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Impacts of Inferential Skills on Reading Comprehension in Thai (L1) and English (L2)

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Abstract

This study investigated the influence of the ability to make inferences on reading comprehension in Thai (L1) and English (L2). Eight measures were utilised, including four measures of inferential skills and reading comprehension in Thai and English, three measures of language skills (vocabulary and listening skills), and the Raven's Advanced Progressive Matrices. Data were collected from 220 undergraduate students in Thailand. Results demonstrated a significant inter-relationship between inferential skills in Thai (L1) and English (L2). Furthermore, findings from hierarchical regression analyses indicated that the addition of the inferential measure scores significantly increased the predictability of reading comprehension in the same language, after controlling for within-language vocabulary levels (and listening comprehension in the case of Thai) and non-verbal reasoning. Analyses across languages showed positive correlations between Thai inferential skills and English reading comprehension, and between English inferential skills and Thai reading comprehension. Hierarchical regression analyses also indicated that the addition of the English inferential measure predicted extra variability in Thai reading comprehension after controlling for English and Thai language related skills and non-verbal reasoning measures, but the addition of the Thai inferential measure did not influence the level of prediction of English reading comprehension after controlling for the same variables. Implications for bi-lingual learners of different ability levels are discussed.

Keywords: Reading comprehension; Inferences; Thai-English speakers; Language transfer

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INTRODUCTION

Drawing inferences is one of the central cognitive processes in reading comprehension. Inference generation takes place when readers want to get more from text than what is literally stated (Kispal, 2008). Inference generation relies upon the ability to integrate clues in the text with prior knowledge to achieve a more fully integrated and coherent representation of text (Cain & Oakhill, 1998; Kintsch, 1998; Pressley, 2000; Snow, 2002). As such, successful inference skills are often seen as key to successful comprehension (Cain, 2010; Cain, Oakhill, Barnes, & Bryant, 2001; Dole, Duffy, Roehler, & Pearson, 1991; Eason, Goldberg, Young, Geist, & Cutting, 2012). Indeed, longitudinal studies have provided evidence of the importance of inference in the development of reading comprehension (Cain et al., 2001; Hannon & Daneman, 1998; Kendeou, Bohn-Gettler, White, & van den Broek, 2008; Oakhill & Cain, 2012).

The significance of inference to reading comprehension has been investigated in first language (L1) contexts. Much of this previous research has examined inferential skills in English as a first language, particularly with regard to school age children (e.g., Cain & Oakhill, 1998, 1999; Cain et al., 2001; Silva & Cain, 2015). For example, the study of Oakhill and Cain (2012) showed that comprehension skills that comprised the ability to make inferences, to monitor comprehension, and the knowledge/use of story structure were the largest predictors of reading comprehension in year 6 English L1 students. Furthermore, Silva and Cain (2015) explored how receptive vocabulary, grammar and verbal memory (which they described as lower level comprehension skills) supported the early development of inference and literal story comprehension (higher level comprehension skills), and identified the predictive power of these skills on subsequent reading comprehension in four to six-year-old English L1 children.

In sum, the results show that inference skills are significant to the construction of text representations in the earliest stages of reading comprehension development. However, research also argues for the influence of inference making on reading comprehension in older learners (the focus of the current research). For example, Cromley and Azevedo (2007) investigated the effects of background knowledge, inferencing, vocabulary, and single word reading on reading comprehension and argued that the ability to use strategies such as summarising and inferencing provided a greater contribution to reading comprehension in adolescents and adults than in children. Studies also indicate that performance on tasks requiring inferences can differentiate groups of adult skilled readers from their less skilled peers (Hannon & Daneman, 1998; Long, Oppy, & Seely, 1994). Therefore, the ability to make inferences is a significant predictor of reading comprehension in a first language.

In terms of research relating inference and reading comprehension in a second language (L2), one area of interest has been lexical inferencing, which is the skill of being able to interpret the meaning of a word based on the context in which the word is found (Nation,

2001). Clearly, this is a skill that could support reading within a language where vocabulary knowledge may be limited. Therefore, lexical inferencing has been investigated in several studies (e.g. Hatami & Tavakoli, 2012; Karlsson, 2014; Prior, Goldina, Shany, Geva, & Katzir, 2014; Wu & Shen, 2009). However, little L2 research has investigated other types of inference, comparable to that widely conducted in L1 research. One example is the study by Lee (2014) in which English second language primary school students showed low levels of inferencing with a narrative text and informational article. Such findings may suggest that more general types of inferencing are less likely to be found in L2 readers in contrast to their L1. Therefore, the present study aimed to investigate the relationship of inferential skills and reading comprehension in students' L1 and L2.

As suggested above, research that has focused on explanations of L2 reading based on underlying cognitive processes (such as processing involved in making efficient inferences about a text) often considers processes as hypothesised in models of L1 reading. Such research on second language learners has also identified cross-linguistic influences in successful reading L2 acquisition: skills developed in one language may support the development of analogous skills in a second, or the same skills developed in one language may be used during reading in the second language (see discussions in Bialystok, McBride-Chang, & Luk, 2005; Sadeghi & Everatt, 2015). This means that models of reading acquisition and practices to support literacy learning need to take account of such cross-linguistic influences (see findings in Lipka & Siegel, 2007). Although transfer between L1 and L2 has been identified, questions still arise regarding what skills/processes transfer from one language to another and whether they produce facilitative versus interfering influences (Koda, 2007; Sadeghi & Everatt, 2015).

Several theoretical hypotheses have been proposed for the potential transfer of reading skills. The Reading Universal Hypothesis postulated by Goodman (1971) argues that the reading process is much the same for all languages, with minor variations to accommodate the specific characteristics of the writing systems and the grammatical structures of the language.

