

FOREIGN LANGUAGE READING ANXIETY SCALE (FLRAS) FOR MANDARIN LEARNERS IN MALAYSIAN UNIVERSITIES: VALIDATION STUDY

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Abstract. Foreign Language Reading Anxiety Scale (FLRAS) is a self-report instrument designed to measure a learner's level of anxiety when reading in a foreign language. Although widely used in English language contexts, its application in Mandarin learning environments has been limited, and the validity and reliability of the scale in such contexts remain underexamined. Moreover, existing studies have raised concerns about its factor structure when adapted to Mandarin. This study investigates the validation of the FLRAS in the context of Mandarin learning through a two-phase validation process using Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). In the pilot phase, data from 120 respondents were analysed via EFA using SPSS. The results indicated that all items could be retained; however, a four-factor structure emerged rather than the previously proposed two-factor model commonly reported in English-language studies. Subsequently, in the main study phase, data were collected from 326 Mandarin learners across Malaysian public universities. These data were analysed using CFA in AMOS. Fit indices, including chi-square, RMSEA, CFI, and NFI confirmed that the four-factor model demonstrated acceptable to good fit ($\chi^2/df = 2.374$, RMSEA = .060, CFI = .964, TLI = .960), thereby supporting the structural validity of the FLRAS for use with Mandarin learners. In conclusion, the FLRAS has been validated as a reliable and structurally sound instrument for assessing foreign language reading anxiety among Mandarin learners in Malaysia. This tool can help educators and stakeholders identify sources of reading anxiety, design targeted interventions, and cultivate learning environments that enhance reading performance and skill development.

Keywords: *foreign language reading anxiety, Malaysian, universities, Mandarin learners, validation*

Introduction

Anxiety has been conceptualized as a state of apprehension, tension and uneasiness based on the fear of potential danger or negative outcomes whether they originate from internal or external sources (Cheng, 2002; Sellers, 2000; Cheng et al., 1999; MacIntyre, 1995). Anxiety is typically seen as a natural psychological obstacle in learning a foreign language. This type of anxiety, referred to as foreign language anxiety (FLA), stems from the particular demands involved in learning a new linguistic and cultural system, and it may be a significant obstacle for learning progression, motivation, and performance (Saito et al., 1999; Horwitz et al., 1986). To measure anxiety associated with reading, the 20-item self-report instrument Foreign Language Reading Anxiety Scale (FLRAS) was developed by Saito et al. (1999). This scale has since been translated into various languages and has become a key tool for diagnosing and

researching reading-specific anxiety across different languages, such as French, Spanish, and English (Hu et al., 2025; Liu and Dong, 2023; Mikami, 2023). However, its application to logographic languages, such as Mandarin, remains limited. This limitation is particularly significant given that alphabetic and character-based scripts engage different psycholinguistic processes, involving distinct cognitive components for word recognition and decoding (Subaşı, 2014; Perfetti et al., 2013; Perfetti and Liu, 2005; Chen, 1996).

Previous studies have revealed that the construct validity of the FLRAS, particularly when examined through exploratory factor analysis (EFA), has been inconclusive across different cultural and linguistic contexts (Baghaei et al., 2014; Matsuda and Gobel, 2004; Hsiao, 2002; Saito et al., 1999). When it was initially developed and validated, the FLRAS was administered to students learning French, Russian, and Japanese within a predominantly English-speaking context (Saito et al., 1999). However, subsequent studies conducted in diverse settings have reported varying factor structures, raising questions about the cross-cultural stability and theoretical generalizability of the scale. Consequently, the optimal factor structure of the FLRAS—particularly for non-alphabetic target languages—remains unclear. Although Saito et al. (1999) proposed a model of L2 reading anxiety involving unfamiliar scripts and cultural elements, empirical support for a consistent factor structure has been lacking. In line with this, Zhao et al. (2013), in a study involving English-speaking learners of Mandarin Chinese in the United States, identified three primary sources of anxiety: unfamiliar scripts, unfamiliar topics, and concern over comprehension. This finding suggests that the dimensionality of the FLRAS may vary depending on the linguistic distance between the learners' native language and the target language. Nevertheless, this three-factor structure has yet to be cross-validated across diverse learning contexts and populations, thereby raising concerns about its generalizability (Bensalem, 2019a; Baghaei et al., 2014; Zhao et al., 2013; Matsuda and Gobel, 2004; Hsiao, 2002; Saito et al., 1999).

