A comparative study of two interventions to support reading comprehension in primary-aged students

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**Abstract**

**Purpose** – The purpose of this paper is to explore the explicit teaching of information text schema with vocabulary instruction to primary-aged students in Hong Kong international education.

**Design/methodology/approach** – Data were collected through three quasi-experimental studies with different age groups and participants. Each study divided participants into two randomly assigned groups, either informational texts (IT) or vocabulary building (VB). Impact was evaluated with gain scores on a standardized reading comprehension test and researcher-designed cloze tests of fiction and nonfiction passages.

**Findings** – The explicit teaching of IT can benefit student reading comprehension from an early age, particularly to first language (L1) English students and possibly second language (L2) English learners. School reading programmes should include opportunities for students to experience IT (nonfiction) and fiction materials, and build their vocabulary through incidental learning and explicit teaching. For IT, they should be exposed to: layout – e.g., headings, sub-headings, glossary, and index; and content – photographs and specific/technical vocabulary. For fiction-based texts and VB, the following themes should be covered by younger aged students: antonyms, synonyms, and affixes.

**Research limitations/implications** – Several limitations apply to this study which will need to be addressed in future studies. These include: the random sampling of students from the overall student population was not an option, given the necessity of voluntary participation and avoiding disruption to school routines. This study used meta-analysis to aggregate results across multiple comparisons largely because of the extremely small samples available. The data show large standard errors as a consequence of small numbers of participants. Hence, the current results, notwithstanding the power of meta-analysis, need to be validated with much larger samples in future studies.

**Originality/value** – This paper suggests that greater comprehension and cloze performance among L1 students was found due to the teaching of IT compared to vocabulary training, with the reverse result for L2 English learners.

**Keywords** International education, Reading comprehension, Vocabulary, Informational texts, Reading interventions

**Paper type** Research paper

**Main text**

The term “information text” is synonymous with nonfiction or expository texts (Stoodt-Hill and Amspaugh-Corson, 2009). Most reading material found in classrooms, workplaces, magazines, and internet websites are informational in content (Stoodt-Hill and Amspaugh-Corson, 2009) and, when used in classroom settings, are usually considered reliable sources of authoritative information. Information texts incorporate documents such as textbooks, encyclopaedia entries, journal articles, and manuals.

Despite the overwhelming presence of instructional texts in the environment, there has been a shortage of informational texts (IT) as instructional material for reading comprehension in classrooms (Duke, 2004; Read *et al.*, 2008; Witmer *et al.*, 2014). The situation, however, notably changed in 2009 in the USA with the introduction of the...
Common Core State Standards (CCSS) for English language arts and literacy in history/social studies, science, and technical subjects (Common Core State Standards Initiative, 2016).

Evaluations of teaching interventions for information text comprehension are relatively rare among English language learners and in East Asian schooling settings. Indeed, it is not clear whether the purported benefits of IT apply equally to first language (L1) English learners and second language (L2) English learners. It is possible that, at the same age or grade, English L1 readers will have larger vocabularies and are, thus, be more able to benefit from instruction in information text schema. In contrast, L2 English readers, with generally smaller vocabulary sizes in English, may not benefit as much. Hence, this paper reports a series of studies into the benefit of teaching information text reading comprehension skills for a group of English L1 and L2 learners in an East Asian educational environment.

**Informational Texts (IT)**

In order to survive the “information age” (Reutzel et al., 2016), it has been suggested that students need to be familiar with and understand expository or nonfiction texts (Duke et al., 2015). It has been considered “increasingly essential” in a world that is “awash in information” for adults and school-aged students to be able “to extract information from and understand informational texts” (Reutzel et al., 2016, p. 1). Furthermore, Reutzel et al. (2016) contended that in order for students to be ready for college and productive careers, students must be proficient in reading IT. Fisher and Frey (2014, p. 222) similarly remarked that primary grade students need to become familiar with “the characteristics and conventions of informational texts” and to know that such text “reflect the physical, biological, and social world around them”. It has been suggested in the literature that a wide range of text types (e.g. biographies or speeches), modalities (e.g. pictures or maps), and purposes (e.g. to explain or entertain) should be represented in the IT used in elementary grade classrooms (Shanahan and Shanahan, 2014).

Research has found that from an early age, IT rather than narrative texts maybe a stronger motivator for boys learning to read due to their brains being developmentally less advanced and unable to comprehend early childhood fictional texts which generally focus on emotions and language skills (Senn, 2012). Furthermore, Senn (2012) stated that the subject matter of IT will be more closely aligned with the interests of young boys.

The layout or text organisational features of information texts have structural characteristics usually including: a table of contents; index; glossary; headings and subheadings; charts, diagrams, maps, drawings; photographs; and captions and labels (Brown, 2003; Bradley and Donovan, 2010). The point of these various features, which are not seen in conventional narrative text, is to enable more rapid and flexible identification of and use of information embedded in the text. For example, headings signal the structure and content of a text, typographic techniques (e.g. bold, italic, etc.) draw the reader’s attention to key new terms or ideas, while page design features such as text call outs or boxed information indicate, respectively, key ideas or supportive information that can be used later (Brown, 2003). The use of photographs to illustrate IT interests and engages children, allowing them opportunities to visualise and make connections to their own experiences of the real world, and help second language English learners in their reading comprehension (Parkes, 2003). Such structural characteristics or schema can assist readers in rapid scanning/skimming for key information, understanding the main points, and mastery of the structure of a knowledge domain. In addition to these macro-characteristics, there are certainly linguistic features of expository text (e.g. use of passive voice, reporting of permanent states with present tense, etc.). However, in this study, the focus is on the structural and modal characteristics of information texts, rather than the linguistic features. This position is taken since the former characteristics are the more prominent, and thus, more easily accessed features of informational text.
Thus, in order for children to comprehend expository texts, they need to use different skills to those needed for narrative passage comprehension (Eason et al., 2012). The American CCSS focus heavily on the use of primary IT sources (Clark et al., 2013; Duke, 2013; Duke et al., 2013; Maloch and Bomer, 2013; Newman et al., 2015; Pennington et al., 2014) and provide curricular standards that provide a reference point. The CCSS guidelines recommend that K-12 students read and receive informational and narrative texts instruction with a 50/50 ratio by Grade 4 and 70/30 by Grade 12 (Clark et al., 2013). Reading standards for IT at Grade 2 state that students need to know and use various text features, for example, headings and tables of contents in order to efficiently locate key facts of information in a text. Grade 5 students are expected to compare and contrast two or more texts of their overall structure, for example, chronology or comparison of events, ideas, concepts, or information (Common Core State Standards Initiative, 2016).