Cummins (1981) proposed the theory of the Common Underlying Proficiency (CUP), which is also called the Interdependence Hypothesis, which makes a strong case for the transfer of literacy skills across languages. The theory argues that there is a cognitive/academic proficiency that is common for all written languages although the surface aspects of two languages differ. Such theories suggest that it is plausible that inference skills developed in one language should transfer to the processing of text in a second. However, such transfer effects are usually considered from the perspective of lower level reading/comprehension skills (based on Silva and Cain's, 2015, delineation of lower and higher comprehension skills). Investigations of higher level comprehension skills across languages have been rare (e.g. Han & Stevenson, 2008). Although studies have considered how lower level skills may transfer to support higher level processes: for

example, Gottardo, Javier, Farnia, Mak, and Geva (2014) showed significant associations between Spanish (L1) word reading and English (L2) reading comprehension. Most studies of transfer focus on L1 to L2; however, recently, research has focused on reciprocal transfer or the transfer from L2 to L1 (e.g., Oller & Cobo-Lewis, 2002; van Gelderen, Schoonen, Stoel, de Glopper, & Hulstijn, 2007). These studies suggest that reading skills may transfer between languages; while, the majority of studies on cross-linguistic transfer have focused on early reading skills, such as decoding or phonological awareness, the current study aimed at investigation into transfer of high level skills in reading comprehension such as inference among English language learners.

The present study investigated the impact of inferential skills on reading comprehension of Thai (L1) and English (L2). The research questions were posed as follows:

1. Is there any relationship between inferential skills in Thai (L1) and English (L2)?

2. Do inferential skills support reading comprehension within-language (Thai and/or English)?

3. Can inferential skills in one language support reading comprehension in another language?

METHODS

Participants

The sample for this study was 220 second year undergraduate students in eastern Thailand. The participants were studying various majors except English language, but they were required to complete three English courses in order to meet the requirements for a four-year undergraduate programme. As part of the study, participants completed a questionnaire that included demographic information and were asked for details of language learning. Based on these self-reports, all participants were Thai native speakers, aged 18-19 years old. The sample comprised 76 male (34.5%) and 144 female 144 (65.5%). They had studied English as a foreign language for about 12 to 13 years before attending the tertiary level.

Measures

A range of measures were used in this study to assess skills in Thai and English. These assessed reading comprehension, inferencing, language and non-verbal reasoning. For all measures, pilot work was also conducted, and involved adult students from a similar university background, but who were independent of those participants whose data were analysed in the results of this paper.

Thai and English Reading Comprehension

The Thai and English reading comprehension measures were adapted from the Thai language critical reading test (Prasansorn, 2001). This test was originally developed to assess the reading abilities of secondary school students before and after teaching methods that focused on higher-level thinking. Given the focus of the current study, such a measure fitted the needs to assess more complex reading skills as well as be relevant to the target population of Thai students. The test items were constructed on the basis of the cognitive domains of Bloom's taxonomy (Anderson et al., 2001), enabling different types of reading skills to be investigated. By random selection, the English reading comprehension test was constructed based on the Thai language critical reading test Form A, whereas Form B of the test was used as the basis of the Thai reading comprehension test. Form A was translated from Thai into English, and some types of reading passages (i.e., Thai poetry and advertising commercials) were omitted to avoid ambiguity or misinterpretation by the adult students who were the focus of the current study – they would not be familiar with such passages in English.

This process resulted in the selection and piloting of a total of 10 passages. These procedures led to an English measure comprising 40 comprehension questions and a Thai measure of 35 comprehension questions. Participants were given 25 minutes to complete the Thai measure and 30 minutes to complete the English version. Their task was simply to read the passages silently to themselves and answer the comprehension questions following each passage. The number of questions answered correctly in each measure was recorded. Part of an English reading item can be found below as an example of the measures used.

Passage:

> Nawarat Pongpaiboon was born on 26 March 1940 at PhanomThuan district, KanchanaBuri. He is a son of Sombat and Somjai Pongpaiboon. He was in the family where everyone loved Thai literature. His father was especially interested in Thai classical music and Thai poetry.
>
> Nawarat's mother herself liked reading Thai literature. She also liked to share her enjoyment through the stories she read to her children. His father loved reading not only poems, but also other things, such as traditional Thai literature and contemporary stories.

Question:

> What factors encouraged Nawarat Pongpaiboon to become a poet?
> a. Nawarat's personal interests b. Nawarat's talents
> c. Nawarat's teachers and friends d. Nawarat's family

Thai and English Inferential skills

The Thai and English inferential skills tests were developed in parallel to make them as consistent as possible. The tests consisted of ten short reading passages followed by a series of multiple-choice-questions with four choices for each. All reading passages were carefully written, taking into account the potential for cultural interference and the participants' interests and competency. Each reading passage included five different types of question to ensure that a range of inferences were tested. Literal questions asked for factual information explicitly stated in the passage; these questions were included to ensure that the reader had a basic level of text comprehension (Hogan, Bridges, Justice, & Cain, 2011): for example, following the text "Debbie was going out for the day with her friend Michael", a literal question would be "Who did Debbie spend the afternoon with?" (Cain & Oakhill, 1999, p. 495). Grammatically connecting inferences involved a referent which was used in the text to refer to a person or object: for example, given "Tim also took off his dusty overalls and threw them into a plastic garbage bag", then a correct answer to the question "Where did Tim put his overalls?" would suggest that the reader had correctly inferred that "them" related to "overalls". Vocabulary related meaning inferences meant that the reader had to infer the relationship between two words or phrases that referred to the same concept: for example, "every morning" and "daily" would refer to similar concepts in the text and in the comprehension question.

