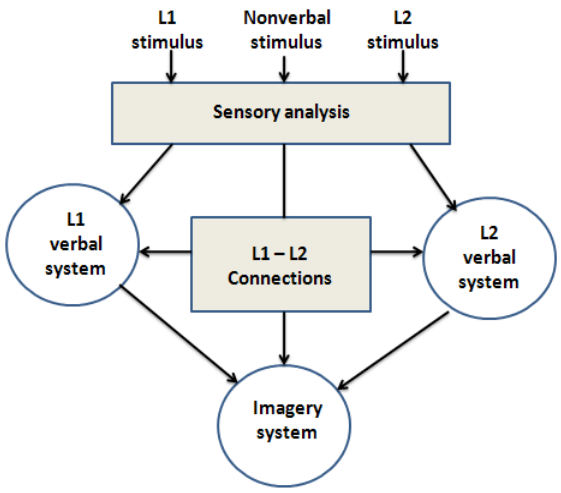

Figure 2. Bilingual Dual-Coding Model

Figure 2 is an adapted version of Paivio & Desrochers's (1980: 391) schematization of bilingual dual coding, somewhat simplified by leaving out the associations within each of the three systems so as to focus on the concern of the present paper which will be made clear presently.

Understandably, for historical reasons, there exist far more studies using Paivio' dual-coding theory than those using Paivio & Descrochers's bilingual dual-coding theory. However, the two types of studies have some different orientations. By definition, studies using the bilingual dual-coding have to focus not only on the imagery-verbal connections, but also on the L1-L2 connections. Nevertheless, the latter, which is the additional link and the focal tenet of Paivia & Desrocher's model, has not received as much attention as it deserves, as is illustrated in the studies cited below.

Soon after the appearance of the bilingual dual-coding theory, Paivio, Clark, & Lambert (1988) conducted an experimental study with French-English bilinguals. Their participants freely recalled lists of concrete and abstract words, repeated at different inter-item lags, involving repetitions of the same words, translation equivalents, or same-language synonyms. The results corroborated previous findings and supported Paivio's dual-coding theory and the independence-

storage hypothesis of bilingual memory. More interesting in the context of this paper, supporting the bilingual dual-coding theory of Paivio & Desrochers, were the findings that semantic repetitions through translations had additive effects on recall, and that semantic repetition effects were weaker for intra-lingual synonyms than for translations, especially for abstract words, although intrusion errors and pair recall were higher for translations than for synonyms, especially for concrete words, at long lags.

Later, Danan (2006) studied the facilitating effect of subtitled video programs to the learning of foreign languages. The three-viewing methods compared in a pilot study were (1) French audio only, (2) English subtitles, and (3) English dialogue with French subtitles. In two subsequent experiments, English subtitles were replaced with bimodal input of French audio with French subtitles. The participants college students of French at beginners' and intermediate level who were tested on vocabulary recall after watching a five-minute video excerpt in French. The success of reversed subtitling (English dialogue with French subtitles) proved to be the most beneficial condition. This was attributed to translation facilitating foreign language encoding. It was further argued that multiple memory paths created by the visual and bilingual input enhanced retrieval, in line with bilingual dual coding model. Apparently, although this study involved two languages, the focus was not on L1-L2 connections, but on the relative facilitating effect of the languages.

Hummel's (2010) study addresses the role which active translation may have in second language vocabulary learning. Participants were native French-speaking students enrolled in a *Teaching-English-as-a-Second-Language* program. They performed three different tasks: (1) L1 to L2 translation, (2) L2 to L1 translation, and (3) a rote-copying task. Results show no difference in short-term memory between the two translation conditions, but there is an advantage for the rote-copying condition over the translation conditions. Compared with Danan's study cited above, this study focuses more specifically on the connections between the two verbal systems.

It is readily appreciated that most such studies mainly involve European languages, but more recently, there emerges an interest in pairing English and Asian languages. Since the Paivio & Desrochers model was developed implicitly for English, its validity for non-European languages needs to be verified and such studies, as cited below, may shed some light on this. Although such studies are still few in comparison, as Asian nations are becoming increasingly bilingual, more research can be expected to be done in the future.