Reading nonfiction texts has been shown to lead to higher reading achievement (Kletzien and Dreher, 2004). Over 25 years ago, Pearson and Fielding (1991) reported that almost any instruction focusing on assisting students to identify and use informational text structures improved their comprehension. Massey (2014) stated that students have opportunities to use abstract language and develop their oral language competency further through interactive read aloud sessions in the classroom utilising IT. Shanahan and Shanahan (2014) remarked that it is insufficient for students to only learn the meanings of vocabulary and terminology in IT but need to understand how and why words are used differently in various disciplines. Furthermore, the authors remarked that vocabulary can be taught to students in every subject area in order for them to understand the specialised nature of discipline-specific words (Shanahan and Shanahan, 2014). Duke (2003) and her colleagues (e.g. Caswell and Duke, 1998; Duke and Bennett-Armistead, 2003; Duke and Pearson, 2002) found that among first and second grade students, no harm and, indeed, some modest benefit to students’ reading development arose from increasing exposure to IT in their early schooling. Benefits included better writing of IT, quicker progression in reading levels, and fewer declines in attitude towards recreational reading by the end of Grade 1.

Reading IT can support students with their fictional text comprehension in three ways: by building background knowledge; by helping develop text-related vocabulary; and by increasing motivation to explore the topic being discussed (Soalt, 2005). When units of study contain fiction and IT material on the same topic, students are given multiple contexts in which to explore new vocabulary.

Vocabulary building (VB)
In early language and literacy programmes, vocabulary instruction is considered a critical component (Spencer et al., 2012). The goal of vocabulary instruction is to help students develop and apply vocabulary knowledge, connect new vocabulary to existing knowledge and experience, and understand text and develop better use of strategies to figure out new vocabulary independently (Linan-Thompson et al., 2003). Effective vocabulary instruction should include explicit teaching and intentional learning (Schmitt, 2008, 2010; Spencer et al., 2012); be multifaceted and encompass the teaching of individual words, providing extensive exposure to rich language (oral and written) and building generative word language (Nagy, 2005). Nation (2015) contended that extensive reading allows for repeated word exposure in varying contexts and provides opportunities for using dictionaries to provide word definitions.

Definitions of words and situating words in context, multiple word exposure, student discussion involvement, active processing of the meaning of words, and assisting students to review words in various contexts over time are effective methods of vocabulary instruction (Graves et al., 2014). Graves et al. (2014) also discussed the challenges teachers encounter when they need to make decisions regarding the words they teach to students.
The authors posed the following questions (p. 334): “should we select words that are essential for comprehension of the selection? Should we select words that may not be crucial for comprehending the selection but are important for developing a broader reading and writing vocabulary? Should we teach relatively common words that are not likely to be known by students with limited vocabularies, including English learners? Should we teach words that are not in the selection but represent themes in narratives or key concepts in informational texts?”

It has also been suggested that incidental word learning is the primary way new words are learnt by people, regardless of age (Carlisle, 2007; Ma, 2009). Particularly in L1 vocabulary acquisition, most words are incidentally acquired through extensive reading and using oral language in conversations (Newton et al., 2008).

Daily reading programmes in primary schools have traditionally focused on explicitly teaching vocabulary using fiction texts such as graded story books. This study employed teaching word-learning strategies and the teaching of individual words in the VB intervention sessions.

**L2 reading acquisition**

In the simple model of reading (Hoover and Tunmer, 1993), learning to read depends on knowledge of the language being read and the ability to decode the symbol system used to map written text to oral language. In oral language, context assists those learning English as a second language, to overcome confusing expressions. However, in learning to read in a second language (in this case, English), young students face additional challenges since they may or may not be literate in their first language and that language may not use the same encoding system as the target language (e.g. alphabetic English vs Chinese characters). Thus, competence in reading in a new language is both complicated by and enabled by target language knowledge and general competence in decoding (Geva and Siegel, 2000).

There are several L2-specific factors involved in L2 reading which include first language (L1) transfer, L2 proficiency level, and previous literacy experience (Nassaji, 2014). With regard to differences between lower-level processes in L1 and L2 reading, for L1 learners, they are mainly converting graphic input into meaning encoded via a linguistic system already mastered to a high level, whereas for L2 readers, this is not necessarily the case; their proficiency in their L2 could be more limited and, as a consequence, their knowledge of basic L2 vocabulary and grammar will be limited (Nassaji, 2014). Furthermore, Nassaji (2014) reported that the importance of word recognition in L1 reading has been well documented in L1-related studies but that few L2 studies have directly investigated how word recognition contributes to L2 reading. L2 research, Nassaji (2014) contends, has predominately investigated the specific nature of L2 word recognition and focused on how these processes vary in L1 and L2 reading or between L2 readers who have different L1 backgrounds, experiences, or proficiency levels.