Text coherence inferences focused on relating information in two contiguous phrases or sentences to achieve the coherence meaning of a written text. An example based on Cain and Oakhill (1999) was "Michael got some drink out of his duffel bag. The orange juice was very refreshing." which provided the information needed to answer the question "Where did Michael get the orange juice?". To answer the question, the reader needed to make a connection between the phrase "some drink" and the phrase "orange juice". Prior knowledge inferences required the ability to connect information in the text with background knowledge about the text or incidents described. For instance, in "No one came to the party. Nancy threw away the cake." (an example from Hogan et al. (2011, p. 6), the question might be "What was Nancy's feeling after the party?". Here, the correct answer would likely be to infer that she was upset.

For the Thai measure, two Thai lecturers gave specific advice on the reading passages and questions. Based on this advice, and the results of pilot work, the test was revised in terms of content and complexity. The English measure was also revised based on pilot work, and materials were reviewed by two English native speakers. Both tests were reviewed by experts in test development who provided feedback in terms of content quality, clarify and lack of ambiguity, and sensitivity to cultural issues.

The Thai inferential skills test comprised reading passages between 150-250 words in length and a total of 45 comprehension questions, and students were given 20 minutes to read the passages silently to themselves and answer the questions. A similar procedure

was used for the English version, with reading passages of between 140 and 225 words in length, 35 questions and about 30 minutes. The number of questions answered correctly for each language version formed the scores for these measures.

English vocabulary

Vocabulary, or word knowledge, is vital for text comprehension (Cain & Oakhill, 2014) and, therefore, has been found to be one of the best predictors of reading comprehension (Carroll, 1993; Thorndike, 1973), particularly in skilled adult readers (Guo, Roehrig, & Williams, 2011). Word knowledge, or vocabulary size, is typically measured by determining the number of words of varying frequency that participants can understand. The Vocabulary Size test (Nation & Beglar, 2007) was determined to be the most appropriate measure to investigate the vocabulary proficiency of the participants as this is a standardised test that was developed to measure receptive vocabulary of non-native speakers of English.

The 20,000 version of Nation & Beglar's Vocabulary Size test contains two forms (A and B) with 100 items in each form. For this study, form B was randomly chosen to be a measure of English vocabulary. To avoid the participants' boredom and a lack of motivation in attending a 100 item test administration, 40 test items were used in the study which showed good variability of scores in pilot work conducted with independent participants prior to the current study. Participant were given a word in isolation and within a sentence and then selects from the four choices the meaning of the isolated word. The score for the test was the number correct out of 40 and they were given 15 minutes to complete as many items as possible. An example from the test is provided below.

basis: This was used as the <basis>.

a. answer
b. place to take a rest
c. next step
d. main part

Thai vocabulary

The set of Thai vocabulary used for the Thai vocabulary test was randomly selected from Thai vocabulary lists of secondary level education Thai language textbooks. Participants would have encountered all of these words when they were in high school, though their frequency of use would be variable outside of school. These words were then placed in a format following that used with the English vocabulary measure. Based on pilot work with students independent of those in the current study, 50 items were selected for the measure. Participants were given 12 minutes to complete as many items as they could, with the score being the number correct. An example from the test is provided below.

กัลยาณี เธอเป็นกัลยาณี
ก. หญิงงาม ข. หญิงที่เรียบร้อย
ค. หญิงสุขุม ง. หญิงอ่อนช้อย

Thai listening comprehension

Given that Thai language was the participants' first language, an additional measure of language ability was included in the study to ensure that any identified relationships between inference ability and reading comprehension were not simply due to general language skills not assessed by the vocabulary measure: for example, the process of understanding words combined into sentences may not be assessed by the vocabulary measure. Hence, a measure of listening comprehension in Thai was included to assess skills in combining words for understanding. This measure focused on the ability to derive meaning from what was actually stated, rather than infer meaning.

The Thai listening comprehension test consisted of a series of spoken passages followed by one or more YES/NO questions. The measure was developed for the specific purpose of this study – though using procedures consistent with measures of listening comprehension reported in the literature (Bell & Perfetti, 1994; Juel, Griffith, and Gough (1986). Following amendments based on the suggestions of two Thai university lecturers, all the listening comprehension passages and questions were recorded by a Thai native speaker at normal conversational speed. In total there were 25 questions that the participant was expected to answer; and the test took approximately 10 minutes. The number of questions answered correctly was the score for this task. An example from the test is provided below.

Spoken passage:

วันนี้แม่รู้สึกไม่ค่อยดี ครั่นเนื้อครั่นตัว เจ็บคอ สงสัยจะโดนไข้หวัดเล่นงานซะแล้ว เมื่อเช้าทานยา แต่อาการก็ยังไม่ดีขึ้น เดี๋ยวจะโทรไปลางานก่อน และคงต้องไปหาคุณหมอแล้วล่ะ

Spoken question:

ผู้พูดรู้สึกดีขึ้นหลังทานยาใช่หรือไม่
(ใช่) (ไม่ใช่)

Non-verbal reasoning ability

The Advanced Progressive Matrices (Raven, 1962) is one of the most common and popularly used tests of non-verbal ability (Kaplan & Saccuzzo, 2009) and has been used across a wide range of age groups, including adults (Raven & Raven, 2008). A primary drawback of the full form (36 items) of Raven's Advanced Progressive Matrices is the

length of the test administration, which might increase the influence of interfering variables, such as fatigue and boredom (Chiesi, Ciancaleoni, Galli, Morsanyi, & Primi, 2012). Therefore, several shortened versions have been proposed, including the one included in the present study by Arthur and Day (1994). This 12 item test has been used with samples of university students and has been shown to produce results consistent with the full version (e.g., Chiesi et al., 2012). For the present study, a practice item was used to ensure that the students understood the task. This was followed by the 12 test trails that comprised a matrix of nine areas, eight of which contained shapes that formed a sequence based on shapes, orientation or shading. For each of the 12 test items, the participants were asked to identify the missing element that completes a pattern from eight options provided. The students were given 10 minutes to complete as many of the abstract sequences as they could.