Hence, this study aims to address this gap by conducting a cross-validation of the FLRAS among Mandarin learners in Malaysian higher education institutions using both exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). The specific objectives are: (1) to identify the potential factor structure of foreign language reading anxiety among this population, and (2) to assess how well the measurement or structural model fits based on goodness-of-fit indices. The findings will enhance our understanding of reading anxiety in the context of logographic language learning and provide a validated instrument for assessing this emotional barrier among practitioners teaching Mandarin as a foreign language. The validated Mandarin FLRAS can assist lecturers in identifying at-risk readers, implementing appropriate reading interventions, reducing anxiety through targeted pedagogical strategies, and fostering greater confidence to support more successful reading development in Mandarin as a Foreign Language (MFL) classroom in Malaysia.

Literature review

Theoretical foundations of FL reading anxiety

The theoretical foundation of Foreign Language Reading Anxiety (FLRA) is established within the cognitive-affective models of foreign language learning. In other words, this is an integration of Tobias (1979) three-phase interference model of anxiety and Krashen (1982) Affective Filter Hypothesis. According to Tobias (1979), anxiety

interferes with the three stages of cognitive processing: input, processing, and output. Anxious readers lack the focus to process textual input, which leads to cognitive overload during decoding and comprehension. This, in turn, leads to a failure in recall or understanding (Eysenck et al., 2007; Sellers, 2000; Zbornik and Wallbrown, 1991). Krashen (1982) claims that under high-anxiety conditions, reading ability is impaired. Inspired by these models, the first version of FLRA was introduced by Saito et al. (1999), who posit that reading ability is impaired by anxiety (in alphabetic languages such as English).

The widespread use of the FLRAS in Western settings suggests that it is adequate for learners of alphabetic languages; however, some researchers have highlighted certain limitations regarding its cross-contextual functionality and feasibility (Baghaei et al., 2014; Zoghi and Alivandivafa, 2014; Miyanaga, 2005). The FLRAS has been criticized for its potential cultural and educational biases, as items developed within the U.S. university context may not adequately capture the anxiety experienced by learners in European secondary schools or adult education classrooms, where teaching methods and literacy demands differ (Gregersen and MacIntyre, 2014; Horwitz, 2001). Such concerns regarding underlying factor structures and cross-contextual validity have also been observed in Western implementations, prompting scholarly discussion that underscores the necessity of adapting and revalidating the FLRAS for specific learner populations. This need is particularly critical in multilingual contexts such as Malaysia, where learners represent a distinctive group who have typically acquired other language systems, such as Malay, English, and often a Chinese dialect prior to learning Mandarin. Such a complex linguistic environment may shape reading anxiety in ways that differ significantly from monolingual or alphabetically literate learners, thereby necessitating an instrument that is sensitive to the unique challenges of acquiring a logographic writing system within a multilingual framework.

Existing instruments and their limitations

The empirical studies conducted on Foreign Language Reading Anxiety (FLRA) have been established using two prominent instruments: the Foreign Language Reading Anxiety Scale (FLRAS), developed by Saito et.al (1999), and the English as a Foreign Language Reading Anxiety Inventory (EFLRAI), developed by Zoghi (2012a; 2012b). Despite the widespread acceptance of these scales among researchers, a significant limitation can be identified: both instruments were designed primarily for learners whose mother tongue is alphabetic. They were developed to be sensitive to the cognitive and orthographic realities of languages such as Japanese, Russian, French, and English, where phonological decoding and grapheme-to-phoneme correspondences are central to the reading process. Indeed, the FLRAS, which serves as a cornerstone in the field, was originally validated with American learners of Japanese, Russian, and French. The 20 items of the FLRAS measure anxieties related to foreign writing systems, unfamiliar terms, and comprehension difficulties, all situated within an alphabetic processing framework. While the scale has demonstrated good reliability and validity across various samples and effectively predicts weaker reading performance in second or foreign language contexts, its conceptual foundation remains inherently alphabetic. The anxiety measured by this scale presupposes a writing system in which symbols map onto sounds, a principle that does not govern the reading of Mandarin characters.