In one study, Martin et al. (2013) investigated bilingual readers who were L1 Spanish and whether they had the ability to predict final sentence words when reading in their L2. Martin et al. (2013) reported that the L2 participants did not actively predict upcoming words during sentence comprehension to the same degree as their L1 counterparts. In a meta-analytic review (Melby-Lervåg and Lervåg, 2014) of 82 studies, reading comprehension and its underlying components such as language comprehension, decoding and phonological awareness were compared. The review found that when L2 learners were compared to their L1 counterparts, they demonstrated a medium-sized deficit in their reading comprehension whereas a large deficit was apparent in language comprehension. Only small differences, however, were found in the L1 learners’ phonological awareness and decoding.
English is taught as a compulsory subject in Hong Kong from approximately three years old at kindergarten Level 1 (Wong et al., 2015). In the Hong Kong context, students of Chinese ethnicity are usually expected to perform well in their reading of Chinese and English written texts; however, English has been considered a “truly a foreign language” due to its limited and formal usage (Lin et al., 2012). Even for students who are non-Chinese but who have spent more time immersed in Chinese culture and have, therefore, had an opportunity to interact around text through the cultural lenses to which they are exposed, better comprehension results would be expected.

In the USA, Koo et al. (2014) found an interaction between English language learner status (L1 vs L2) and grade level in the tested reading performance of students in two different grades (third and tenth). They reported that on phrases-in-context items such as vocabulary knowledge (e.g. morphology and word relations) scores were lower for English L2 third graders after controlling for ability. For tenth graders, however, L2 students performed significantly better than L1 students on evaluation items after the ability level was controlled. In other research (Zhang and Koda, 2013) conducted with Chinese EFL sixth graders in North-West China, it was concluded that L2 morphological awareness was a result of the joint effects of learners’ L2 lexical exposure and L1 morphological experience. Zhang and Koda (2013) suggested that morphological training could be beneficial to L2 reading for learners from many backgrounds not just L1 Chinese learners. Furthermore, the authors highlighted that learning activities such as segmenting affixes from derived words, identifying base morphemes, or inferring meanings of unfamiliar derived words from familiar base words could be of assistance to L2 learners with the functions of derivational affixes in the English language and the structure of English derivational words.

In sum, past research has shown the purported benefits of IT for higher reading achievement particularly with younger aged children. Reading IT also supports fictional text comprehension in areas including building background knowledge and text-related vocabulary development. For VB and instruction, school programmes should not only focus on teaching individual words and include explicit intentional learning, but also maximise multiple exposure to words in varying contexts, as well as provide opportunities for incidental learning of vocabulary.

**Research purpose**

As a high percentage of contemporary text is informational, a possible innovation for teaching reading comprehension is to make explicit informational text schema. However, the research into informational text schema has relied predominantly on studies with English L1 learners leaving open the possibility that this strategy may not be equally effective with English L2 learners. This research was undertaken to ascertain the relative effects of two interventions (i.e. IT and VB) on the reading comprehension of L1 and L2 English-speaking students in a Hong Kong international school context and consequently make recommendations as to improved curricula or programmes for reading.

The main research questions underpinning the studies were:

*RQ1.* What effect does instruction in informational text schema have on vocabulary and reading comprehension?

*RQ2.* Is the information text schema equally effective for English L1 and L2 students?

Within this framework, the validity of the results was also examined by investigating whether there was on order effect (i.e. experiencing the information texts treatment first or second), a grade effect (i.e. a greater effect for Grade 2 vs Grade 6 students), and a type of reading comprehension measure effect (i.e. a passage reading comprehension test vs a cloze reading test).
Research context
The context for this research was a tuition fee-charging, private international school in the New Territories of Hong Kong in which the first author was employed as a classroom teacher. Approximately 400 students were enrolled, with two classes per year group (i.e. pre-nursery to Year 6), and a maximum of 25 students in each class. The majority of the students were L1 Cantonese speakers, and the medium of instruction (MOI) was English. Mandarin (Putonghua) was offered as an additional language taught in daily 40-minute lessons. There was language support for L2 English students with English as an alternative language and for L1 non-Chinese students, Chinese as a second language. The school’s daily reading programme exposed students to a mixture of fiction and nonfiction texts.

Method
Design
Data were collected in a quasi-experimental design using nonequivalent, but randomly assigned, control and treatment groups (Cook and Campbell, 1979). One pilot study and two studies with different age groups and participants were conducted. Each study divided participants into two randomly assigned groups, either IT or VB. Therefore, the number of L1 English-proficient and L2 English learners in each group and study were not equal. In each study, an alternating intervention design was employed. That is, whilst one group received their treatment, the other group acted as the control and did not attend any after-school teaching sessions. A pilot study was conducted with Year 2 students (N = 14). Study 1 (N = 12) involved Year 2 students, while Study 2 (N = 20) used Year 6 students. Studies 1 and 2 were conducted with two contrasting year groups in order to ascertain whether there were any differences in effect with age. Two different interventions were trialled to better evaluate the efficacy of informational text instruction and two different measures were used to evaluate treatment effects on different aspects of reading comprehension.

Note that Studies 1 and 2 reversed the order of presentation of interventions in the pilot study. It was considered possible that information texts impact might be attributable to being presented first allowing for its effect to be seen potentially on assessments at O_2, O_3, and O_4, with the VB intervention only having possible effect on assessment at O_4. Thus, by changing the order in Studies 1 and 2 (i.e. VB intervention first), this could be accounted for.

Many participants had English as their L2 despite the school’s MOI being English; enrolment in the school was a free choice made by each child’s family. No control for ethnic background was made so that groups in all conditions were both multilingual and multiethnic. By isolating student ethnicity and L1, it was possible to contrast English as L1 with English as L2 and Chinese ethnicity with non-Chinese ethnicities. However, this meant that variations in L1 and ethnicity were uncontrolled. The design of the pilot study and Studies 1 and 2 is diagrammed in Table I, using conventional notation (Campbell and Stanley, 1963; Cook and Campbell, 1979), where G represents the group; O the testing observations; X the experimental treatment for IT and VB, and C the control. Pre-tests (i.e. O_1 and O_3) were given one week before the interventions, while the post-tests (i.e. O_2 and O_4) were given one week after the intervention finished.