Taura (1998) investigates, *inter alia*, the effect of Japanese language specificity on the bilingual dual-coding hypothesis. Balanced Japanese-English bilinguals, who had returned to Japan after having resided in an English-speaking country, were presented with pictures to be labeled in English, Japanese words to be translated into English, and English words to be copied as they were. It is obvious that the study had its focus on L1-L2 connections.

Whereas Taura's study paired English with Japanese, Sham's (2002) paired English and Chinese. The study was conducted using Fifth to Ninth Graders whose first language or medium of instruction was English, but who learned to read Chinese as a second language. In one of the experiments, Sixth Graders learned to read compounds of two Chinese characters in two conditions, namely word-and-word and picture-and-word. The result shows that phonetic compounds were learned better when presented along with their English equivalents than when accompanied by a picture of the object represented. In another experiment, Ninth Graders learned six concrete sentences and six abstract sentences in Chinese. There were two conditions of learning:

(1) *no*-picture condition where a Chinese sentence was printed on a card underneath its English translation, and
(2) *with*-picture condition where a picture was placed above the sentences.

The analysis shows better results for the no-picture conditions than for the with-picture condition, and the difference was greater for concrete sentences than for abstract sentences. The findings seem to be contrary to what the bilingual dual-

coding model would suggest and hence, the validity of the model is called to question. In view of this, the researcher proposes a new dual-coding model, based on the bilingual dual-coding theory for different patterns of reading Chinese as a second language.

Nambiar's (2009) study explicitly investigated the L1-L2 connections and studied the learning strategies used by proficient bilingual Malaysian tertiary students. The participants read L1 (Bahasa Melayu) and L2 (English) texts and were then examined as to whether there was cross-language transfer between the ability to read in the two languages. Data were collected by way of think-aloud protocols, retrospective recalls, and reading passages in L1 and L2. While the participants were able to read the L1 passage fluently, they had difficulty with the L2 passage. Some participants found the complexity of the L2 passage to be an obstacle.

In the same context as that of Nambiar's study, Siti & Abdul (2009) investigated the effectiveness with which low proficiency ESL learners used their first language to generate ideas for writing in their second language. Students in the experimental group used Bahasa Melayu to generate ideas before writing essays in English whereas those in the control group used English for the same task. There was a marked improvement in the writing performance of the experimental students who generated ideas in their first language before using their second language. The interest in the L1-L2 connections was explicit in this study at a higher cognitive ideational level, but not at the language level.

Not only do researchers focus on verifying the validity of the bilingual dual-coding model, but they also attempt to use it as a pedagogical principle. Moreover, they branch off and go beyond language to study effects of instructional devices (e.g. bilingual knowledge maps, computer-assisted instruction) and non-cognitive factors.

For instance, Bahr & Dansereau (2001) investigated the effectiveness of bilingual knowledge maps (BiK-maps) as a tool for learning English-German word pairs. In

this study, undergraduates learned word pairs under four presentation conditions:

(1) BiK-Maps with word pairs embedded in a spatial and semantic array and

(2) lists of word pairs.

The third and forth conditions were the same as the first and second conditions, but with additional semantic materials. The participants were tested in three ways:

(1) free-recall,

(2) cued-recall, and

(3) multiple-choice test, MCQ.

It was found that BiK-maps learners scored better on all three measures than did learners of the lists of word pairs.

Kuo & Hooper's (2004) study illustrates the combination of bilingual dual-coding and the use of the computer as a teaching device. They investigated the effects of visual and verbal coding mnemonics on learning Chinese characters in computer-based instruction. They randomly assigned high-school students to one of five learning conditions: (1) translation, (2) verbal mnemonics, (3) visual mnemonics, (4) dual coding mnemonics, and (5) self-generated mnemonics. All students were instructed and assessed in a computer-based environment. The results show that students who generated their own mnemonics scored higher on post-test than did those in visual coding, verbal coding, and translation groups. Also, students in the dual coding group scored higher than did those learning by translation. Qualitative data, obtained via follow-up survey, suggest that learners' interpretations of the Chinese characters were rooted in their cultural backgrounds and personal experiences. This last point underlines the importance of culture when discussing learning effectiveness – an area which promises interesting and useful investigations.

