Decoding Success: Investigating the Impact of Trait and State Strategies on Reading Test Performance among Thai High School Learners

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Abstract

The field of second language (L2) acquisition has increasingly emphasized learner strategies, cognitive and metacognitive methods, as crucial factors in individual differences and reading comprehension. Grounded in Bachman and Palmer's communicative language ability (CLA) model, this study investigates how strategic competence in cognitive and metacognitive strategies impacts reading comprehension among Thai high school students. By employing quantitative methods, including structural equation modeling (SEM), the study explores how trait strategies (perceived strategic knowledge) and state strategies (actual strategy use) influence reading test performance. The research involved 685 students from a public high school who completed Likert scale questionnaires about their strategy use before and after comprehension tests. Results reveal that state strategies are employed more frequently than trait strategies and show a significant positive correlation with reading performance. While cognitive strategies like comprehension and memory are critical for understanding text content, metacognitive strategies like planning and monitoring improve learners' ability to regulate their strategic application. However, evaluation strategies were found to be less frequently used. The study's findings advocate for balanced training in both cognitive and metacognitive strategies to bridge the gap between strategic knowledge and effective application, thereby empowering learners to become more autonomous and proficient readers. Further research should investigate strategic competence in different cultural contexts, employ longitudinal studies, and expand the research to other language skills to gain a comprehensive understanding of L2 learners' strategies.

Keywords: Strategic competence, trait and state strategies, reading test, Thai high school learners

1. Introduction

Recently, there has been an exciting shift toward exploring the distinctive characteristics of second language (L2) learners, with a particular emphasis on language learner strategies (Cohen & Macaro, 2007). This field has captivated researchers as a crucial variable of individual differences, featuring prominently in a number of studies (Cohen, 2011; Griffiths, 2008; Oxford, 2017; Phakiti, 2008b; Purpura, 2014, 2016; Sukying, 2021; Zhang, 2016a, 2016b; Zhang et al., 2016; Zhang, 2018; Zhang et al., 2014; Zhang & Zhang, 2013). These investigations seek to decode the strategies of proficient readers and their strategies for reading comprehension (Akram, 2019; Macaro, 2006; Phakiti, 2003; Zhang, 2018).

Grounded in Bachman and Palmer's (1996) model of communicative language ability (CLA), the research probes into the strategic competence necessary for reading tests. Strategic competence entails a sophisticated set of metacognitive strategies that learners deploy to manage their cognitive processes to meet their communication goals. These strategies are pivotal for orchestrating the cognitive activities required during test-taking, such as planning, monitoring, and evaluating one's performance. Bachman and Palmer (2010) further refined their framework of language ability to incorporate cognitive strategies, highlighting their roles in real-world language tasks and testing contexts. They identified these strategies as crucial for executing language use plans, particularly in reading tests, where learners demonstrate their language knowledge and strategy application. Researchers have explored how language learners implement cognitive and metacognitive strategies – cognitive strategies assisting in comprehension, memory, and retrieval, while metacognitive strategies involve planning, monitoring, and evaluating the learning process (Khamkhien, 2011; Phakiti, 2007, 2016; Sukying, 2021; Tieocharoen & Rimkeeratikul, 2019). The distinction between "trait" strategies, which learners believe they use, and "state" strategies, which they actcually employ during specific tasks, highlighting the complexity of strategic competence in language learning. This distinction often arises because learners may overestimate their strategic knowledge or struggle to apply theoretical knowledge into practice (Pawlak, 2021; Purpura, 2016). Recent studies emphasize the importance in understanding and enhancing learners' reading comprehension and strategic management during reading tasks, particularly in test situations (Akram, 2019; Charoento, 2017; Habók & Magyar, 2018; Oxford, 2017; Phakiti, 2016; Zhang, 2018).

Strategic competence merges both metacognitive and cognitive strategies in a dynamic interplay that transcends more cognition awareness and regulation. For instance, in reading comprehension tests, applying test-taking strategies necessitates an integrated

understanding of text structure, vocabulary, grammar, and inferencing skills to derive meaning from the text. Extensive research in this area has expanded to consider various dimensions of strategic competence, emphasizing the role of trait strategies (perceived strategic knowledge) and state strategies (actual strategy use) in shaping how test-takers tackle reading tasks and their evolving performance. These studies champion a holistic view of strategic competence that incorporates cognitive and metacognitive strategies while also acknowledging the impact of emotional and social factors on test outcomes (Ghafournia, 2023; Grabe & Stoller, 2020; Oxford, 2017, Purpura, 2021; Zhang & Guo, 2020; Zheng et al., 2023).

Reading in English as a foreign language (EFL) or a second language (L2) presents a rich tapestry of complexity involving a symphony of linguistic and non-linguistic skills (Al-Qahtani, 2013; Charoento, 2017; Habók & Magyar, 2018; Oxford, 2017). This multifaceted skillset spans from foundational processes like decoding and encoding to advanced linguistic functions such as syntax, semantics, and discourse. Beyond these, it demands an intricate assembly of higher-order skills, including text representation, comprehension integration using topical knowledge, and sophisticated oversight through monitoring and evaluation (Brevik & Hellekjær, 2018; Yeom & Jun, 2020).

Moreover, EFL reading is not just about text interaction but also a dance between the reader and various contextual influences (Alderson, 2000; Phakiti, 2007). Factors intrinsic to the reader, such as their first language (L1), existing knowledge, language proficiency, motivation, metalinguistic awareness, and strategic application, all play critical roles. Externally, the readability and type of text, alongside verbal and non-verbal cues, significantly shape the reading experience (Alderson, 2000; Lin, Lam & Tse, 2021; Phakiti, 2007).

While L2 reading shares many parallels with reading in one's native language, as noted by Grabe and Stoller (2011, 2020), it often proceeds at a slower pace and with varying degrees of success. Success in L2 reading hinges not just on language proficiency but also on the nature of the reading tasks and their complexities. These tasks engage a dynamic interplay among the reader's developing language skills, personal traits, and external conditions (Alderson, 2000; Koda, 2005; Phakiti, 2007).