Although the FLRAS is widely used in educational settings, particularly in Western countries, it has also faced criticism and unresolved issues. Empirical data have revealed

that the factor structure of the scale is inconsistent across studies. Researchers have reported one-factor, two-factor, three-factor, and four-factor structures depending on the context and population studied. This issue is particularly evident in Asian educational contexts, where studies conducted in Taiwan, Japan, and Korea have yielded different conclusions. For instance, Hsiao (2002) investigated a sample of Taiwanese university students and reported that the FLRAS assesses only a single factor, suggesting unidimensionality. In contrast, Matsuda and Gobel (2004) identified a three-factor model among Japanese university students, a finding later supported by Hamada and Takaki (2021a; 2021b). Furthermore, Miyanaga (2005) found a four-factor structure among Japanese university students, with factors relating to difficulty at a global level of reading, lack of confidence and enjoyment, unfamiliar topics, grammar and vocabulary, and dissatisfaction with reading ability. This finding aligns with the study by Hwang and Bae (2022), who examined Korean college students using the Foreign Language Reading Anxiety Inventory (FRAI) and also reported a four-factor structure comprising form-oriented reading anxiety, self-efficacy in reading, content-related reading anxiety, and culture-bound reading apprehension. Even in a study involving Korean children aged 8 to 13 years, Cho (2023) identified two factors based on anxiety related to English and anxiety related to reading. Taken together, this body of evidence demonstrates that the factor structure of the FLRAS is ambiguous and context-dependent, varying as a function of educational level, age group, native linguistic background, and instructional environment. This instability underscores the necessity of revalidating the instrument for different learner populations.

The logographic challenge

Learning Mandarin as a foreign language can be considered a challenging task since it is cognitively demanding because of its writing system. Unlike alphabetic languages, where alphabets represent sounds, Mandarin characters do not have any clue to help to pronounce. In other words, the visual shape of a character has no connection to its pronunciation (Duan and Cai, 2024; Kuan, 2021; Perfetti and Liu, 2005). Each character is a visual unit that represents a meaning, but the sound is not obvious from looking at it. For learners who are used to alphabetic writing, this is very challenging because they cannot simply pronounce the word as they would in English (Everson, 1994). Cognitive psychology research shows that reading Mandarin uses different brain pathways than reading alphabetic scripts. Learners must recognise the whole character visually, analyse its internal parts (radicals), and connect meaning to sound, even though the sound is often unclear (Shen and Ke, 2007; Hayes, 1988). This process is slow and mentally tiring for beginners. It uses up working memory that should be used for understanding the text (Feng et al., 2009). The issues are further compounded because many characters look very similar (e.g., 未 vs 末), and many characters sound the same but have different meanings (Zhou et al., 1999). This leads to frequent mistakes in recognising and recalling characters.

This mental burden is a major source of reading anxiety for Mandarin learners. The standard FLRAS (Saito et.al, 1999) mentions "unfamiliar scripts" as a cause of anxiety. However, its questions are too general (e.g., "I get worried when I see new symbols"). They do not capture the specific fears that Mandarin learners actually experience. For Mandarin learners, anxiety is not just about seeing "new symbols." It is about not being able to figure out a character's composition, failing to guess meaning from radicals, struggling to remember the exact visual form of a character, and confusing two

characters that look almost the same (Zhao et.al, 2013). If the FLRAS is implemented without modification for Mandarin learners, it may fail to capture what truly makes them anxious. The scale does not fully measure the real problems or issues confronted by these learners. Therefore, the present study is necessitated to validate the FLRAS for Mandarin learners in Malaysian public universities. To accurately capture the reading anxiety of these learners, the FLRAS must be reconfigured to reflect the cognitive demands of character-based literacy. Generic items developed for alphabetic scripts cannot adequately measure anxieties related to decoding, retaining, and distinguishing logographic characters. In other words, the current scale risks construct underrepresentation when applied to Mandarin learners, as it fails to capture the specific sources of anxiety that arise from learning a non-alphabetic, logographic writing system.