Procedures

The measures were performed in two sessions each of which took about 90 minutes, but with a thirty-minute intermission in order to avoid participant exhaustion. The first part of the first session involved completing a questionnaire asking for background details (demographic details and language experience), the Thai listening comprehension measure and the Thai reading comprehension measure. The second part involved the Thai vocabulary test and the Thai inferential measure. The second session involved the Raven's advanced progressive matrices, English vocabulary test, English inferential measure and English reading comprehension – again split over two parts with a rest break.

RESULTS

Scores on the measures were coded and entered into a statistical programme for analysis. Descriptive statistics can be found in Table 1, followed by correlations between the study variables in Table 2, and correlations between reading comprehension and the different type of inference question in Table 3.

Correlations indicated relationships between Thai reading comprehension and all of the Thai language measures, and the non-verbal measures. However, the Thai Inferential skills measure produced the largest correlation with Thai reading comprehension. A similar pattern was identified for the English measures: the inference measures showed larger correlations with English reading comprehension than English vocabulary and the non-verbal measure. In terms of cross-language relationships, the Thai inferential measure was significantly positively correlated with the English inferential measure. Interestingly, the relationship between English inferential skills and Thai reading comprehension was larger than the relationship between Thai inferential skills and English reading comprehension, though both were significant and consistent with cross-language transfer of such inferencing skills.

Table 1. Descriptive statistics for all measures in this study (N = 220)

Measures	No of items	Mean	SD	Range
Thai reading comprehension	30	17.12	3.81	7-27
Thai inferential	45	27.82	5.77	9-38
Thai listening comprehension	15	10.64	2.06	2-15
Thai vocabulary	40	21.80	4.19	8-33
English reading comprehension	35	10.10	3.31	1-20
English inferential	35	13.22	4.35	3-26
English vocabulary	30	8.70	3.38	1-16
Non-verbal reasoning	12	5.42	2.29	0-11

Table 2. Pearson product moment correlation between the variables in the study

	1	2	3	4	5	6	7	8
1. Thai reading comprehension		.42**	.20**	.25**	.09	.32**	.12	.23**
2. Thai inferential			.16*	.44**	.16*	.41**	.22**	.24**
3. Thai listening comprehension				.21**	.21**	.06	.11	.21**
4. Thai vocabulary					.05	.33**	.33**	.19**
5. English reading comprehension						.37**	.20**	.14*
6. English inferential							.28**	.17*
7. English vocabulary								.11
8. Non-verbal reasoning								

**p < .05., **p <.01.*

Table 3. Correlations between reading comprehension and the different types of inference questions

	Thai reading comprehension	English reading comprehension
Thai inference questions		
Literal	.31**	.06
Grammatical	.33**	.05
Vocabulary related	.25**	.19**
Text coherence	.37**	.14*
Prior knowledge	.28**	.13
English inference questions		
Literal	.27**	.24**
Grammatical	.23**	.29**
Vocabulary related	.23**	.10
Text coherence	.12	.26**
Prior knowledge	.19**	.28**

Hierarchical regression analyses were conducted to investigate whether inferential skills predicted same-language reading comprehension (see Table 4). Two analyses were performed, one for each language and with the reading comprehension measure as the dependent variable. For each analysis, gender, language and non-verbal reasoning were entered prior to the inference measure to investigate whether the latter explained variability in reading comprehension over that of the other measures. The inferential

Table 4. Hierarchical regression analysis investigating predictive ability of inferential skills on reading comprehension within-language

Step and variables entered	R^2	R^2 Change	Sig. R^2 Change	Final Beta
DV = Thai reading comprehension				
1. Control	.100	.100	F = 24.29 p < .001	Gender: .279 (p<.001)
2. Thai language and Non-verbal reasoning	.215	.115	F =10.49 p < .001	Thai listening: .086 (NS) Thai vocabulary: .068 (NS) Matrices: .150 (p=.015) Thai inferential: .300 (p<.001)
3. Thai inferential	.283	.068	F = 20.39 p < .001	Literal: .062 (NS) Grammatical: .091 (NS) Vocabulary: .087 (NS) Text coherence: .200 (p=.007) Prior knowledge: .048 (NS)
DV = English reading comprehension				
1. Control	.000	.000	F = 0.02 p = 878	Gender: -.021 (NS)
2. English language and Non-verbal reasoning	.054	.054	F = 6.17 p = .002	English vocabulary: .096 (NS) Matrices: .072 (NS) English inferential: .332 (p<.001)
3. English inferential	.151	.097	F = 24.47 p < .001	Literal: .103 (NS) Grammatical: .147 (p=.043) Vocabulary: .048 (NS) Text coherence: .172 (p=.012) Prior knowledge: .116 (NS)

Table 5. Hierarchical regression analyses predicting across languages of inferential skills on reading comprehension