Grabe (2009) distinguishes reading skills into lower-level and higher-level abilities, both of which operate within the confines of working memory. Grabe and Stoller (2020) state that lower-level processes include automatic word recognition, lexical access, syntactic parsing, and constructing semantic propositions. On the other hand, higher-level processes encompass constructing text representations, developing situational models for interpretation, and engaging executive control and strategic processing.

This comprehensive perspective highlights that mastering EFL or L2 reading involves more than just linguistic proficiency; it requires a holistic engagement encompassing cognitive abilities, personal motivations, and contextual dynamics. Cognitive skills in L2 reading range from basic decoding and lexical processing to more complex schematic processing and cognitive flexibility, alongside critical metacognitive strategies for planning, monitoring, and evaluating comprehension. Personal motivations, both intrinsic – such as a genuine interest in the reading material – and extrinsic – like the pursuit of grades or peer approval – significantly influence a learner's engagement and success in reading. Additionally, the context in which reading occurs, including the physical and socio-cultural environment, as well as the educational setting and text selection, plays a crucial role in shaping the reading experience. This multifaceted approach not only aids in linguistic acquisition but also fosters a deeper, more practical understanding of language use within various real-world contexts, enhancing overall learning outcomes.

Diving into the intricate world of EFL reading strategies, there remains a compelling void in research, particularly regarding how cognitive and metacognitive strategies influence test performance among high school students in Thailand. Previous explorations into this area, such as those by Phakiti (2007), have opened the door. Still, much remains unexplored, especially within strategic competence as defined by Bachman and Palmer (2010).

This study aims to bridge this gap, shedding light on the dynamic interplay between cognitive and metacognitive strategies – both trait and state strategies – and their impact on reading comprehension tests. By examining these strategies through the sophisticated lens of Structural Equation Modeling (SEM), this research captures the essence of these strategies. It integrates measurement errors into the analysis, providing a more accurate depiction of their effectiveness.

The implications of this study stretch far and wide, promising to enrich theoretical understanding, refine methodological approaches, and enhance pedagogical practices in L2 reading. Specifically, it explores the stability and efficacy of these strategies over time, offering invaluable insights that could transform L2 teaching and testing methodologies and contribute to the broader field of second language acquisition. To navigate this exploration, the study poses pivotal questions:

1. What is the nature of trait and state cognitive and metacognitive strategies and their relationships to reading comprehension test performance among EFL high school learners?
2. To what extent do cognitive and metacognitive strategies exhibited by traits and states affect Thai EFL high school learners' performance on reading comprehension tests?
3. How consistent are these trait and state cognitive and metacognitive strategy use on reading comprehension test performance over time?

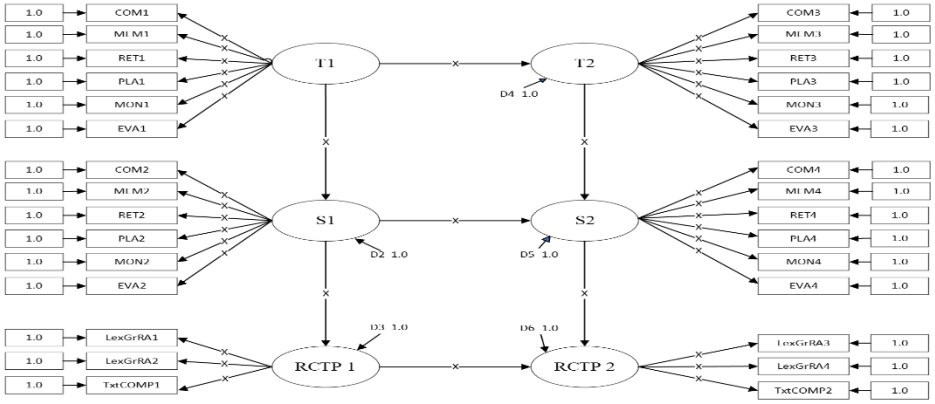


Figure 1. Hypothesized of trait and state strategy use on reading comprehension test performance

Note. T = Trait, S = State, 1 = Time 1, 2 = Time 2, RCTP = reading comprehension test performance;

COM: Comprehending; MEM: Memory; RET: Retrieval; PLA: Planning; MON: Monitoring;

EVA: Evaluating; LexGrRA = Lexical-Grammatical reading ability, TxtCOMP = Text comprehension ability

2. Method

2.1 Research Design

This study adopted a quantitative research method to explore the impact of trait and state strategies and the dynamic interplay between cognitive and metacognitive strategies on reading comprehension tests.

2.2 Participants and Setting

The participants in this study included 685 students from a public high school (or secondary school) in the northeastern part of Thailand who were senior high school (Grade 12), 17-18 years old. Pseudonyms were used to protect the anonymity of the participants. All participants had at least ten years of English studying experience and, therefore, they were assumed to have the same English language learning experience background in school contexts. The current study used convenience sampling methods to select participants as it was an efficient means to obtain basic information quickly and efficiently (Dörnyei, 2007).

According to the Office of the Basic Education Commission (Office of The Basic Education Commission, 2014, 2015), the learning area of foreign languages was aimed at enabling learners to acquire a favourable attitude towards foreign languages, the ability to use foreign languages for communicating in various situations, seeking knowledge, engaging in a livelihood, and pursuing further education at higher levels. Learners thus had knowledge and understanding of diversified matters and events of the world community. All participants completed a minimum of ten years of EFL courses as a required subject, and they attended four 50-minute English classes per week with EFL teachers and one 50-minute English lesson with native English speakers. This school's class sizes ranged from 20 to 45 students.