Participants
With school permission, recruitment letters were sent to parents of all students in Years 2 and 6. Parents were advised of the planned interventions and testing procedures; assured that students would not be given additional homework; assured that there would be no financial costs; advised that participation was voluntary; and informed that they could withdraw their child at any time should they wish to. After two weeks, parents who had not replied were sent a reminder letter. The participating students, therefore, could be considered a convenience sample, as opposed to a representative sample (DeKeyser, 2013).
The volunteer sample of L1 and L2 English students were randomly assigned to one of two intervention groups: IT or VB. The students’ English was defined as follows: if either or both parents were L1 English, the student was considered to be L1 English. Otherwise, if neither parent was L1 English, the student was considered L2 English. School administrative records were used for selection purposes. For the pilot study, 14 of 20 Year 2 volunteers completed the study; in Study 1, 12 of 16 Year 2 volunteers likewise completed; and in Study 2, 20 of 21 Year 6 students completed the study, giving a total sample of 46 students. Students who withdrew did so because they changed schools or parents withdrew consent without reason, in accordance with ethical procedures. Table II displays the details of students in each group, their gender, L1, and ethnicity. The students in these studies were from five L1 language backgrounds of Cantonese, Dutch, English, Mandarin, and Spanish. In total, there were seven after-school sessions the students were required to attend. In the first week, a pre-test was administered. In the subsequent five weeks, an intervention teaching session of 60 minutes was conducted once a week. Finally, in the seventh week, a post-test was administered. Whilst a group of students were receiving their treatment, the control group either went home or to their regular extra-curricular activities.

Interventions

All lesson interventions were designed and conducted by the first author. It is possible that there was a minor threat of bias in the teaching; however, testing was objective and standardized. In future studies, teacher(s) would be trained to eliminate possible biases. The IT sessions were non-narrative text based and focused on the content and layout of information/nonfiction books and magazines. Concept maps and graphic organisers were used by the students to share their ideas. Graphic organisers have been reported on their use in brainstorming and organising thoughts and ideas (Clark et al., 2013). The VB interventions, in comparison, used narrative texts and materials. The sessions were word-based teaching appropriate lexis and covered a number of themes including synonyms, antonyms, and affixes. Students were encouraged to share their prior word knowledge and use dictionaries and thesauruses in the sessions. The younger students in the pilot study and Study 1 were reminded how to use them. Sessions were carefully planned to ensure that students had sufficient time to discuss prior knowledge and in the session plenaries, to discuss what they had learnt. Additional material on the session themes were prepared in advance and available for the students to use if required. A detailed description of the sessions undertaken with the younger students in the pilot study and Study 1, and the older students in Study 2 as follows.

**IT intervention sessions.** The sessions for Year 2 primarily used two issues of the *National Geographic Young Explorer* series (Mahler, 2010a, b). The *National Geographic*
<table>
<thead>
<tr>
<th>Study and intervention group</th>
<th>Gender</th>
<th>Age M (SD) (years)</th>
<th>L1 English</th>
<th>L2 English</th>
<th>Ethnicity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cantonese</td>
<td>Dutch</td>
<td>Mandarin</td>
</tr>
<tr>
<td>Pilot study (N = 14)</td>
<td></td>
<td>6 y, 7 m (0.45)</td>
<td>1</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Informational texts (n = 7)</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Vocabulary building (n = 7)</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Study 1 (N = 12)</td>
<td></td>
<td>6 y, 4 m (0.29)</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Informational texts (n = 7)</td>
<td>2</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Vocabulary building (n = 5)</td>
<td>1</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Study 2 (N = 20)</td>
<td></td>
<td>10 y, 3 m (0.50)</td>
<td>6</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Informational texts (n = 11)</td>
<td>7</td>
<td>4</td>
<td>6</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Vocabulary building (n = 9)</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>8</td>
<td>8</td>
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<td>Total</td>
<td>22</td>
<td>24</td>
<td>16</td>
<td>26</td>
<td>1</td>
</tr>
</tbody>
</table>

Notes: G, girls; B, boys; L1, home language
series were available as interactive whiteboard resources, although students had their own printed copy of the magazine articles. IT books were also used from the school library, as well as photographs, taken from the internet to supplement and provide additional exposure on the themes of the sessions. After consultation with the class teachers, the themes Ecology, Pedal Power, and Bones were chosen, as they had not been explicitly taught to the students in the school’s reading programme.

In each session, the layout of IT (contents page, glossary, index, headings, and sub-headings) was discussed (Kletzien and Dreher, 2004). In order to compare and contrast the skeletal structures of humans and other animals, graphic organisers (matrices) were introduced to the students (Hall and Sabey, 2007; Williams et al., 2005). In the penultimate and final sessions, the students were asked to choose one of the three session themes and design/write their own IT book (Read, 2005). The students were reminded of layout conventions and encouraged to use the information trade books, photographs, and internet resources (e.g. Google images) to select images for use in their work. In each session, ongoing formative interactions were used to identify students needing individual support or work with a partner. As in the pilot study and Study 1, Year 6 themes in Study 2 (i.e. storms including thunderstorms and tornadoes; super slugs; and glass blowing) were chosen that had not been explicitly taught to the students.

**VB intervention sessions.** Synonyms (adjectives and verbs), antonyms, compound words, affixes (prefixes and suffixes), and word families were selected as the session themes for Year 2 studies based on the work of Blachowicz and Fisher (2002) and Diamond and Gutlohn (2006). The sessions primarily used photocopyable resources from the Scholastic Literacy Skills Vocabulary Years 1-2 programme (Bennett, 2010) to support the explicit teaching of selected targeted words. Words were either selected according to the content of the photocopyable resources or the word card games played in the sessions. The British National Corpus list was used to create word families for targeted base words. To provide multiple opportunities for consolidation, repeated exposures of the targeted words were provided. To contextualise the five chosen themes, the storybook The Fabulous Food Machine (MacDonald, 2006), which was unfamiliar to the students, was read. For Year 6, synonyms (adjectives and verbs), antonyms, spoonerisms and palindromes, affixes (prefixes and suffixes), and nonsense words were selected as the session themes. Photocopiable resources from the Scholastic Literacy Skills Vocabulary Year 6 programme (Howell, 2010) were used and words selected according to the content. The storybook The Brave One (Bell, 2004), which was unfamiliar to the students, was read to support the explicit teaching of selected targeted words, providing multiple exposure for students, consolidating their understanding of synonyms.