Steffensen, Goetz, & Cheng's (1999) study goes into the affective domain, in contrast with the usual attention given to the cognitive domain. Using the dual-coding theory as the theoretical base, Steffensen et al. studied the imagery and

emotion of bilingual reading. The study involved ethnic Chinese students who were randomly assigned to read a passage about a third-class train trip in China, either in English or Chinese. The analysis of the free reports and ratings on images and emotions suggests that verbal and nonverbal processes are similar in the two languages and that corresponding structures exist across different cultural and linguistic groups.

An early study by Soh & Neo (1993) illustrates the use of the L1-L2 connections to enhance reading comprehension, which is a concern of most second language teachers. They were randomly assigned to two conditions of reading. The *primed* pupils first read stories in English (L1) then they read the same stories in Chinese (L2), and thereafter took a comprehension test based on the Chinese stories. On the other hand, the pupils of the control group read the same Chinese stories as the primed pupils, and then took the same comprehension test in Chinese. Thus, the *primed* pupils had the advantage of reading the same stories twice, first in English then in Chinese. The results show between 10 % to 15 % priming advantage, depending on the class level. The results suggest that the *primed* pupils had the benefit of L1-L2 connection which was not tapped for the control pupils.

Having briefly surveyed this area of research, we may conclude that it is too early to come to any definitive conclusion about the validity of the bilingual dual-coding model, and that more studies on the L1-L2 link are necessary. As a theory, it is relative young, as compared with its origin, the dual-coding model for one language. As the learning of a foreign or second language, especially English and Chinese, has become a world-wide trend, a better understanding of the processes involved in bilingual dual-coding as well as moderator factors and conditions which facilitate or prevent it should prove useful to the L2 teaching community.

Within this context, the present study re-analyzes and re-interprets data collected for a different purpose (Soh 1985), takes the imagery-verbal connection for real

and focuses exclusively on the connection between the two verbal systems. We will try to answer the following two related questions the answers to which have some important implications for the second or foreign language curriculum and instruction:

1. Are the linguistic features an L2 learner has acquired in his L1 available in his L2? If so, to what extent?
2. Does L1 knowledge help or hinder to solve problems posed in L2, and vice versa?

2 Method

2.1 Participants

Participants were 435 Third to Fifth Graders from four Singaporean elementary schools in Singapore of high academic standing in terms of their above-average results for the national Primary School Leaving Examination (PSLE) in the three consecutive years prior to data collection. As school intake normally does not change drastically between consecutive years, the schools' PSLE performance was taken as a trustworthy indication of the ability of the pupils involved in the present study.

There were two groups of pupils with different language backgrounds. Pupils of the English Group (N=221) mainly came from English-speaking homes and mostly spoke English outside the classroom. Chinese was learned by them at a second-language level and took up about 15% of the total curriculum while all other subjects were taught in English. On the other hand, the Chinese Group (N=214) comprised pupils who came from homes in which Mandarin (spoken Chinese) and Chinese dialects were spoken. These pupils exclusively spoke Chinese or Chinese dialects outside the classroom. They learned English as a stand-alone subject and used Chinese to study all other subjects in the curriculum.

As would be expected, the two groups did not only differ in their language environments and curricula, but were taught by teachers who were largely monolingual in either English or Chinese. As was the vogue at the time of data collection, pupils were encouraged to use their respective language of instruction only (i.e., English for the English Group and Mandarin for the Chinese Group) in and outside the classroom, and they would even be penalized in some ways if they were found to use the other language.

With such language backgrounds and curricular experience, the English Group *bona fide* comprised EL1 pupils learning Chinese as a second language and the converse was true of the pupils forming the Chinese Group.