2.3 Instruments

Two research instruments were used in this study. The first was reading tests; two parallel versions of the reading tests are A and B. The reading tests consist of 60 items divided into two reading test sections. The first section was gap-filling, which consisted of 20 test items (10 to measure reading/vocabulary and 10 to measure reading/grammar). The first sub-section aimed to measure scanning and skimming for information abilities. The performance of this study in this section was labelled as lexico-grammatical reading ability (LexGrRA). Another section was a reading comprehension test, which consisted of 40 items in various passages ranging from 100 words to 700 words. It aimed to measure the test-taker's ability to read English texts for main ideas, details, and inferences. This section was labelled as text comprehension (TxtCOMP). The content of both tests was checked and validated by five experts in English language teaching (ELT), indicating a high level of agreement. In addition, the text difficulty was also evaluated using the Computer Range Program, indicating an average of around 90% coverage of the written text, which makes it suitable for second language testing according to studies by Nation (2006). KR-20 was also carried out, showing a good parallel between the two tests in the difficulty level and test formats. The reliability of the tests was also high, with Cronbach's Alpha of .94 and .93 for versions A and B. Specifically, version A was administered at Time 1, whereas version B was conducted at Time 2.

The second research instrument was the six-point Likert questionnaire. The questionnaire was slightly adapted from Phakiti's (2007) and Zhang's (2018). There are 51 questions. The trait strategy use questionnaire was written using the Simple Present as it asked students about their general strategy use. In contrast, the state strategy used the Simple Past to ask students about their thinking during the test. For example, an item of a state planning strategy in a test situation was '*I had made a plan before I began the reading comprehension test.' A generally perceived trait planning strategy was 'I make a plan before I begin the reading comprehension test*.' The questionnaire was given in Thai to prevent language barriers. The reliability of the questionnaire was at 0.97 for the trait and at 0.99 for the state. Table 1 presents the strategy composites in the questionnaires.

Table 1. Internal consistency of trait and state cognitive and metacognitive strategies

Trait and State	Subscale	No. of items	Items
Cognitive strategies	Comprehending	6	11, 12, 13, 14, 15, 16
	Memory	8	17, 18, 19, 20, 21, 22, 23, 24
	Retrieval	7	25, 26, 27, 28, 29, 30, 31
Metacognitive strategies	Planning	10	1, 2, 3, 4, 5, 6, 7, 8, 9, 10
	Monitoring	14	32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45
	Evaluating	6	46, 47, 48, 49, 50, 51
	Total	51	

2.4 Data Collection Procedure

The current study used convenience sampling methods to select participants as it efficiently obtains basic information quickly and efficiently (Dörnyei, 2007). The first step in collecting data was for all participants to sign a consent. Permission from the school would be obtained before the main study. For collecting data Time 1, the participants answered the trait questionnaire in Thai a week before taking the test in version A at the beginning of the semester. Next, the participants took a reading comprehension test that lasted one hour in this study. After they had completed the test, they were asked to complete the state EFL reading comprehension test strategy use questionnaire on their cognitive and metacognitive strategy use. The data collection at Time 2 would be held at the end of the semester or about three months later. The participants answered the trait questionnaire in Thai a week before taking test version B. The participants took a reading comprehension test in version B. After completing the test, they were asked to immediately complete the state EFL reading comprehension test strategy use questionnaire on their cognitive and metacognitive strategy use.

2.5 Data Analysis

The current study applied quantitative and qualitative data collection approaches. The Statistical Packages for Social Sciences (SPSS) program computed descriptive statistics and analysed reliability. It also completed the full-latent SEM (Bentler, 2006) to reveal the relationships between cognitive and metacognitive strategies and EFL reading variables.

The study was conducted in different phases. First, the participants were nominated and recruited. Second, the reading comprehension tests and questionnaires were administered to the recruited participants. The data were collected. Then, the reading tests and questionnaires with missing data were excluded from the final analysis. At the same time, the reading tests and questionnaires with no missing data were coded and entered into SPSS. Fourth, the data were computed and transferred into LISREL software. The mean scores and standard deviations of the scores on the dependent and independent variables were calculated using SPSS. In addition, the software was used to test the proposed structural equation modeling (SEM) and the structural relations between the dependent variables (RCPT) and its components (LexGrRA and TxtCOMP) and the independent variable (trait and state cognitive and metacognitive strategy use) and its factors (COM, MEM, RET, PLA, MON, and EVA). Finally, AMOS provides different model fit indices, among which the following indices were focused on the present research: CMIN (likelihood ratio chi-square test), Normed Fit Index (NFI), comparative fit index (CFI), adjusted goodness-of-fit index (AGFI), goodness-of-fit index (GFI), root mean square error of approximation (RMSEA) and X^2 /df.

3. Results

3.1 Descriptive Statistics

3.1.1 EFL High School Learners' Trait Cognitive and Metacognitive Strategy Use

Table 2 illustrates the trait strategy use at Time 1; the analysis of the data revealed that Thai EFL high school learners employed cognitive strategy with an average of 3.33 (55.56%) and a standard deviation of 0.542 and used metacognitive strategy with a mean of 3.08 (51.23%) and a standard deviation of 0.558. This finding is similar to that at Time 2; that is, Thai high school learners preferred to use trait cognitive strategies (62.67%; M = 3.76; SD = 0.660) more frequently than trait metacognitive strategy (59.03%; M = 3.54; SD = 0.690). Overall, the results showed that Thai EFL high school learners implemented an average of 3.21 (53.46%) with a standard deviation of 0.535 at Time 1 and an average of 3.65 (60.85%) with a standard deviation of 0.664 at Time 2. These findings indicate that Thai EFL high school learners used a relatively moderate level of trait cognitive and metacognitive strategies on reading tests. Other figures and related results are shown in Table 2. In addition, the findings suggest that Thai high school learners operated cognitive rather than metacognitive strategies.

The paired *t*-test was conducted to determine if there was any significant use of the trait strategy at two different points in time. The analysis of the findings revealed that all pairs of trait strategies used at Times 1 and 2 among Thai EFL high school learners were significantly different. These findings indicate that Thai EFL high school learners improved their awareness of cognitive and metacognitive strategies while doing formal schooling in secondary education.