Step and variables entered	R^2	R^2 Change	Sig. R^2 Change	Final Beta
DV = Thai reading comprehension				
1. Control	.100	.100	F = 24.29 p < .001	Gender: .266 (p<.001)
2. Non-verbal reasoning	.167	.067	F = 17.33 p < .001	Matrices: .141 (p=.022)
3. Thai language	.215	.048	F = 6.62 p = .002	Thai listening: .092 (NS) Thai vocabulary: .042 (NS)
4. English language	.217	.002	F = 0.64 p = .425	English vocabulary: .004 (NS)
5. Thai inferential	.284	.067	F = 19.81 p < .001	Thai inferential: .260 (p<.001)
6. English inferential	.297	.013	F = 3.96 p = .048	English inferential: .131 (p=.048)
DV = English reading comprehension				
1. Control	.000	.000	F = .02 p = .878	Gender: -.015 (NS)
2. Non-verbal reasoning	.020	.020	F = 4.42 p = .037	Matrices: .072 (NS)
3. English language	.054	.034	F = 7.79 p = .006	English vocabulary: .080 (NS)
4. Thai language	.073	.019	F = 2.18 p = .116	Thai listening: .006 (NS) Thai vocabulary: .085 (NS)
5. English inferential	.155	.082	F = 20.62 p < .001	English inferential: .327 (p<.001)
6. Thai inferential	.151	.097	F = 0.36 p = .548	Thai inferential: .046 (NS)

variable was entered in one analysis as a total score and then in a second as the five separate types of questions; the latter was performed to determine if one type of question explained more variance than the others. The Thai analysis indicated that the Thai inference measure explained a statistically significant additional variability in Thai reading comprehension despite controlling for Thai language skills and the non-verbal reasoning.

Furthermore, Thai inferential skills produced the largest beta weight in the final regression model (β=.30, p<.001). When the inference measure was divided into the five types of questions and these were entered as the last step in the regression, only the text coherence type questions produced a significant beta score (β=.20, p=.007). The English analysis showed a similar pattern of results, with English inferential skills predicting additional variability in English reading comprehension over that explained by language and non-verbal processes. In the final regression model, the English inference measure produced the largest beta weight (β=.33, p<.001). And when the five types of questions were entered separately in the final step, the text coherence questions also produced a significant beta score (β=.17, p=.01); though for English, the grammatical type questions also produced a significant beta (β=.15, p=.04).

Similar hierarchical regression analyses were performed to assess cross-language relationships between reading comprehension and inferential skills taking measures of language and non-verbal ability into account (see Table 5). Again, Thai or English reading comprehension was used as the dependent variable in each analysis, and the same entry method was used with the exception that both Thai and English language measures were entered prior to the inference measure, and the same-language inference measure was entered prior to assessing the cross-language relationships. The results of these analyses suggested that the addition of Thai inferential skills scores did not increase the level of prediction of English reading comprehension, with only the variable of English inferential skills producing a statistically significant beta score in the final model (β=.33, p<.001). However, for the Thai reading comprehension model, English inferential skills explained a statistically significant additional variability in Thai reading comprehension, and both Thai inferential skills (β=.26, p<.001) and English inferential skills (β=.13, p=.048) produced significant beta scores in the final model.

DISCUSSION

Three major areas of findings were reported in this study. First, the correlational analyses demonstrated the positive relationship between inferential skills and reading comprehension within the same language and also across languages. Second, hierarchical multiple regression analyses showed inferential skills made independent contributions to reading comprehension within the same language, but only the English inferential measure predicted extra variability in reading comprehension across languages. Finally, analyses of the five types of inferential questions demonstrated that

text coherence inferences were the type of questions most associated with reading comprehension in both Thai and English.

The positive relationship between inferential skills in Thai and English suggests that it is plausible that transferability of inferential skills across languages/orthographies may occur. Such results are consistent with several studies that have demonstrated the transference of skills across L1 and L2; though many of these have focused on measures of phonological awareness (Bialystok, Luk, & Kwan, 2005; Keung & Ho, 2009; Lindsey, Manis, & Bailey, 2003) and morphological awareness (Deacon, Wade-Woolley, & Kirby, 2009; Schiff & Calif, 2007). However, in a study by Abu-Rabia, Shakkour, and Siegel (2013), improvements in a range of skills including reading comprehension were found in both Arab (L1) and English (L2) after an intervention program conducted in English. The present findings are consistent with such previous research and suggest that such transfer can occur at the level of making inferences from text (or higher level comprehension processes, according to Silva & Cain, 2015). This conclusion is in line with Tang's (1997) study which demonstrated that bilingual Chinese (L1) and English (L2) adult learners used similar reading strategies to construct the meaning of texts presented in their L1 and L2.

Making inferences enables a reader to connect one part of a text to other parts, as well as to background knowledge, in order to comprehend a meaningful and coherent mental representation. Thus, inferential skills are reasonably viewed as a constructive cognitive higher level comprehension skills (Kendeou, van den Broek, Helder, & Karlsson, 2014). Therefore, the process of inference generation is likely to be similar in any language: as such, inferential skills in Thai and English will share cognitive commonalties. Despite the considerable linguistic differences between these two languages, and between the two writing systems, the positive associations between inferential skills in two different language, and their potential cross-language interactions with reading comprehension, supports theories of reading that argue for common underlying processes (Cummins, 1981; Goodman (1971).