2.2 Measures

Using the *same* content, the following four multiple-choice tests were designed with different combinations of languages for the item stems and the four options:

- *English-English Monolingual Test*: Item stems and options are all in English. This is the usual English vocabulary test in which pupils are to respond in English all the time. Hence, code-switching is not involved. The score reliability was 0.90. A sample item is shown below:

> Kong Wah and Ali are _____. The always play together.
>
> 1. brothers
> 2. sisters
> 3. friends
> 4. relatives

- *Chinese-Chinese Monolingual Test*: Item stems and options are all in Chinese. This is the usual Chinese vocabulary test in which pupils are to respond in Chinese exclusively. Again, no code-switching is involved. The score reliability of this test was 0.84. Below is a sample item:

光华和阿里是_____. 他们常在一起玩耍。

1. 兄弟
2. 姐妹
3. 朋友
4. 亲戚

- *English-Chinese Bilingual Test*: Item stems are in English, the options being in Chinese. This is a vocabulary test involving two languages, in which pupils read the questions in English and choose the correct option in Chinese. It is presumed that pupils are forced to code-switch and hence call upon their L1-L2 connections (for the English Group) or their L2-L1 connections (for the Chinese Group). The score reliability was .90 for this test. A sample item is shown below:

Kong Wah and Ali are _____. The always play together.

1. 兄弟
2. 姐妹
3. 朋友
4. 亲戚

- *Chinese-English Bilingual Test*: Item stems are in Chinese, the options being in English. This is a vocabulary test involving two languages, in which pupils read the questions in Chinese and choose the correct option in English. It is presumed that pupils are forced to code-switch and hence call upon their L2-L1 connections (for the English Group) or their L1-L2 connections (for the Chinese Group). A score reliability of 0.90 was obtained for this test. Below is a sample item:

光华和阿里是_____. 他们常在一起玩耍。

1. brothers
2. sisters
3. friends
4. relatives

As was pointed out earlier, these four vocabulary tests were based on the same content. In other words, the corresponding items in the tests were translation equivalents. This is different from the usual testing method of bilingual ability in which the content of the tests in different languages is not controlled. Arguably, the control on content minimizes, if not totally rules out, the influence on test performance of non-linguistic knowledge, and thus renders the tests purer in terms of measuring pupils' ability in different languages. The 65 items forming the four tests were selected from a pool of 120 items, which had been pre-tested and item-analyzed, and the the responses of two separate groups of pupils similar to those involved in the present study were used.

While these four tests were used to ascertain L1-L2 connections at the word level, the following two tests were meant to assess the connections at higher levels of phrase and text comprehension. This was deemed necessary for a more comprehensive understanding of the functioning of the bilingual dual-coding.

- *Bilingual Phrase Test*: Keeping within the same language level, this test consisted of 20 items. Each item comprised five phrases, with four of them functioning as item options and the fifth being an item stem to complete a meaningful sentence. All items required an L1-L2 or L2-L1 switch. The positions of the item stem and options were balanced with about half of the items beginning with the stem and the rest beginning with the options. This test had a score reliability of 1.01; this better than perfect reliability is due

partly to rounding. Two sample items are shown below:

1. 晴天，
2. 天气冷，
3. 雨天，
4. 天气凉，

。。。。 Mei Leng carries a red umbrella.

1. In the bag,
2. In the cupboard,
3. Under the table,
4. Under the chair,

。。。。摆了许多美丽的花瓶。

- *Bilingual Text Test*: Again, keeping the same language level, a passage of about 80 words was written in English followed by five multiple-choice questions for comprehension in Chinese. Likewise, a passage of about 100 Chinese characters was written, with five comprehension multiple-choice questions in English. Thus, when responding to the items, pupils were required to switch between English and Chinese, activating the respective L1-L2 connections. The test as a whole yielded a moderate score reliability of 0.55. As this is similar to the usual comprehension tests, except that each item involved two languages, no sample items are given.

3 Results of the Analysis

Only descriptive statistics were used to analyze the test scores. This was decided upon the fact that the two groups of pupils did not form random samples but convenient intact classes and, hence inferential statistics were irrelevant.

3.1 Word Tests

Table 1 presents the performances on the four Word Tests of the two groups, separately and combined. The English Group scored practically equally well on all four tests, being able to answer correctly about 71% of the 65 items in each test, on the average. This result suggests that the pupils in this group were able to activate the L1-L2 connections of the bilingual dual-coding model with equal efficiency.

For the Chinese Group, the situation was slightly different; the pupils did not score equally well in the four tests as did the English group:

59% for the English Test;
72% for the Chinese Test;
58% of the English-Chinese Test, and
64% of the Chinese-English Test.