Table 2. Trait strategy use of reading comprehension test at Time 1 and Time 2

Trait (T1)	Mean	%	Std	Trait (T2)	Mean	%	Std	*t*-test	*p-value*
Comprehending	3.77	62.79	0.548	Comprehending	4.11	68.44	0.518	19.789	.000*
Memory	3.17	52.81	0.604	Memory	3.66	61.04	0.773	16.479	.000*
Retrieval	3.07	51.10	0.653	Retrieval	3.51	58.55	0.800	14.439	.000*
Cognition	*3.33*	*55.56*	*0.542*	*Cognition*	*3.76*	*62.67*	*0.660*	*17.526*	*.000**
Planning	3.15	52.52	0.563	Planning	3.66	60.98	0.610	27.027	.000*
Monitoring	3.07	51.09	0.563	Monitoring	3.51	58.45	0.800	14.177	.000*
Evaluating	3.03	50.43	0.662	Evaluating	3.46	57.66	0.815	14.200	.000*
Metacognition	*3.08*	*51.35*	*0.558*	*Metacognition*	*3.54*	*59.03*	*0.690*	*18.158*	*.000**
Overall	3.21	53.46	0.535	Overall	3.65	60.85	0.664	18.206	.000*

Note: N=685; T = Trait; 1 = Time 1; 2 = Time 2; *Significant at the 0.05 level (p<0.05)

3.1.2 EFL High School Learners' State Cognitive and Metacognitive Strategy Use

Table 3 shows the state strategy use at Time 1; the analysis of the data revealed that Thai EFL high school learners employed cognitive strategy with an average of 4.26 (71.00%) and a standard deviation of 0.842 and used metacognitive strategy with a mean of 4.00 (66.60%) and a standard deviation of 0.815. This finding is similar to that at Time 2; that is, Thai high school learners preferred to use state cognitive strategies (77.34%; M = 4.64; SD = 0.643) more frequently than state metacognitive strategies (72.10%; M = 4.33; SD = 0.578). Overall, the results showed that Thai EFL high school learners implemented an average of 4.13 (68.80%) with a standard deviation of 0.815 at Time 1 and 4.48 (72.72%) with a standard deviation of 0.586 at Time 2. These findings indicate that Thai EFL high school learners used a relatively moderate level of state cognitive and metacognitive strategies on reading tests. Other figures and related results are shown in Table 3. In addition, the findings suggest that Thai high school learners used cognitive rather than metacognitive strategies.

The paired *t*-test was conducted to determine if there was any significant use of the state strategy at two different points in time. The analysis of the findings revealed that all pairs of state strategies at Times 1 and 2 used among Thai EFL high school learners were significantly different. These results demonstrate that Thai EFL students in high school increased their use of cognitive and metacognitive strategies while enrolled in formal secondary education.

Table 3. State strategy use of reading comprehension test at Time 1 and Time 2

State (S1)	Mean	%	Std	State (S2)	Mean	%	Std	*t*-test	*p-value*
Comprehending	4.48	74.64	0.657	Comprehending	4.69	78.24	0.601	26.696	.000*
Memory	4.18	69.73	0.956	Memory	4.58	76.34	0.656	22.607	.000*
Retrieval	4.12	68.63	1.043	Retrieval	4.65	77.45	0.803	19.547	.000*
Cognition	*4.26*	*71.00*	*0.842*	*Cognition*	*4.64*	*77.34*	*0.643*	*24.906*	*.000**
Planning	4.05	67.53	0.765	Planning	4.47	74.44	0.579	31.973	.000*
Monitoring	4.19	69.86	1.028	Monitoring	4.59	76.45	0.689	20.283	.000*
Evaluating	3.75	62.42	0.814	Evaluating	3.92	65.41	0.631	15.008	.000*
Metacognition	*4.00*	*66.60*	*0.815*	*Metacognition*	*4.33*	*72.10*	*0.578*	*26.133*	*.000**
Overall	4.13	68.80	0.815	Overall	4.48	74.72	0.586	27.021	.000*

Note: N=685; S = State; 1 = Time 1; 2 = Time 2; *Significant at the 0.05 level (p<0.05)

3.2 Results for Structural Equation Modeling (SEM)

3.2.1 Evaluation of Model

Table 4 illustrates the SEM results of the hypothesized Model of the relationship between trait and state strategy use and reading comprehension test performance of Thai high school learners. In testing this hypothesized Model, it did not fit well with the data. Post hoc fittings (LM test for adding parameters) were then performed. Thus, covariances for non-random measurement errors for these pairs were added in a re-hypothesized model. This modified Model was then re-tested and found to fit better with the data (Hair, Risher, Sarstedt & Ringle, 2019).

Table 4. Results of Conformance of Structural Model with Fitness Indicators of Relationship between State and Trait Strategy Use and Reading Comprehension Test Performance

	χ^2	df	CMIN/df	*p*-value	GFI	AGFI	CFI	SRMR	RMSEA
Acceptable			<3.0	> 0.05	> 0.90	> 0.90	> 0.90	< 0.08	< 0.08
Reported	144.27	128	1.12	0.15	0.99	0.95	1.00	0.07	0.01

Table 4 shows that the hypothesized Model of the relationship between trait and state strategy use and reading comprehension test performance of Thai high school learners fits with the theoretical Model. Therefore, it can be concluded that the re-hypothesized Model was acceptable for studying this relationship.

3.2.2 Trait and State Strategy Use Models in Reading Comprehension Test Performance

Figure 2 shows the measurement and structural Model showing the relationship between trait and state strategy use in reading comprehension test performance at Time 1, Time 2, and over time. Figure 3 illustrates the hypothesized Model (Model 1), which provides a diagrammatic representation of trait and state strategy use at Time 1 (from T1 to S1 to RCTP1) and Time 2 (from T2 to S2 to RCTP2),

in which the standardized parameter estimates are indicated. A path from reading comprehension test performance Time 1 (RCTP1) to reading comprehension test performance Time 2 (RCTP2) (⟶ **) indicates the degree of stability of the same construct measured at different times over time.