However, the cross-language hierarchical regression indicated that only English inferential skills were predictive of Thai reading comprehension. One potential reason for this specific effect may be due to the fact that inferential skills were likely to have been explicitly taught in the students' English classrooms. A study by Chen (2012) investigated non-native English language teachers at one university in Thailand and found that the teachers' taught and provided practice in both metacognitive and cognitive reading strategies that are rarely explicitly taught in Thai language classrooms. Although further research is required, the current findings argue for the potential transferability of these explicitly taught L2 skills to L1 processing, a finding that is line with several intervention studies on explicit teaching in L2 strategies development in both L2 and L1 (e.g.,Abu-Rabia et al., 2013; Aghaie & Zhang, 2012; Akkakoson, 2011; Salataci, 2002). The targeted L1 in these studies represented different languages: Iranian (Aghaie

& Zhang, 2012), Turkish (Salataci, 2002), and Thai (Akkakoson, 2011). However, the L2 of all the studies was English. Such research indicates that strategy instruction/training in L2 (English) can have a positive effect on both L1 and L2 reading comprehension and suggests that students who have acquired strategies from L2 learning may be able to use similar strategies when reading in their L1.

The analysis of the five types of inferential questions indicated that text coherence inferences were specifically associated with reading comprehension in both Thai and English. The potential role of such inferences in reading comprehension is consistent with the results of Cain and Oakhill's (1999) study with school-age L1-English children. Their results demonstrated that skilled readers were more able to make text connecting inferences (which shares similarities to the text coherence inferences of this study) than less skilled readers, but those same skilled readers were not significantly better than their less skilled peers on gap-filling inferences, which required the incorporation of the reader's background knowledge. However, other studies with school-age children have identified differing results. For example, Carlson et al. (2014) found that good, average, and struggling readers did not differ in their use of text-based inferences, and Bowyer-Crane and Snowling (2005) found no difference in achieving coherence inferences between skilled and less skilled comprehenders. Therefore, further research is required to identify the specific type of inferences that may support reading comprehension and which may vary across ability levels. However, a positive conclusion from the current study is that once these specific areas of deficit are identified, they can be acquired by second language learners and, under the right conditions, may show the potential to transfer from one language to another.

In conclusion, the findings are consistent with the importance of inferential skills in supporting reading comprehension of adult students when using their L1 and L2. One of the potential implications of this is that the explicit teaching of inferential skills would be a recommendation for practice in different language classrooms. Syllabus design and activities across language teachers would potentially allow for more opportunity for students to practise drawing upon inferential skills in various contexts. With direct and explicit explanation, as well as regular practice, students may become more skilled readers (Gaskins, 1994) both in their home/first language, but potentially also in newly acquired (second or additional) languages. Indeed, the evidence for cross-language transfer, which suggests that a skill learnt in one language can be used, or support the development of a similar skill, in a second, indicate that, rather than being a barrier to educational outcomes, bilingualism and/or second language learning may be an aid such literacy acquisition (see discussions in Sadeghi & Everatt, 2015). One way in which this may manifest is akin to when compensatory mechanism can be used to support learning following difficulties in acquisition: e.g., for those with dyslexia and word decoding problems, the context in which a word is written can be used to compensate for difficulties in word processing (see Nation & Snowling, 1998; Stanovich, 1986). Similarly, difficulties in processing in one language may be supported by second or additional

language processes, particularly if the acquisition of those processes are easier in one language compared to another. This has been argued to be the case in learning the relationships between written characters and language sounds since the more consistent these relationships, the faster the development of word decoding skills (for example, see discussions in Everatt et al., 2010): more transparent or regular orthographies have been found to show faster development of decoding processes and if these can transfer across language/orthographies, then faster development in one orthography may support the acquisition of the same skills in a less transparent orthography. Identifying how these compensatory influences manifest should lead to better informed teaching strategies. This should also support teachers: if a skill is easier to teach in one language/ orthography compared to another, and is known to transfer between languages, appropriate bilingual teaching strategies should impact positively on learning, especially when difficulties are encountered. Additionally, problems with literacy learning can lead to negative feelings about the task to be learnt, and hence disengagement. Learning a second language in which negative consequences related to feelings of failure have not been established may also be a way to overcome learning difficulties that have manifested in L1 via a process of re-engagement in learning, and by strategically using positive outcomes and skills transfer as a way to support additional learning strategies in an L1. Clearly, more data are needed to determine how to implement these practices effectively, and how to vary them based on the strengths and weaknesses of the individual (more general or more complex needs typically require different overall strategies compared to more specific deficits). However, evidence for transfer should provide opportunities to develop teaching strategies, as well as suggest another positive feature of trends towards a more multilingual world.

REFERENCE

Abu-Rabia, S., Shakkour, W., & Siegel, L. S. (2013). Cognitive retroactive transfer (CRT) of language skills among bilingual Arabic-English readers. *Bilingual Research Journal, 36*(1), 61-81. doi:10.1080/15235882.2013.775975

Aghaie, R., & Zhang, L. J. (2012). Effects of explicit instruction in cognitive and metacognitive reading strategies on Iranian EFL students' reading performance and strategy transfer. *Instructional Science, 40*(6), 1063-1081.

Akkakoson, S. (2011). *Raising the comprehension skills of Thai tertiary readers of English through strategies-based instruction.* (Unpublished doctoral thesis), The University of Otago, Dunedin, New Zealand,

Anderson, L. W., Krathwohl, D. R., Airasian, P. W., Cruikshank, K. A., Mayer, R. E., Pintrich, P. R., . . . Wittrock, M. C. (Eds.). (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives.* New York, NY: Longman.

Bialystok, E., Luk, G., & Kwan, E. (2005). Bilingualism, biliteracy, and learning to read: Interactions among languages and writing systems. *Scientific Studies of Reading, 9*, 43-61.

Cain, K. (2010). *Reading development and difficulties*. Chichester, England: BPS Blackwell.