The mandarin learning In Malaysian public universities

The integration of Mandarin (foreign language) into Malaysian public university curricula, driven by China's economic influence, has led to a growing number of non-heritage learners primarily ethnic Malays who engage with a linguistically distant script. This shift makes the accurate assessment of FLRA essential. However, applying the widely used FLRAS in Malaysia's multilingual context presents significant challenges, underscoring the need for localized validation to ensure both pedagogical relevance and research accuracy. Existing research confirms that reading anxiety is heavily influenced by script type. The unique cognitive demands of Chinese characters which require visual-orthographic rather than phonological processing are a key source of anxiety (Zhao et al., 2013; Perfetti and Liu, 2005). Yet, these studies largely involve learners from alphabetic L1 backgrounds. Malaysian learners typically possess multilingual proficiency in Bahasa Malaysia and English before tackling Mandarin as foreign language. This prior experience may reshape their anxiety profile in ways not captured by the original FLRAS items, which were designed for different learner demographics. Moreover, the Malaysian Mandarin classroom is mostly attended by non-heritage learners, creating a distinct social-motivational dynamic. Non-heritage learners, frequently driven by instrumental career motivation, may experience heightened anxiety due to fear of failure and feelings of comparative inadequacy. The generic FLRAS items (e.g., "worried about new symbols") lack specificity for local struggles, such as difficulty decomposing characters or confusing similar radicals. Without validation and adaptation, the scale risks misdiagnosing anxiety, leading to ineffective teaching interventions. Therefore, validating the FLRAS in Malaysian higher education is imperative. This process involves examining its factor structure through EFA and CFA and ensuring item relevance to local learners. A validated instrument will provide educators with a reliable tool to identify and address reading anxiety, supporting more effective Mandarin instruction within Malaysia's unique multilingual setting.

Materials and Methods

The present study adopted a cross-sectional research design, whereby data were collected at a single point in time (Sekaran and Bougie, 2016). Data for both the pilot and actual studies were collected from language faculties across eight public universities in Malaysia. A cluster sampling method was employed to select respondents among Level 3 Mandarin learners, as these students were considered to have progressed

beyond the elementary stage. This specific group was targeted because intermediate learners possess sufficient language experience to provide meaningful reflections on their learning journey, yet the learners remain in a critical phase of linguistic development, making them an ideal cohort for examining the variables central to this research. The items of the questionnaire were adapted and adopted into a Mandarin version. Content validity was assessed and verified by five experts from different universities, each with more than 20 years of experience in Mandarin language teaching. A pre-test was first conducted to ensure the content validity, face validity, and criterion validity of the FLRAS prior to the actual fieldwork. The criterion validity of the FLRAS was assessed by a statistical expert to confirm the appropriateness of the scale. Subsequently, the FLRAS was submitted to a certified translator for back translation from English to Malay (Bahasa Malaysia) to establish face validity, as the majority of respondents are native Malay speakers.

Once the validation procedure was completed, the FLRAS was pre-tested on 10 randomly selected respondents to gauge the consistency of their responses and to gather feedback on any ambiguous terms, the clarity of the questions, and the overall questionnaire design. These issues were identified and addressed before the pilot study and actual fieldwork (Zikmund and Babin, 2010). After the instrument was revised based on comments from the panel of experts and the pre-test, a pilot study was conducted, and 120 valid responses were obtained, thus fulfilling the required minimum sample size of 100 (Bahkia et al., 2019; Awang, 2015). The pilot study data were subjected to exploratory factor analysis (EFA) prior to the actual survey. The results of the EFA are presented in Section 4.1 (*Table 3*). The finalised version of the FLRAS instrument consisted of 20 items, excluding questions on respondents' demographic profiles. A 10-point Likert scale ranging from 1 (strongly disagree) to 10 (strongly agree) was employed for the instrument. This interval scale was recommended by Awang (2015) and Coelho and Esteves (2007) to ensure that the data obtained from the FLRAS were more statistically robust. The actual survey obtained 380 responses, of which 326 were found to be valid. The response rate of 85.7% is considered good. The Statistical Package for Social Science (SPSS) and Analysis of Moment Structures (AMOS) were utilised to analyse the data. SPSS was used for data screening and the EFA, while AMOS was used to validate the measurement model for constructs, assessing unidimensionality, validity, and reliability through confirmatory factor analysis (CFA) (Afthanorhan et al., 2019; Mahfouz et al., 2019; Mohamad et al., 2019; Rahlin et al., 2019; Awang et al., 2018; Awang, 2015).