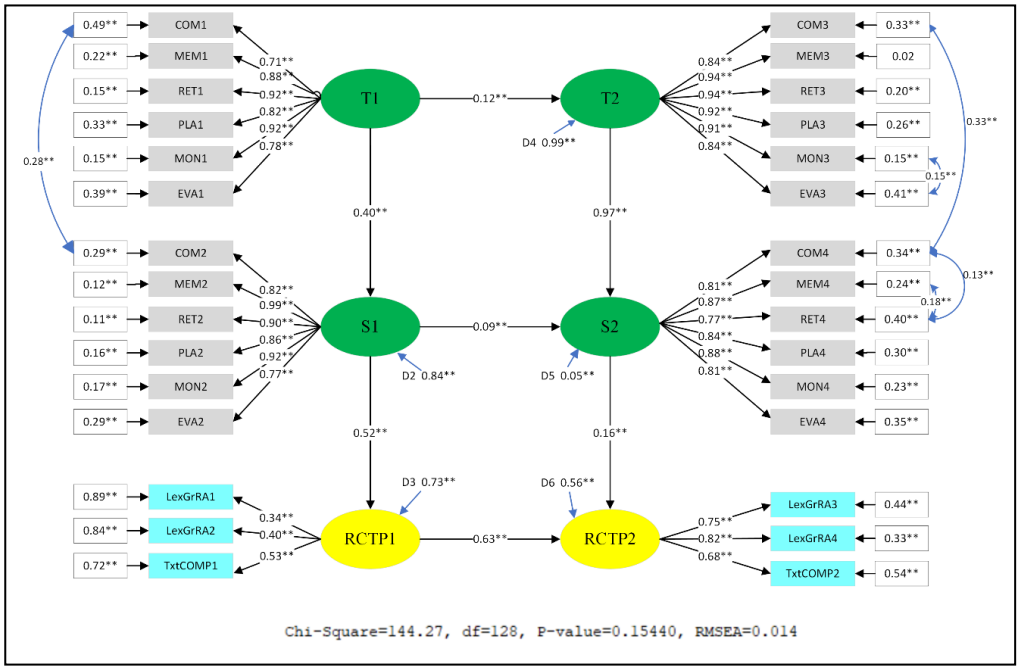
All factor loadings of trait strategy use at Time 1 (T1) were statistically significant at the 0.01 level. According to Figure 3, the total common factor variance (h^2: how much of the theoretical construct is explained by the shared common variance in the set of variables loading on the single factor) was 0.838. This indicated that the six variables account for 83.8% of the variance. The unique (residual) factor variance (the amount of variance not explained) was 16.2%. It should be noted that the percentages indicated how much of the theoretical construct was described by the shared common variance in the set of regression coefficients. Moreover, the correlation coefficients between observed variables could be computed by multiplying the weights or factor loadings between pairs of variables. For instance, trait comprehending strategy use and trait evaluating strategy use had a correlation coefficient of 0.32 (i.e., 0.71 x 0.78, large ES) (Cohen, 1992). The analysis of state strategy use at Time 1 (S1) revealed that the standardized solution loadings ranged from 0.77 (R^2 = 0.59) for evaluating strategy use to 0.99 (R^2 = 0.98) for memory strategy use. The total common factor variance was 0.877. This suggests that the six variables explain 87.7% of the factor variance. The unique residual variance (the amount of variance not defined) was 0.133. The study found that implementing trait and state strategies indirectly and directly affects Thai high school students' reading comprehension test performance. The six variables explain 87.7% of the factor variance, with correlation coefficients ranging from 0.63 for EVA2 and COM2 to 0.91 for MEM2 and MON2.

All factor loadings of trait strategy use at Time 2 (T2) were statistically significant at the 0.01 level. The h^2 of T2 was 0.898. This indicated that the six variables account for 89.8% of the variance. The unique residual variance was 10.2%. It should be noted that the percentages indicated how much of the theoretical construct was described by the shared common variance in the set of regression coefficients. Moreover, the correlation coefficients between observed variables could be computed by multiplying the weights or factor loadings between pairs of variables. For instance, trait memory and retrieval strategy use had a correlation coefficient of 0.88 (i.e., 0.94 x 0.94, large ES) (Cohen, 1992). The study found that the h^2 of state strategy use at Time 2 (S2) was 83.0%, and the unique residual variance was 17.0%. According to the computation of correlation coefficients among these observed strategies, the correlation coefficients ranged from 0.62 for RET4 and EVA4 to 0.76 for MEM4 and MON4. These findings suggest that trait and state strategy use indirectly and directly affect Thai high school students' reading comprehension test performance.

The use of trait strategies, including planning, monitoring, evaluating, comprehending, memory and retrieval strategies, was observed on both test occasions, consistent with the measuring Model described in Figure 3. Regarding all strategies, factor loadings in the Model were comparatively high. The differences in trait strategy use that were considered comparable to both occasions were 83.8% for trait strategy use at Time 1 (T1) and 87.7% for trait strategy use at Time 2 (T2) with the regression coefficient of 0.12 (R^2 = 0.014, small ES). The two-time points shared 1.44% of the variance in trait strategy use. The shared common variance in trait strategy use T2 in the structural Model was higher than in the measurement model, as presented in Model 1. It should be noted that the percentages indicate how much of the theoretical construct is accounted for by the shared common variance in the set of regression coefficients. These findings suggest that language learning strategy use or trait strategy use is stable over time.