Cain, K., & Oakhill, J. (1998). Comprehension skill and inference-making ability: Issues of causality. In C. Hulme & R. M. Joshi (Eds.), *Reading and spelling* (pp. 329-342). Mahwah, NJ:

Erlbaum.
Cain, K., & Oakhill, J. (1999). Inference making and its relation to comprehension failture. *Reading and Writing, 11*, 489-503.
Cain, K., & Oakhill, J. (2014). Reading comprehension and vocabulary: Is vocabulary more important for some aspects of comprehension? *Annee Psychologique, 114*(4), 647-662. doi:10.4074/S0003503314004035
Cain, K., Oakhill, J., Barnes, M. A., & Bryant, P. E. (2001). Comprehension skill, inference-making ability, and their relation to knowledge. *Memory & Cognition, 29*(6), 850-859.
Carlson, S. E., van den Broek, P., McMaster, K., Rapp, D. N., Bohn-Gettler, C. M., Kendeou, P., & White, M. J. (2014). Effects of comprehension skill on inference generation during reading. *International Journal of Disability, Development and Education, 61*(3), 258-274. doi:10.1080/1034912X.2014.934004
Carroll, J. B. (1993). *Human cognitive abilities: A survey of factor-analytic studies.* Cambridge, England: Cambridge University Press.
Chen, G. (2012). A study on the use and teaching practice of reading strategies of non-native teachers of Rajamangala University of Technology Lana. *Journal of Humanities, Naresuan University, 9*(2), 101-116.
Chiesi, F., Ciancaleoni, M., Galli, S., Morsanyi, K., & Primi, C. (2012). Item response theory analysis and differential item functioning across age, gender and country of a short form of the Advanced Progressive Matrices. *Learning and Individual Differences, 22*(3), 390-396. doi:10.1016/j.lindif.2011.12.007
Cromley, J. G., & Azevedo, R. (2007). Testing and refining the direct and inferential mediation model of reading comprehension. *Journal of Educational Psychology, 99*(2), 311-325. doi:10.1037/0022-0663.99.2.311
Cummins, J. (1981). The role of primary language development in promoting educational success for language minority students. *In Schooling and language minority students: A theoretical framework* (pp. 3-49). Sacramento, CA: California State Department of Education.
Deacon, S. H., Wade-Woolley, L., & Kirby, J. R. (2009). Flexibility in young second-language learners: Examining the language specificity of orthographic processing. *Journal of Research in Reading, 32*, 215–229.
Dole, J. A., Duffy, G. G., Roehler, L. R., & Pearson, P. D. (1991). Moving from the old to the new: Research on reading comprehension instruction. *Review of Educational Research, 61*, 239-264.
Eason, S. H., Goldberg, L. F., Young, K. M., Geist, M. C., & Cutting, L. E. (2012). Reader-text interactions: How differential text and question types influence cognitive skills needed for reading comprehension. *Journal of Educational Psychology, 104*(3), 515-528.
Everatt, J., Ocampo, D., Veii, K., Nenopoulou, S., Smythe, I., Al-Mannai, H., & Elbeheri, G. (2010). Dyslexia in biscriptal readers. In N. Brunswick, S. McDougall & P. d. M. Davies (Eds.), *Reading and dyslexia in different orthographies*. Hoboken: Psychology Press.
Gaskins, I. (1994). Classroom applications of cognitive science: Teaching poor readers how to learn, think, and problem solve. In K. McGilly (Ed.), *Classroom lessons: Integrating cognitive theory and classroom practice* (pp. 129-154). Cambridge, MA: MIT Press/Bradford Books.
Goodman, K. S. (1971). Psycholiguistic universals in the reading process. In P. Pimsleur & J. Quinn (Eds.), *The psychology of second language learning.* Cambridge, MA: Cambridge University Press.
Gottardo, A., Javier, C., Farnia, F., Mak, L., & Geva, E. (2014). Bidirectional cross-linguistic relations of first and second language skills in reading comprehension of Spanish-speaking English

learners. *Written Language and Literacy, 17*(1), 62-88. doi:10.1075/wll.17.1.04got

Guo, Y., Roehrig, A. D., & Williams, R. S. (2011). The relation of morphological awareness and syntactic awareness to adults' reading comprehension: Is vocabulary knowledge a mediating variable? *Journal of Literacy Research, 43*(2), 159-183. doi:10.1177/1086296X11403086

Han, F., & Stevenson, M. (2008). *Comprehension monitoring in first and foreign language reading.* University of Sydney Papers in TESOL, 3, 73-110.

Hannon, B., & Daneman, M. (1998). Facilitating knowledge-based inferences in less-skilled readers. *Contemporary Educational Psychology, 23*, 149-172.

Hatami, S., & Tavakoli, M. (2012). The role of depth versus breadth of vocabulary knowledge in success and ease in L2 lexical inferencing. *TESL Canada Journal, 30*(1), 1-22.

Hogan, T. P., Bridges, M. S., Justice, L. M., & Cain, K. (2011). Increasing higher level language skills to improve reading comprehension. *Focus on Exceptional Children, 44*(3), 1-20.

Juel, C., Griffith, P. L., & Gough, P. B. (1986). Acquisition of literacy: A longitudinal study of children in first and second grade. *Journal of Educational Psychology, 78*(4), 243-255.

Kaplan, R. M., & Saccuzzo, D. P. (2009). In *Psychological testing: Principles, applications, and issues* (7 ed., pp. 325–327). Belmont, CA: Wadsworth.

Karlsson, M. (2014). Advanced learners' L1 (Swedish) versus L2 (English) inferencing. *Australian Review of Applied Linguistics, 37*(1), 3-23.