**Measures**

Within each study, different measures were used for pre- and post-test. Two different kinds of reading comprehension tests were used in Studies 1 and 2 to better account for the possibility that gains in vocabulary might be obscured in a text-based reading comprehension test. Multiple-choice tests for assessing reading comprehension have been questioned, for example, due to possibly containing text-dependent questions (Andreassen and Bråten, 2010). The Assessment Tools for Teaching and Learning (asTTle) measured a variety of reading skills using a mixture of fiction texts (e.g. poetry and short stories) and nonfiction texts (e.g. locating information in recipes and postcards), as well as a mix of closed multiple-choice and open questions. The cloze tests, in contrast, explicitly tested vocabulary and were based on the content introduced in the intervention sessions.

**AsTTle reading comprehension testing.** The asTTle computer programme (Hattie and Brown, 2008) was developed in New Zealand, to allow school-based assessment of reading.
writing, and mathematics (Hattie et al., 2003). The content of the asTTle tests could be considered New Zealand centric; however, the setting for this research was an international school and, parents and staff expect students to be able to read material from any location globally. The school does not follow the Hong Kong curriculum and there is no expectation that the material should be especially situated in Hong Kong. While there are other standardised reading comprehension tests available for purchase, the asTTle tests were made available to the first author at no cost by the second author who was one of the test developers.

The asTTle system allows users to set the difficulty and curriculum objectives of a 40-minute reading comprehension test generated by the software out of a test bank of over 1,000 reading comprehension test questions. The system allows inspection of the complete test, with options to revise content if the test does not adequately align with intentions. Each test and all items are calibrated to the New Zealand curriculum levels and framework. The system automatically computes a scale score (Year 6: $M = 500$, $SD = 100$) using single parameter item response theory calculations in which higher scores are achieved by answering harder questions correctly, rather than the classical test sum of items correct approach (Hambleton and Jones, 1993).

The New Zealand National Curriculum levels are normatively aligned to years of schooling and age of students who start school at age 5. Curriculum Level 2 is centred on Years 3 and 4 (ages 7-8), Curriculum Level 3 on Years 5 and 6 (ages 9-10), and Curriculum Level 4 on Years 7 and 8 (ages 11-12). Curriculum Level 2 was selected for the tests used in the pilot study and Study 1 and Curriculum Level 3 for Study 2. The four selected tests had 15 per cent or less repeated items, thus, reducing the possibility of improved performance through student practice effects. The Level 2 tests were randomly assigned as pre-tests or post-tests for the pilot study, and subsequently used in Study 1 being implemented in the same order. A similar procedure was used in Study 2 to assign Level 3 tests.

**Cloze tests.** Four different cloze tests were created. The content of two tests were based on the texts read in the vocabulary training intervention (i.e. *The Fabulous Food Machine* (MacDonald, 2006) in Study 1; *The Brave One* (Bell, 2004) in Study 2). Two tests were based on the content of the texts read in the information texts interventions (i.e. *National Geographic* texts on rubbish, bikes, and bones in Study 1; and thunderstorms in Study 2).

In all, 20 of the words explicitly taught in the intervention sessions were deleted in the tests. These were primarily nouns. The initial letter of each deleted word was provided as cues (Helfeldt et al., 1986) with solid lines of equal length (Grenewald, 1981). Scoring used classical test theory sum of items correct, with no adjustment made for word difficulty. The testing situations were conducted as alike as possible in order for student performance to be compared (Mulholland and Neville, 1989).

**Analysis**

Mean scores were calculated for each pre- and post-test measure, resulting in 12 group means (i.e. 3 studies × 2 halves × 2 times) (Table III). Evaluation of the mean score differences can be done using multiple t-tests, but such an approach does not readily determine patterns of effect according to type of treatment (information texts vs VB), year group of student (Year 2 vs Year 6), type of reading measure (asTTle vs cloze), or type of L1 (English, $n = 16$ vs other language, $n = 30$). A further disadvantage of using statistical significance tests of differences in mean score (e.g. $t$-test, $F$-test) is that they do not provide an estimation of the size or scale of the difference; they only indicate whether the difference is greater than would be observed by chance. A third disadvantage of multiple statistical significance tests is that they are prone to Type I error (i.e. falsely rejecting the null hypothesis achieved by conducting multiple tests).
A more meaningful approach is to examine the scale of difference between mean scores using a standardized effect size which converts the mean score difference into a proportion of standard deviation (i.e. Cohen’s d) (Cohen, 1992). While Cohen (1992) provided standards for interpreting d, Hattie (2009) established, across thousands of educational studies, that |d| ≤ 0.20 are trivial, 0.20 < |d| ≤ 0.39 are small, 0.40 < |d| ≤ 0.59 are medium, and |d| > 0.60 are large.