It was also discovered that each of these trait strategies was highly interrelated. The correlations between these generally perceived strategies at T1 vary, with trait comprehending and trait evaluating strategies having a large effect size of 0.56 (R^2=0.32). In contrast, trait retrieval and trait monitoring strategies have a large effect size of 0.84 (R^2=0.72). At Time 2, the relationships between these generally perceived strategies vary, with trait comprehending and trait evaluating strategies having a large effect size of 0.77 (R^2=0.60) and trait retrieval and trait monitoring strategies having a large effect size of 0.88 (R^2 = 0.88). Based on the factor loadings and correlations between the two observed variables, it can be drawn that the knowledge required to perform the reading test using strategies primarily pertains to (1) monitoring to reprocess or retrieve information and (2) assessing the planning to attain the goals.

The Model shows that the factor loadings for each strategy were relatively high. The shared common variances of state strategy use on both occasions were 89.8% for the state strategy use at Time 1 (S1) and 83.07% for state strategy use at Time 2 (S2). The regression coefficient between the use of state strategy at S1 and S2 was 0.09 (R^2=0.008), indicating a small effect size. The regression coefficient indicates that a 9% prediction can be made regarding the degree to which state strategy is used in one context in another.



Note: T = Trait, S = State, 1 = Time 1, 2 = Time 2, RCTP = reading comprehension test performance

Figure 2. The hypothesized Model of the relationship of trait and state strategy use on reading comprehension test performance over time

The study found a strong correlation between state strategies and reading comprehension. At Time 1, the relationships varied from 0.63 for comprehending and evaluating strategies to 0.91 for memory and monitoring strategies. At Time 2, the relationships increased, with retrieval and evaluative strategies having a larger effect size. The knowledge about these strategies primarily focuses on planning goals, retrieving information, and monitoring comprehension.

The use of the trait strategy is more stable than the state strategy. The low stability of state strategy use found in this study might be related to the context of the present study. This context was directly relevant to a formal classroom environment where instruction of EFL reading was expected to improve reading comprehension skills. Perhaps the instruction impacted the state strategy use reports changes at Time 2.

4. Discussion

4.1 The Nature of Trait and State Cognitive and Metacognitive Strategy Use and Its Relationships to Reading Comprehension Test Performance

The finding that Thai EFL high school learners employed state strategies (actual strategy use) more than trait strategies (perceived strategy knowledge) during reading test performance sheds light on the dynamic between learners' awareness of strategies and their actual strategic behaviors in test situations. Several factors may explain why this occurs, particularly in the context of language testing.

Trait strategies refer to the strategies learners believe they use or know about, which may not always translate into actual use during performance situations. State strategies, on the other hand, represent the strategies learners actually employ during specific tasks, such as a reading test. This discrepancy often occurs because learners may overestimate their strategic knowledge or find it challenging to apply theoretical knowledge in practical contexts (Pawlak, 2021; Purpura, 2016). In high-pressure environments like tests, learners might revert to more automatic or practiced strategies, reflecting a more genuine state of strategic use.

The immediate need to comprehend and respond to questions during language tests can also lead learners to employ more practical and spontaneous strategies. These conditions can push learners to utilize state strategies that are more adaptive to immediate task demands. In contrast, trait strategies might not be as readily activated if they require deliberate reflection or planning, which can be harder to manage under the time pressures of a test.

In many EFL contexts, including Thailand, there is often a gap between what is taught (or perceived to be learned) and what students can apply in practice. This might be due to how strategies are taught — often decontextualised — which can affect students' ability to employ these strategies effectively during tests (Ketworrachai & Sappapan, 2022; O'Malley & Chamot, 1990). Suppose learners are not given enough practice or feedback on using strategies in context. In that case, they may be unable to deploy them when it counts, leading to a higher reliance on state strategies that emerge naturally from the task.

Moreover, the level of language proficiency can significantly affect the type of strategies employed. Learners with lower proficiency might not feel confident in their ability to use complex metacognitive or higher-order cognitive strategies, which they might perceive as

part of their strategic knowledge (Jessica Abisheganathan & Mahani, 2022). Instead, they might rely on simpler, more direct strategies that are easier to execute and do not require advanced language skills (Bachman & Palmer, 2010).

Test-related stress and anxiety can also influence strategy use. Under stress, students might find it challenging to deploy complex, perceived strategies and default to simpler, more automatic strategies they have practiced and found successful in past experiences (MacIntyre & Gardner, 1994).

The predominance of state strategies over trait strategies in reading test performance among Thai EFL high school learners highlights the importance of practical, task-based strategy training in language learning programs. Educators should focus on helping students bridge the gap between theoretical strategic knowledge and practical application, ensuring that learners are not only aware of various strategies but are also proficient in applying them effectively in test situations and real-life settings. This approach can enhance the learners' strategic competence and overall language proficiency.

The observed strategic usage among Thai EFL high school learners, where cognitive strategies are predominantly employed over metacognitive strategies during language test performance, can be attributed to several key factors related to language learning practices, cognitive development, and the specifics of language proficiency.

Firstly, cognitive strategies, including comprehending, memory, and retrieval strategies, involve direct interaction with the text, focusing on understanding and recalling information. These strategies are generally more straightforward and are the first set of strategies taught and practiced in the EFL contexts due to their direct application to common test items, such as identifying main ideas and details (Anderson, 2002). However, metacognitive strategies are higher-order thinking skills that require learners to plan, monitor, and evaluate their understanding and approach to tasks (Oxford, 2011; Rivas, Saiz & Ossa, 2022). These strategies are more complex because they involve self-regulation and a critical assessment of one's performance and strategies.

Secondly, this phenomenon could be explained by didactic focus and pedagogical practices. Specifically, Thai educational systems often emphasize direct instruction of content and basic processing skills over the development of metacognitive awareness. This academic focus may make students more familiar with and rely on cognitive strategies. Curriculum and assessment practices that prioritize factual recall and comprehension may further reinforce this trend, as these assessments do not necessarily encourage or require using metacognitive strategies (Norman, 2020; Purpura, 2016).