Kendeou, P., Bohn-Gettler, C., White, M. J., & van den Broek, P. (2008). Children's inference generation across different media. *Journal of Research in Reading, 31*, 259-272.

Kendeou, P., van den Broek, P., Helder, A., & Karlsson, J. (2014). A Cognitive view of reading comprehension: Implications for reading difficulties. *Learning Disabilities Research & Practice, 29*(1), 10-16. doi:10.1111/ldrp.12025

Keung, Y.-C., & Ho, C. S.-H. (2009). Transfer of reading-related cognitive skills in learning to read Chinese (L1) and English (L2) among Chinese elementary school children. *Contemporary Educational Psychology, 34*(2), 103-112. doi:10.1016/j.cedpsych.2008.11.001

Kintsch, W. (1998). *Comprehension: A paradigm for recognition.* Cambridge, England: Cambridge University Press.

Kispal, A. (2008). *Effective teaching of inference skills for reading. Literature review.* Slough, England: National Foundation for Educational Research.

Koda, K. (2007). Reading and language learning: Crosslinguistic constraints on second language development. *Language Learning, 57*(1), 1-44.

Lee, H. C. (2014). Inferencing behaviour of ESL readers. *Electronic Journal of Foreign Language Teaching, 11*(1), 21-37.

Lindsey, K. A., Manis, F. R., & Bailey, C. E. (2003). Prediction of first-grade reading in Spanish-speaking English-language learners. *Journal of Educational Psychology, 95*(3), 482-494. doi:10.1037/0022-0663.95.3.482

Lipka, O., & Siegel, L. S. (2007). The development of reading skills in children with English as a second language. *Scientific Studies of Reading, 11*(2), 105-131.

Long, D. L., Oppy, B. J., & Seely, M. R. (1994). Individual differnces in the time course of inferential processing. *Journal of Experimental Child Psychology: Learning, Memory, and Cognition, 20,* 1245-1470.

Nation, I. S. P. (2001). *Learning vocabulary in another language.* Cambridge, England: Cambridge University Press.

Nation, I. S. P., & Beglar, D. (2007). A vocabulary size test. *The Language Teacher, 31*(7), 9-13.

Nation, K., & Snowling, M. J. (1998). Individual differences in contextual facilitation: Evidence from

dyslexia and poor reading comprehension. *Child Development, 69*(4), 996-1011.
Oakhill, J., & Cain, K. (2012). The Precursors of Reading Ability in Young Readers: Evidence From a Four-Year Longitudinal Study. *Scientific Studies of Reading, 16*(2), 91-121. doi:10.1080/10888438.2010.529219
Oller, D. K., & Cobo-Lewis, A. B. (2002). The ability of bilingual and monolingual children to perform phonological translation. In D. K. Oller & R. E. Eilers (Eds.), *Language and literacy in bilingual children.* Tonawanda, NY: Multilingual Matters.
Pressley, M. (2000). What should comprehension instruction be the instruction of? In M. L. Kamil, P. B. Mosenthal, P. D. Pearson, & R. Barr (Eds.), *Handbook of reading research* (Vol. 2, pp. 545 -562). Mahwan, NJ: LEA.
Prior, A., Goldina, A., Shany, M., Geva, E., & Katzir, T. (2014). Lexical inference in L2: Predictive roles of vocabulary knowledge and reading skill beyond reading comprehension. *Reading and Writing, 27*(8), 1467-1484. doi:10.1007/s11145-014-9501-8
Raven, J. C. (1962). *Advanced progressive matrices*. London, England: Lewis & Co., Ltd.
Raven, J. C., & Raven, J. E. (2008). *Uses and abuses of intelligence: Studies advancing Spearman and Raven's quest for non-arbitrary metrics.* Unionville, NY: Royal Fireworks Press.
Sadeghi, A., & Everatt, J. (2015). Influence of language background on English reading comprehension skills: Cross-language transfer effects. In L. T. Wong & A. Dubey-Jhaveri (Eds.), *English language education in a global world: Practices, issues and challenges.* (pp. 69-80). New York: Nova Science Publishers.
Salataci, R. (2002). Possible effects of strategy instruction on L1 and L2 reading. *Reading in a Foreign Language, 14*(1), 1-17.
Schiff, R., & Calif, S. (2007). Role of phonological and morphological awareness in L2 oral word reading. *Language Learning, 57*(2), 271-298. doi:10.1111/j.1467-9922.2007.00409.x
Silva, M., & Cain, K. (2015). The relations between lower and higher level comprehension skills and their role in prediction of early reading comprehension. *Journal of Educational Psychology, 107*(2), 321-331. doi:10.1037/a0037769
Snow, C. (2002). *Reading for understanding: Toward a research and development program in reading comprehension.* Arlington, VA: RAND.
Stanovich, K. E. (1986). Matthew effects in reading: Some consequences in individual differences in the acquisition of literacy. *Reading Research Quarterly, 21*(4), 360-364.
Thorndike, R. L. (1973). *Reading comprehension education in fifteen countries: an empirical study.* (Vol. 3). New York, NY: Wiley.
van Gelderen, A., Schoonen, R., Stoel, R. D., de Glopper, K., & Hulstijn, J. (2007). Development of adolescent reading comprehension in language 1 and language 2: A longitudinal analysis of constituent components. *Journal of Educational Psychology, 99*(3), 477-491. doi:10.1037/0022-0663.99.3.477
Wu, W. S., & Shen, M. Y. (2009). Technical university EFL learners' reading proficiency and their lexical inference performance. *e-FLT: Electronic Journal of Foreign Language Teaching, 6*(2), 189.