When multiple studies are available for evaluation, as in this report, it is possible to evaluate patterns of effect sizes by combining and weighting the effects of each study by the number of participants in each group (Rosenthal, 1994). This approach, known as meta-analysis (Rosenthal and DiMatteo, 2001), is able to effectively determine noteworthy pooled patterns in the size of effect across multiple studies, even when individual studies are small or statistically nonsignificant (Thompson, 2007). Based on the 20 effects available in this study, inspection of

<table>
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<th>asTTle</th>
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<sup>Note</sup>:<sup>a</sup>Intervention first; <sup>b</sup>intervention second

Table III. asTTle and cloze one-way ANOVA descriptive statistics and effect sizes

A more meaningful approach is to examine the scale of difference between mean scores using a standardized effect size which converts the mean score difference into a proportion of standard deviation (i.e. Cohen’s d) (Cohen, 1992). While Cohen (1992) provided standards for interpreting d, Hattie (2009) established, across thousands of educational studies, that |d| ≤ 0.20 are trivial, 0.20 < |d| ≤ 0.39 are small, 0.40 < |d| ≤ 0.59 are medium, and |d| ≥ 0.60 are large.

When multiple studies are available for evaluation, as in this report, it is possible to evaluate patterns of effect sizes by combining and weighting the effects of each study by the number of participants in each group (Rosenthal, 1994). This approach, known as meta-analysis (Rosenthal and DiMatteo, 2001), is able to effectively determine noteworthy pooled patterns in the size of effect across multiple studies, even when individual studies are small or statistically nonsignificant (Thompson, 2007). Based on the 20 effects available in this study, inspection of
the weighted effect size across all important theoretical distinctions (i.e. student year, type of treatment, type of reading measure, student L1, and order of presentation) allows determination of whether the pooled effect is consistently greater than 0 and if the effect is overall larger than other comparisons. All calculations of effect were carried out using fixed effects models (i.e. difference in mean score adjusted by correlation within effect across times) with Comprehensive Meta-Analysis software version 2.2 (Borenstein et al., 2007).

Results
Table IV provides the summary effect sizes and statistical significance of effects. Cohen’s $d$ indicates the size of the difference between each treatment or control session, while the 95% confidence interval shows the plausible range of observed effects taking into account the standard error determined by the number of effects being included in the statistic. The $z$-value is used to determine the probability that the effect is greater than 0.

The results of the studies are analysed according to the two research questions underpinning these studies:

$RQ1$. What effect does instruction in informational text schema have on vocabulary and reading comprehension?

<table>
<thead>
<tr>
<th>Comparison</th>
<th>No. of effects</th>
<th>Cohen’s $d$ (standardised difference in means)</th>
<th>SE</th>
<th>Variance</th>
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<th>Upper</th>
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<td>1.364</td>
<td>2.745**</td>
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</tr>
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<td>Cloze measure</td>
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</table>

Table IV. Effect size values by comparison

Notes: ns, not significant. *Includes all treatment effects. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$
The total effect of the information texts treatment was medium, which was twice the effect of the VB treatment. Regardless of treatment, the cloze test showed more pronounced effects than the asTTle reading comprehension test (large vs small in information texts treatment; medium vs trivial in VB treatment). The Year 2 treatment effect, independent of content, was considerably smaller than the Year 6 effect, though both effects were statistically significant. These results indicate that the information texts treatment was both effective and stronger than the VB treatment and that the cloze measure was more effective in detecting the effect of the experimental intervention.

The overall average of all treatments and test scores was found to be 0.306 and, therefore, close to the total vocabulary treatment effect size (0.290). Furthermore, the majority of the effect of the vocabulary treatment was noticeably in the lower tail of the 95% confidence interval of the IT treatment total. See Figure 1 displaying treatment diagrams:

RQ2. Is the information text schema equally effective for English L1 and L2 students?

The effect of the two treatments, however, was inverse according to the first language at home. For students with English L1, the information texts treatment had a large effect according to the cloze measure, while the VB treatment was trivial on both the asTTle and cloze measures. In contrast, for students with Chinese L1, the VB treatment had a medium effect on the cloze measure and a large effect for the information texts treatment was statistically significant. Medium gains were also found for the other L2 English students. The data suggested that the more prevalent English is communicated at home, the less effect there was on the cloze measurement; but for other L1s, there seemed to be a positive trend that explicit vocabulary teaching was beneficial to performance on the cloze measurement.

Discussion

Consistent with previous American research (Caswell and Duke, 1998; Duke, 2003), this study demonstrated that the explicit teaching of informational text structures had a small to large effect (depending on reading comprehension measure) on student performance.

Chinese L1 learners gained a small amount from the information texts treatment on the asTTle assessment, but much more from the explicit VB instruction. This seems consistent with the simple model of reading which suggests that successful comprehension depends on language knowledge as much as it does upon decoding ability. This finding suggests that English L2 students may require vocabulary instruction much more than they need instruction in the schema of information texts; English L1 students were more familiar with the information texts but were novel for the L1 Chinese students; English L1 students already have large vocabularies and short treatment intervention sessions were less beneficial; or that the L1 Chinese students may have had more positive attitudes towards teaching, learning, and testing and more diligent and effortful than their L1 English counterparts.

This finding echoes other researchers (Nation, 2006; Schmitt, 2008) who have contended that an 8,000-9,000 word-family vocabulary is required for unassisted comprehension,
with a vocabulary of 6,000-7,000 words for spoken texts. In the Hong Kong context, Wong et al. (2015) reported receptive vocabulary to be important for successful comprehension of English speech fluency for L2 English learners in Hong Kong. This finding also echoes a study reporting questionnaire data (Sorrell and Forlin, 2015) that found that a number of English L2 primary-aged students had experienced problems learning new English vocabulary and spellings. Such problems included putting prepositions in the correct place in sentences, having to learn too many new words at the same time, and confusions with rhyming words. Furthermore, this study also reiterates Liebfreund (2015) who reported vocabulary to be a consistent predictor of IT comprehension for higher comprehenders in Grades 3-5.

Limitations
Several limitations apply to this study which will need to be addressed in future studies. Random sampling (Rudestam and Newton, 2007) of students from the overall student population was not an option, given the necessity of voluntary participation and avoiding disruption to school routines. Furthermore, the English L2 group comprised of students with multiple L1 backgrounds, that is, L1 Cantonese, Dutch, Mandarin, and Spanish students were grouped together and, therefore, not equal to each other meaning no analysis at the level of a specific L1 was possible. Hence, current results about English L2 students may be invalid for children from a specific L1 background.