Language proficiency levels could be another factor affecting the use of these strategies. The effective use of metacognitive strategies may hinge on a higher level of language proficiency. For Thai EFL learners, applying complex metacognitive tasks in English – a non-native language – can be daunting. This language barrier might discourage using strategies that require extensive language processing beyond straightforward comprehension. Therefore, Thai learners are likely to adjust their strategy usage towards cognitive types (Bachman & Palmer, 2010).

The dominance of cognitive strategies among Thai EFL learners reflects current learning methodologies that favor direct content delivery and basic comprehension tasks over critical thinking and self-regulation. Enhancing educational practices to include a balanced focus on both cognitive and metacognitive strategy training can significantly benefit learners, fostering a more holistic development of language skills and strategic competencies. By adjusting teaching methodologies to promote these higher-order skills, educators can better prepare students for the complexities of language use both inside and outside the academic environment (Bachman & Palmer, 2010; Phakiti, 2008a).

The SEM analysis provided further insights into the relationship between these strategies and reading comprehension performance. Initially, the hypothesized Model did not fit the data well, suggesting that the complexity of strategic interactions might be more intricate than initially thought. Adjustments made through post-hoc fittings improved the Model's fit, indicating that non-random measurement errors and other modifications were necessary to accurately capture the dynamics of strategy use. The revised model from SEM highlights a robust connection between the use of both trait and state strategies and reading comprehension performance. This connection is evidenced by the significant factor loadings and the high percentage of variance explained by the strategies. Such findings suggest that strategic competence in reading is not merely about the isolated use of cognitive or metacognitive strategies but involves a complex interaction of these strategies over time.

The analysis of trait and state strategy use among Thai EFL learners reveals a dynamic and evolving nature of strategic competence. These significant improvements over time and the strong correlation with reading comprehension performance highlight the critical role of strategic training in language learning. These findings advocate for a balanced approach to teaching reading strategies, integrating both cognitive and metacognitive components to effectively enhance student outcomes in EFL contexts.

4.2 Cognitive and Metacognitive Strategies Exhibited by Traits and States Affect Thai EFL High School Learners' Performance on Reading Comprehension Tests

The current study reveals that strategic processing is closely linked to reading test performance, accounting for up to 91% of the variance in some cases. However, the extent of this contribution can vary significantly across different contexts. One plausible explanation for this variation is the influence of both contextual and learner-specific factors. These factors include communicative language ability, the characteristics of the test method, test-taker traits, and random influences, all of which simultaneously impact reading test performance.

Additionally, both cognitive and metacognitive elements play critical roles in language achievement. Factors such as language

competence, threshold levels of linguistic knowledge, working memory capacity, the degree of automaticity in language processing, motivation, and task difficulty significantly contribute to language performance (Bachman & Palmer, 2010; Phakiti, 2007; Tabatabaei et al., 2020). These diverse influences mean that the unique contribution of strategic competence to test performance is inherently limited.

Moreover, the effectiveness of strategy use in language tests often hinges on specific conditions (Anderson, 2005). These conditions include the appropriateness of the strategy to the task, the integration of the strategy with other relevant strategies and processes, and the alignment of the strategy with the learner's learning style. In many cases, EFL learners' strategic competence may be underdeveloped or misapplied (Lin et al., 2021; Tukan, 2024), evidenced by poor strategic regulation and limited metacognitive awareness. Phakiti (2016) highlighted this issue in his study on test-takers' calibration, where he found that individuals generally overestimated their performance on difficult questions and underestimated it on easier ones, suggesting a significant gap in accurate self-assessment and strategic evaluation.

Finally, it is crucial to acknowledge that research findings can sometimes be artifacts of the methodologies and instruments used. Strategic competence is a complex construct that is not directly observable and often requires inferential analysis based on individuals' self-reported insights into their cognitive processes. Although structural equation modeling offers a robust analytical framework, it does not provide a direct view into the minds of individuals, given that human behavior is unique, dynamic, and influenced by specific contexts and situations (Phakiti, 2007, 2008a). This limitation underscores the need for cautious interpretation of data regarding strategic competence and its impact on language performance.

4.3 The Consistency of the Trait and State Cognitive and Metacognitive Strategy Use on Reading Comprehension Test Performance Over Time

The present study has demonstrated the consistency of both trait and state cognitive and metacognitive strategy use in reading comprehension test performance among Thai EFL high school learners over time. These findings enhance our understanding of how these strategies affect reading comprehension and their varying levels of stability and effectiveness (Habók, Oo & Magyar, 2024; O'Malley & Chamot, 1990). The observed consistency in strategy use aligns with the theoretical framework and empirical evidence presented in the study.

Trait strategies, which are based on learners' perceptions or beliefs about their strategy use, have shown significant development over time. This progression is evident in the increasing use of both cognitive and metacognitive trait strategies as learners advance in their educational journey. Such an increase likely reflects growing familiarity with the strategies and improved recognition of their effective application during tests. The statistically significant improvements across various components of trait strategy, such as comprehending, memory, and planning, indicate consistency and increasing sophistication over time (Purpura, 1997, 2016).

In contrast, state strategies, which refer to the actual strategies employed during specific tasks like tests, have also displayed an upward trend. This suggests a real-time application that is closely aligned with the immediate demands of reading tests. The notable increase in state cognitive strategies, particularly those involving comprehension and memory, underscores that students are applying these strategies effectively under test conditions, contributing to consistent improvements in test performance.

Several factors may influence this consistency in strategy use among Thai EFL learners. Educational intervention and instructional practices play a crucial role, especially as continuous instructional support and strategic training in EFL contexts significantly enhance the use of both trait and state strategies (Bachman & Palmer, 2010). Additionally, repeated exposure to similar types of tests and test formats can lead learners to develop a routine in strategy use, fostering consistency in their approach to reading comprehension tests.