This group studied English as a stand-alone subject in the curriculum. A comparison of the means for the monolingual English and the bilingual English-Chinese tests, it appears that the pupils proficiency in their second language (English) set an upper bound, implying that they were able to tap on the L1-L2 connections only up to the point of their L2 proficiency, with a slight advantage if the problem is posed in their first language and the responses required of them are in the second language (as is the case of the Chinese-English Test). Our study does not suggest the same results for the English Group, and the pattern of the means implies that these pupils were more balanced in the two languages. However, for the Chinese group, the mean difference of 2.6 between the English-Chinese and Chinese-English tests has a corresponding Glass's *delta* of 0.2, which by Cohen's (1988) recommended standard is small or trivial.

For the two groups combined, the average of the four test means suggests that the pupils were able to make use of up to about two-thirds lexical knowledge learned in one language to solve problems posed in the other.

Group	N	English-English		Chinese-Chinese		English-Chinese		Chinese-English	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
English	221	46.5	9.37	47.5	9.01	45.3	10.48	46.4	10.96
Chinese	214	38.4	13.27	47.1	8.29	38.1	12.24	40.7	12.62
Combined	435	42.5	11.46	47.3	8.66	41.7	11.38	43.6	11.80

Table 1. Means and Standard Deviations for Word Tests

The extent with which what has been learned in one language can be transferred to another can be looked at in a different way via inter-correlations among the word tests. Table 2 shows the inter-correlations among the four Word Tests for the two groups, separately and combined.

Group	N	EE-CC	EC-CE	EC-EE	EC-CC	CE-EE	CE-CC
English	221	0.895	0.902	0.781	0.799	0.834	0.769
Chinese	214	0.598	0.889	0.744	0.517	0.747	0.519
Combined	435	0.764	0.896	0.763	0.675	0.792	0.658

Note: E=English; C=Chinese

Table 2. Inter-correlations among Word Tests

As shown therein, for the English group, the correlation between the monolingual tests (EE-CC) is a high 0.895, indicating a shared variance of as high as 80%. Of the other correlations, the lowest is 0.769 (CE-CC), which suggest that the pupils' second language (Chinese) set the upper limit for the L1-L2 link.

For the Chinese Group, the two monolingual tests correlate with a coefficient of 0.598, which is obviously much lower than the one found for the English Group. At the same time, the lowest correlation of 0.519 is for CE-CC. As this group scored lowest in their second language (EE), this supports the interpretation that the pupils' L1-L2 link was capped by their second language (English). Although

there is 36% shared variance between the two monolingual tests, code-switching was achieved only up to 27%.

As for the two groups combined, the inter-correlations vary from 0.658 (CE-CC) to 0.896 (EC-CC). The fact that the two languages shared 58% variance (as indicated by a correlation of 0.764 for EE-CC) suggests that much of what the pupils learned in one language was available in the other, and they were able to tap into the L1-L2 link up to 43%, up to the limit of their second language proficiency.

3.2 Phrase and Text Tests

Table 3 presents the performances of the two groups of pupils in the Phrase and Text Tests. As the tests were administered three months after the word tests, some pupils were absent. Hence the numbers of pupils differ from those in Table 1.

Group	N	Phrase test				Text test			
		Mean	SD	r (P-EE)	r (P-CC)	Mean	SD	r (T-EE)	r (T-CC)
English	212	15.1	1.56	0.650	0.630	7.5	1.96	0.605	0.508
Chinese	176	12.2	2.44	0.567	0.337	6.4	2.39	0.598	0.413
Combined	388	13.8	2.01	0.614	0.518	7.0	2.16	0.602	0.467

Note: E=English; C=Chinese; P=Phrase test; T=Text test.

Table 3. Means, Standard Deviation, and Correlations of Phrase and Text Tests

The English Group scored 75% of the Phrase Test (20 items) whereas the Chinese Group only scored 60%. For the text test (15 items), they scored 50% and 43%, respectively. The differences between the groups could well be attributed to their difference in the English proficiency (see Table 1), again with the weaker language (English in the case of the Chinese Group) setting the upper bound when tapping to the L1-L2 connections. However, for the two

groups combined, the pupils scored 70% of the Phrase Test and 40% of the text test; these lower levels of performance of the combined groups were, of course, moderated by the lower levels of the Chinese Group.