The tests created by the asTTle test system included a mixture of narrative and non-narrative passages, confounding somewhat the measure of the information texts teaching on the ability to comprehend IT. However, since asTTle does not report scores by type of text, it was not possible to determine if the intervention had a specific effect by text type. A future study that used a test which could disentangle scores by text type would be desirable.

Likewise, the purity of each intervention was somewhat confounded by the fact that the VB interventions used narrative texts and materials, instead of information texts. This means that the results do not isolate and contrast the teaching of informational text schema vs VB. Furthermore, within the information text intervention, there would at least be some incidental vocabulary instruction and learning. This is an important limitation because the students undergoing the information text intervention likely received some vocabulary training, although quite different to the VB treatment. Thus, future studies should seek to maximise separation of treatments and fidelity of intervention type. Nonetheless, the current study is still strongly suggestive that the teaching of informational text macro-characteristics was beneficial.

Since all interventions were conducted by the one teacher, it is not possible to claim from this study that the observed effects are generalisable to implementation in the regular classroom reading curriculum. However, the current results are promising and certainly indicate that such research is warranted.

This study used meta-analysis to aggregate results across multiple comparisons largely because of the extremely small samples available. The data show large standard errors as a consequence of small numbers of participants. Hence, the current results, notwithstanding the power of meta-analysis, need to be validated with much larger samples in future studies. Such research would provide a stronger basis for generalisability of the claims discussed below.

Conclusion
This study adds to our understanding of the importance of offering instruction in informational text schema at an early age, at least to L1 English students, by confirming previous research with this sample of international students enrolled in an English MOI private school in Hong Kong. While relatively small scale, this study demonstrates, through
its quasi-experimental design and use of meta-analytic techniques, that information texts were more effective than a VB treatment for English L1 primary students.

This study certainly supports the recommendation that primary international schools should include both IT (nonfiction) and fiction input as part of their daily reading programme, especially in the early years and for students learning English as a second or even third language.

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Appendix 1. Information texts lesson plan

Year 2
Session 1: “Ecology”. The *National Geographic* article (Mahler, 2010a) was read together and the students were asked questions to ascertain prior knowledge on the theme and layout of information books. Many demonstrated knowledge about the contents and index pages, and glossary. They were given a selection of information books on recycling to look at and asked questions about recycling in their own homes. The session concluded using an activity sheet in which objects needed to be sorted into two groups on the basis of whether they could be recycled or not.

Session 2: “Pedal Power”. The *National Geographic* article (Mahler, 2010a) was read together on the IWB which was stimulating for the students giving maximum opportunity for engagement with the text. Afterwards, they were given their own printed copy to refer to. The students were asked if they had their own bike and if they enjoyed riding it. They were given an activity worksheet and asked to label bike parts to ascertain prior knowledge. The article also looked at different bike designs and discussion followed on how designs have changed over time. The students were asked to work with a partner, looking at the information books for additional information on key words (e.g. forces, pedals, pulleys, and wheels) from the text. They were asked reminder questions about the layout of the books to assist in locating information. The session concluded sharing thoughts on new knowledge learnt.

Session 3: “Bones”. Before reading the *National Geographic* article (Mahler, 2010b), the students were asked questions on the human body skeletal structure to establish prior knowledge. Each student had their own copy of the article, subsequently used in a shared reading experience, followed by questions. They were shown a graphic organiser on the IWB and told how it could be used to compare and contrast. Using their own organiser, they were asked to think of the three animals described and compare/contrast their bone structure/skeletons to humans. Information books and photographs of the different bone structures/skeletons were also provided. Their ideas were shared in a plenary discussion.

Session 4: Information Text Creation. In this session, issues discussed in the previous three sessions were revisited. The students were instructed on the task for the next two sessions: to choose one of the three themes that most interested them and design their own information book. They were asked to consider the layout of information books and encouraged to search for information on internet websites or use the *National Geographic* magazines and other nonfiction books.

Session 5: Information Text Creation. This session continued Session 4 with reminders of the importance of the layout of their books. Their designs were shared at the end of the session.

Year 6
Session 1: “Storm Warming”. The session primarily used *National Geographic Extreme Explorer* (April 2010) (Mahler, 2010a) magazines and other information trade books on tornadoes, storms, etc. MacBook’s were also available for online research. Concept web/map sheets were used to ascertain prior knowledge. Afterwards, the students shared their ideas with a partner and then as a group. Shared reading of the whole article followed. The students summarised the main points from the article on a concept/brainstorm map: “What had they learnt about tornadoes?” Using other information books and the internet to look up information was the next task. The students were asked to identify the main features of information books, with discussion following on headings, sub-headings, contents page, glossary, and index. As a summary, a *National Geographic Extreme Explorer* (April 2010) (Mahler, 2010a) comprehension check sheet was used for consolidation of the ideas covered in the session.

Session 2: “Super Slugs”. The session largely used *National Geographic Extreme Explorer* (April 2010) magazines (Mahler, 2010a). MacBook’s were available for online research. There was an assessment of student prior knowledge. The words gills, rhinophores, cerata, and photosynthesis were written on the board and the students were asked if they knew any of the words. Texts were given out for shared reading; *National Geographic’s Extreme Explorer* (April 2010) (Mahler, 2010a) article “Super Slugs”. The glossary (Wordwise) was used to locate definitions of the terms/vocabulary. What had they learnt, for example, about nudibranchs? The students were asked to write their ideas down on a
concept map/web, subsequently sharing their ideas. As a plenary, a National Geographic Extreme Explorer (April 2010) (Mahler, 2010a) comprehension check sheet was used.