Cognitive and metacognitive development also significantly influence the consistency of strategy use. As learners mature and progress through their educational phases, they typically develop greater cognitive and metacognitive capacities, which support a more consistent application of strategies, thereby enhancing overall test performance (Anderson, 2005; Vettori et al., 2023). Regular feedback on performance and self-regulation practices further encourage consistency in strategy use, as learners who are adept at monitoring their learning processes and adjusting their strategies based on feedback are likely to show more consistent strategy use over time.

In summary, the consistent use of trait and state cognitive and metacognitive strategies among Thai EFL high school learners indicates ongoing learning support, repeated test exposure, and cognitive development. This consistency is vital for enhancing reading comprehension abilities, directly affecting academic success in EFL settings. By continuing to nurture strategic competence through targeted instruction and practice, educators can further ensure the consistent application of effective reading strategies among learners.

5. Conclusion

The study reveals that both trait and state cognitive and metacognitive strategies play crucial roles in reading comprehension among EFL high school learners. Trait strategies, the strategies learners believe they use, and state strategies, which are those actually used during tests, show distinct use patterns. While both types of strategies are essential, state strategies tend to align more closely with immediate test demands, thereby directly influencing test performance. The robust relationship between these strategies and reading comprehension performance indicates that effective use of cognitive and metacognitive strategies is essential for successful reading comprehension in EFL contexts.

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demands, thereby directly influencing test performance. The robust relationship between these strategies and reading comprehension performance indicates that effective use of cognitive and metacognitive strategies is essential for successful reading comprehension in EFL contexts.

The consistency of strategy use over time among Thai EFL learners indicates a progressive development in strategic competence. Both trait and state strategies show an upward trend in their application, reflecting an enhanced familiarity with strategic processes and an improvement in strategic application in response to test demands. This consistent improvement suggests that continuous exposure to language testing and strategic training contributes significantly to learners' ability to adapt and refine their use of strategies, thereby improving their reading comprehension outcomes over time.

Together, this study emphasizes the pivotal role of both cognitive and metacognitive strategies in shaping EFL learners' reading comprehension abilities. The dynamic interaction between trait and state strategies, mainly how these strategies are developed and applied over time, highlights the complexity of reading comprehension in a second language context. Educational implications from these findings suggest that enhancing instruction in strategic use, focusing on both cognitive and metacognitive aspects can significantly boost learners' performance not just on tests but in broader academic and real-world settings. Moreover, the demonstrated consistency of strategic improvements over time encourages ongoing, focused training in these areas to build robust, adaptable, and effective language users.

6. Implications

This study significantly contributes to the theoretical landscape of second language acquisition by emphasizing the pivotal roles that both trait and state strategies play in EFL learners' reading comprehension. Trait strategies, representing learners' perceived knowledge of strategic use, and state strategies, reflecting the actual strategies employed during specific tasks, form a complex network of cognitive and metacognitive processes. This study's exploration of how these strategies interact provides deeper insights into strategic competence, particularly how learners navigate between their understanding of strategy and their practical application during language tests. By highlighting this dynamic interplay, the research enriches our comprehension of how strategic knowledge and application influence reading performance, thus broadening the theoretical framework that guides language acquisition studies.

Methodologically, using quantitative structural equation modeling (SEM) in this study offers a comprehensive approach to understanding learners' strategic behaviors. SEM allows for examining the relationships between observed and latent variables, providing a detailed picture of how trait and state strategies contribute to reading comprehension. Pedagogically, the findings underscore educators' need to prioritize practical strategy training that effectively bridges the gap between learners' theoretical knowledge of strategies (traits) and their real-time application (state). Traditional language instruction often focuses on the declarative knowledge of strategies without adequate emphasis on their practical application, leading to a disconnect between what students know they should do and what they actually do in real situations. By fostering environments where learners can practice and receive feedback on strategy use in realistic settings, educators can enhance the applicability of strategic training. This approach ensures that learners are not only conscious of various strategies but are also adept at deploying them effectively during tests and in real-world language use scenarios.

This study's integration of theoretical insights, methodological robustness, and pedagogical implications presents a comprehensive model for enhancing strategic competence in EFL contexts. It advocates for a shift in teaching paradigms towards a more application-oriented training regimen that aligns learners' strategic knowledge with their operational competencies, ultimately leading to more effective and autonomous language use. This approach could significantly improve educational outcomes in EFL settings by equipping learners with the skills necessary to navigate complex academic and social-linguistic environments.

7. Limitations and Suggestions for Future Studies

The study's findings primarily apply to Thai high school students, which may limit generalizability to other EFL contexts with different educational backgrounds or cultural settings. Methodological constraints also arise from the reliance on self-reported data through questionnaires and interviews, potentially introducing biases such as social desirability or memory recall inaccuracies. Additionally, the focus on a formal educational setting might not capture the full complexity of strategy use in less structured or varied practical environments, potentially limiting the applicability of findings to other contexts where reading strategies may manifest differently.

Future research could benefit from exploring the strategic behaviors of EFL learners in diverse geographical and cultural settings to enhance the generalizability of these findings. Conducting longitudinal studies and mixed-methods research could also provide deeper insights into how strategic competence evolves over time and across different stages of language proficiency. Moreover, experimental studies that implement specific strategic training interventions could assess the direct impact of such training on reading comprehension performance, helping to refine pedagogical approaches. Lastly, expanding the research to include other language skills, such as writing, speaking, and listening, might offer a comprehensive view of strategic competence across different language modalities, thereby broadening the scope of strategic competence research in EFL contexts.

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Authors' contributions

Both Panassanan Kitichaidateanan and Dr. Apisak Sukying were responsible for study design and data analysis. Panassanan Kitichaidateanan mainly managed the literature review and data collection. Dr. Apisak Sukying provided ongoing guidance and consultation throughout the entire research process. Both Panassanan Kitichaidateanan and Dr. Apisak Sukying jointly analyzed the data, interpreted and discussed the findings. Panassanan Kitichaidateanan drafted the manuscript and Dr. Apisak Sukying revised it. Both authors read and approved the final manuscript. The two authors have contributed equally to the study.

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