It is reasonable to expect performance in the Phrase and Text Tests to depend on the performance in monolingual two Word Tests, since the ability to function at the higher levels of phrase and text is logically dependent on lexical knowledge, since grammatical and syntactic knowledge come into play at these more complex levels. The extent of such dependency is shown by the correlations in Table 3.

As shown therein, the correlations are generally moderate in magnitude, with an average shared variance of 30%, slightly higher for the correlation between the Phrase Test and the monolingual Word Tests (32%) than between the Text Test and the monolingual Word Test (29%). These suggest that the ability to activate L1-L2 connections is, to some extent, governed by the complexity of the code-switching tasks, in which other factors beyond lexical knowledge play a role.

4 Discussion and Conclusion

Glass (1976) defines a secondary analysis as “[the] re-analysis of data for the purpose of answering the original research questions with better statistical techniques, or answering new research questions with old data” (1976: 3). It is with the second purpose as mentioned by Glass that this study was undertaken in the hope that the old data would tell a new story. Against the theoretical background of Paivio & Desrochers’ bilingual dual-coding model, the present study addresses the following key questions:

1. Is what an L2 learner has learned in his L1 available in his L2? If so, to what extent?
2. Does L1 knowledge help to solve problems posed in the L2 or hinder solving them, and vice versa?

The answers to the two questions have obvious implications for the second or foreign language curriculum and teaching. The answer to the first question is a pre-requisite to answering the second. If what a L2 learner has learned in L1 is *not* available in his L2, the L1-L2 link as posited by Paivio & Desrochers does not exist. The implication is that L2/FL curriculum and instruction need to be treated separately and any overlap is co-accidental, by default rather than by design. In other words, under such a condition, children will learn two languages as if they were learning two first/second languages, depending on their home language background. At this point of time, this seems to be the more prevalent situation in many places in which two languages are being taught, and Singapore is definitely a case in point where languages do not interact (and often are consciously prevented to interact). The corollary of this is that L2/FL teachers do not need be concerned with inter-lingual interference since this will not happen, and the second question is meaningless.

On the other hand, if the answer to the first question is in the affirmative, the L1-L2 link does exist. Then, what is learned in L1 is available in L2, the respective effect being positive (*help*) or negative (*hindrance*). This suggests, then, that there is a need to find out the conditions or factors which lead to either of the two outcomes. It also suggests that any curriculum or instruction in which two languages are used needs to be explored and possibly modified for more effective and efficient learning. In other words, transferring what has been learned in one language to the other language will be facilitated by the links between the two verbal systems as posited by the bilingual dual-coding model, and as a consequence, time will be economized and agonies of learning a L2/FL will be saved.

As indicated by the performance in bilingual English-Chinese (EC) and Chinese-English (CE) word tests, pupils at the intermediate Third to Fifth Grades are able to complete test items which require them to tap into the two verbal systems to the extent of between 64% (EC) and 67% (CE). Thus about 65% of what has been learned in one language is available in the other language of pupils who

learn two languages concurrently. However, as the English Group is more balanced in the two languages whereas the Chinese Group is weaker in English, the weaker language of the latter seems to set an upper bound to the pupils' ability to switch between languages.

A similar situation is found at the phrase and text levels where, on the average, 69% and 70% of what is available in one language can be used to answer questions posed in the other language. The slightly higher percentages when compared with the performance at the lexical level may be accounted for by the additional cues or clues provided by the broader context or content of the phrase and text tests. Of course, this does not rule out the possibility that the difference in level is due to the smaller numbers of items at the higher level, with only 15 (*phrase*) and 10 (*text*) compared with the much larger 65 (*word*). This surely is a topic which deserves further investigations.