Results and Discussion

Exploratory factor analysis

The main objective of exploratory factor analysis (EFA) is to summarize data by grouping correlated variables into underlying latent dimensions (Zikmund and Babin, 2010). In this study, EFA was applied to the pilot study data to examine the factor structure of the adapted FLRAS. The analysis yielded a four-factor solution, comprising: (1) Form-driven Reading Anxiety (FD), (2) Self-efficacy and Confidence in Reading (SE), (3) Message-oriented Reading Anxiety (MO), and (4) Culture-bound Reading Apprehension (CB). Several essential prerequisites were assessed prior to conducting the EFA. First, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (MSA) should exceed the recommended threshold of 0.50. Second, Bartlett's

test of sphericity should yield a statistically significant result ($p < 0.001$), indicating that the correlation matrix is suitable for factor analysis (Bahkia et al., 2019; Awang, 2015; Hair et al., 2014).

Table 1 displayed the results of the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test of sphericity for four-factor constructs: Form-driven reading anxiety, Self-efficacy and confidence, Message-oriented reading anxiety and Culture-bound apprehension. For all constructs, the KMO values achieved minimum threshold of 0.5. The Bartlett's test of sphericity for all constructs yielded significant results ($p < 0.001$), aligning with the guidelines suggested by Bahkia et al. (2019), Rahlin et al. (2019), Shkeer and Awang (2019a; 2019b) and Hair et al. (2014).

Table 1. Results of KMO and Bartlett's Test of Sphericity.

Construct	KMO(>0.50)	Bartlett's Test of Sphericity ($p < 0.001$)
Form-driven Reading Anxiety (FD)	0.836	0.00
Self-efficacy and Confidence (SE)	0.773	0.00
Message-oriented Reading Anxiety (MO)	0.816	0.00
Culture-bound Apprehension (CB)	0.802	0.00

In the EFA, principal component analysis was employed to examine the factor extraction process, helping to justify which factors or items should be retained and which should be deleted. The Varimax rotation was chosen, primarily due to its widespread use in orthogonal factor rotation and its effectiveness in facilitating factor analysis (Shkeer and Awang, 2019a; 2019b; Hair et al., 2014). Factor loadings below an absolute value of 0.5 were discarded, while those equal to or exceeding 0.5 were retained for further analysis (Hair et al., 2014).

Table 2 presents the results of the PCA with Varimax rotation for the 20 items under the FLRAS construct. The results revealed that the PCA procedure extracted four distinct components with eigenvalues exceeding 1.0. The total variance explained by all four components was 75.720%, exceeding the minimum threshold of 60% acceptable variance explained in factor analysis for a construct to be considered valid (Shkeer and Awang, 2019a; 2019b; Hair et al., 2010).

Table 2. Results of Total Variance Explained (TVE).

Com	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	T	%V	C%	T	%V	C%	T	%V	C%
1	10.215	46.433	46.433	10.215	46.433	46.433	5.980	27.183	27.183
2	3.253	14.788	61.221	3.253	14.788	61.221	4.199	19.084	46.267
3	1.823	8.288	69.509	1.823	8.288	69.509	3.418	15.537	61.804
4	1.366	6.210	75.720	1.366	6.210	75.720	3.062	13.916	75.720
5	1.259	5.724	81.443						

Note: Extraction Method: Principal Component Analysis; Com=Component; T=Total; %V=% of Variance; C%=Cumulative %.