Session 3: “Cooking with Glass”. The session primarily used National Geographic Extreme Explorer (May 2010) magazines (Mahler, 2010b). A video on YouTube was observed on the interactive whiteboard on glass blowing (www.youtube.com/watch?v=4-KPgjZ_3Ww&NR=1). The students were asked if they had learnt anything surprising about glass. The words physics, state of matter, solid, liquid, and atoms were written on the whiteboard. The students were asked if they knew the meanings of any of the words and their ideas were discussed. Next, they read the headline and questions on the initial pages of the article, looked at the photograph, and asked what they thought the article could be about. The writers were comparing making glass to cooking. The students were questioned why the authors might be making this comparison. Shared reading followed of the National Geographic’s Extreme Explorer (May 2010) article “Cooking with Glass”. It was explained that the story was rather like a recipe and its aim was for the reader to understand the process of making glass step by step. The glossary (Wordwise) was referred to for word definitions. Using the worksheet “Cooking with Glass”, the students were asked to imagine that they were a glassblower and describe the ingredients they would need and the procedure. As a plenary, their ideas were shared using a National Geographic Extreme Explorer (May 2010) comprehension check sheet.

Session 4 recapped on issues discussed during the previous three sessions. They were asked to write down key ideas they could remember under the column headings: “Storms”, “Nudibranchs”, and “Glass blowing”. The session aim was explained: to choose their most interesting theme and, during the next two sessions, individually design their own information book/leaflet/poster. The internet could be used to print out photos or search for facts. Information books were also available. They were asked to consider the design, including title, headings, contents, glossary, and index.

Session 5 briefly recapped on the previous session to remind them of their task. Their information books were shared at the end of the session.

Appendix 2. Vocabulary building lesson plan

Year 2

Session 1: “Synonyms”. Synonyms were brainstormed to determine the students’ prior knowledge and understanding. They were also questioned on their understanding of how to use a thesaurus. Initially, the students were asked to think of synonyms for a variety of words and, subsequently, use a thesaurus to check or find additional words. Word cards were also given to the students to sort into pairs of synonyms (e.g. oily and greasy).

Session 2: “Antonyms”. The session briefly revised synonyms by asking students to think of some other words for the term “wonderful” (which appeared in the text). Discussion followed to determine if there were any similarities and differences in their thoughts. Then, the term “antonym” was introduced. Words were written on the whiteboard and students were asked to think of antonyms. Afterwards, they were given activity worksheets (Bennett, 2010) to complete and discussion followed.

Session 3: “Compound words”. As Session 2, the session began with a brief recap on synonyms and antonyms. Afterwards, the students were asked about compound words, which were written on the whiteboard. The next chapter of the storybook was read and the students were asked to identify as many compound words as possible which were written on the whiteboard for clarification.

Session 4: “Prefixes and suffixes”. The session started with a recap of Session 3. The students were then asked to think in pairs of words they already knew with the “un” and “dis” prefixes and the suffixes “ful” and “y”. Their words were written on the whiteboard. The students were questioned on what the un- prefix meant and one student answered “not”. Afterwards, they completed an activity sheet (Bennett, 2010) based on this prefix and their answers were discussed in the plenary.

Session 5: “Word families”. Words from previous sessions were chosen as base/root words and printed on cards. The students were asked to choose a card and using semantic maps, write down words that they thought might belong to their word family. They were given dictionaries to check how many words were correct and to see if there were others they could have chosen. Time allowing, a new base/root word was chosen. The generated words were discussed, using knowledge gained from
previous sessions on suffixes and compound words. For example, many students added derived forms using suffixes (e.g. “ful” and “y”) and compound words such as “lighthouse” when the base/root word was “light”. The students were given approximately 30 minutes to complete the activity.

**Year 6**

Session 1: “Synonyms”. The students were asked what they knew about synonyms and asked to individually complete two worksheets (“Notes in Class” and “Character Descriptions”) (Howell, 2010). They shared their ideas on synonyms for “wrote” and adjectives to describe characters in each text. The first few chapters of the chosen storybook were read.

Session 2: “Antonyms”. The previous week’s session on synonyms was briefly recapped for consolidation. The students were asked if they have heard of antonyms and if so, what they were. They were not familiar with the term, but when it was defined, were able to provide the antonym for a variety of words. The students were then asked to individually complete the worksheet “My friend is […]” (Howell, 2010) and share their ideas. The storybook was continued to be read.

Session 3: “Spoonerisms and Palindromes”. Session 3’s work on antonyms was briefly recapped. The students were asked if they had heard of spoonerisms and palindromes. They had not heard of either term. Spoonerisms were defined as words whose initial sounds of words are muddled up and that palindromes are words, phrases, or sentences that read the same forwards and backwards. The students were asked to individually complete the two worksheets “Spoonerisms” and “Palindromes” (Howell, 2010) and shared their ideas afterwards. The storybook was completed.

Session 4: “Synonyms, prefixes, and suffixes”. The work covered in the previous session was recapped and afterwards, the students were given a copy of the storybook *The Brave One* (Bell, 2004) and a worksheet that listed words from the text. They were also given a thesaurus and the option of working individually or as a pair to find synonyms for the chosen words. The students were encouraged to re-read the sentence with the synonym to ensure it made sense. Their ideas were subsequently shared. In the second half of the session, they were asked what they knew about prefixes and suffixes and to write down any they knew and share their thoughts which were reviewed and discussed.

Session 5: “Nonsense words”. The session started with a recap of synonyms, prefixes, and suffixes to assess the students understanding and recall. Next, they were informed that we would be thinking about nonsense words. They were asked to think of something of particular interest and a totally ridiculous word and definition. There was some initial discussion on how nonsense words can be compiled, such as by changing initial sounds of existing words, changing prefixes and/or suffixes, thus, building on the content of previous sessions. The students were given two worksheets “Imagine” and “The Amazing Sprandlefoose” (Howell, 2010) which were subsequently discussed. To conclude, the five sessions were reviewed and the students were asked to comment on any new learning.

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