When two languages are taught independently, as is mostly the case, there are two separate, unrelated curricula, two language teachers, and two sets of learning activities: every single element of the learning process is doubled. In this case, learning a word requires the pupils to go through two similar processes, one in each language, as depicted in Figure 3:

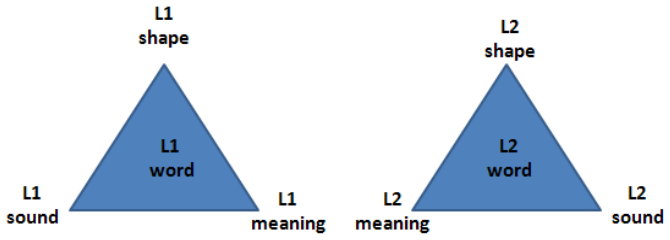

Figure 3: Two similar learning processes: the same word taught independently in two languages

On the other hand, when pupils are guided to invoke what has already been acquired in one verbal system, and code the knowledge into another, the words originally learned are made use of, enriched, and given a new meaning. This represents the traditional process of vocabulary development, be it in one or two

languages. Then, the words are made into translation equivalents. The process is simplified as depicted in Figure 4:

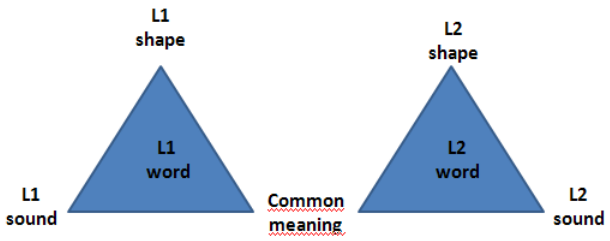

Figure 4: Sharing meanings between two languages through code-switching

In the process of learning a new word in, say L1, the pupil will go through the following paths (see Figure 2):

L1 Stimulus > Sensory System > L1 Verbal System > Imagery System

When bilingual coding is not applied, the pupil will have to go through similar paths this time, thus:

L2 Stimulus > Sensory System > L2 Verbal System > Imagery System

Since in the bilingual dual-coding model, there exist the respective L1-L2 connections, the learning of the meaning of a new word in L2 can be shortened by invoking it, as it has already been built up when the translation equivalent in L1 is being learnt. The process, then, is:

V1 Verbal System > Imagery System > L1-L2 Connections > L2 Verbal System

Usually, learning a new word for the first time may involve verbal explanation, seeing relevant images through pictorial aids, acting the relevant actions, using analogy, embedding the word in a familiar context, etc.. This represents a long process. Going through the same steps for a second time in another language is just not economical as far as time and energy are concerned. Moreover, this may lead to *diglossia* – a situation in which translation equivalents cannot function interactively, the languages being limited to their original learning contexts.

If the hypothesis that there exists an advantage in maximizing the functions of the L1-L2 connections of the bilingual dual-coding mode to teach L2/FL is confirmed, the two language curricula need to be aligned. This does not mean that the textbooks for the two languages must be translated versions of one another, but that their respective content needs to be correlated, sharing sizeable vocabulary to make L1-L2 connections possible in the learning process.

This also means that teachers themselves should be sufficiently bilingual. In the old days, language teachers tended to be monolingual, but with bilingual education becoming more and more common all over the world, most language teachers should be able to make cross-linguistic references at the levels they are teaching. In the case of Singapore, before the implementation of a unified school curriculum, there were Chinese and English schools which mainly produced monolinguals from whom teachers were recruited. Teachers who came from this old system were not able to make cross-linguistic references as implied by the bilingual dual-coding model. Some forty years after the new curriculum, many of the younger teachers are bilingual in English and Chinese, and making cross-linguistic references is not a problem for them, at all. Their bilingual ability should

therefore be activated for a more effective teaching of languages.[42] It is safe to say the same for the teaching of Malay and Tamil in a Singaporean context.

The teaching of methods is not a static but a dynamic process. It has to take into account the changes in learners, teachers, and the respective linguistic environment. In Singapore, as in many other places, such changes are perceivable. With these perceptions in mind, we feel that the moment has come for L2/FL teaching to seriously consider the bilingual approach as an alternative to the time-honoured monolingual approach, which may be out of sync in view of the modern linguistic and social conditions language learners find themselves in.

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[42] Incidentally, it is interesting to have observed some young Chinese language teachers discussing problems of language teaching *in English.*

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