As shown in Table 3, no items required deletion based on the EFA results. However, the grouping of items under each factor in the Mandarin version differed from the original FLRAS, suggesting that the underlying structure of reading anxiety is experienced differently by Malaysian Mandarin learners. Despite this reconfiguration, all 20 items from the initial pool were retained, as illustrated in Table 3. These retained items were subsequently carried forward to the next stage of analysis-Confirmatory Factor Analysis (CFA).

Table 3. Final EFA result of Foreign Language Reading Anxiety Scale (FLRAS).

No	Rotated Component Matrix		Component			
	Dimension	Items	1	2	3	4
1	FD	I am worried about all the new characters I have to learn in Mandarin.	.712			
2		When I read Mandarin, I get nervous when I do not understand every character.	.798			
3		I get worried when I encounter unknown grammar while reading Mandarin.	.813			
4		When reading Mandarin, I usually end up translating word by word without understanding the overall meaning.	.595			
5		By the time I get past the characters in Mandarin, it is hard to remember what I am reading about.	.861			
1	SE	I get upset when I am unsure whether I understand what I am reading in Mandarin.		.669		
2		When I am reading Mandarin, I get so confused that I cannot remember what I am reading.		.706		
3		I get upset when I read Mandarin because I have to read things again and again.		.728		
4		I enjoy reading Mandarin.		.889		
5		I feel confident when I am reading in Mandarin.		.883		
6	Self-efficacy and Confidence	I am satisfied with the level of reading ability in Mandarin that I have achieved so far.		.657		
7		I enjoy to read history and culture of Mandarin.		.667		
1		When reading Mandarin, I understand the words but still cannot understand what the author is saying			.722	
2		I feel intimidated whenever I see a whole page of Mandarin in front of me.			.768	
3		Once I get used to it, reading Mandarin is not so difficult.			.802	
4	MO	The hardest part of learning Mandarin is reading.			.799	
5		I would be happy just learning to speak Mandarin rather than having to learn to read as well.			.838	
6		I do not mind reading to myself, but I feel very uncomfortable when I have to read Mandarin aloud.			.666	
1	CB Culture bound Apprehension	Chinese culture and ideas seem very foreign to me.				.863
2		I have to know so much about Chinese history and culture in order to read Mandarin.				.879

Note: Extraction Method: Principal Component Analysis; Rotation Method: Varimax with Kaiser Normalization; a. Rotation converged in 4 iterations.

Based on Table 3, the EFA of the FLRAS revealed a four-factor structure comprising 20 items, with no items requiring deletion. The four components identified are: (1) Form-driven Reading Anxiety, (2) Self-efficacy and Confidence, (3) Message-oriented Reading Anxiety, and (4) Culture-bound Apprehension. Notably, there was no cross-loading of items across the components; each item loaded cleanly onto its respective factor. This clear separation allows for the components to be distinctly labeled, each representing a unique construct.

Confirmatory Factor Analysis (Pooled-CFA)

In the present study, it was necessary to validate the measurement model of the latent constructs in terms of (1) unidimensionality, (2) validity, and (3) reliability (Awang, 2015; Hair et al., 2014; Mohamad et al., 2019). This essential and compulsory procedure is referred to as “confirmatory factor analysis” (CFA). For the measurement model of the latent constructs to be considered acceptable, it had to satisfy three types of validity: convergent validity, construct validity, and discriminant validity (Yusof et al., 2017; Awang, 2015; Hair et al., 2014). In the actual study, three distinct types of validity were assessed. Convergent validity was evaluated by computing the Average Variance Extracted (AVE). Construct validity was examined by assessing the fitness indices of the measurement model. Discriminant validity was established by developing the Discriminant Validity Index Summary. In addition, Composite Reliability (CR) was calculated to determine the reliability of the FLRAS. Although there are differing views

among scholars regarding whether reliability should be tested independently, Awang (2015, 2018) argues that in CB-SEM using AMOS, composite reliability is a preferable alternative to the traditional Cronbach's alpha. This is because composite reliability allows all constructs to be tested concurrently rather than dependently. Therefore, CR can be considered a more suitable method for testing the reliability of items within a construct than Cronbach's alpha (Yusof et al., 2017; Awang, 2015; Hair et al., 2014). The outcomes of the present study are presented in *Figure 1*.

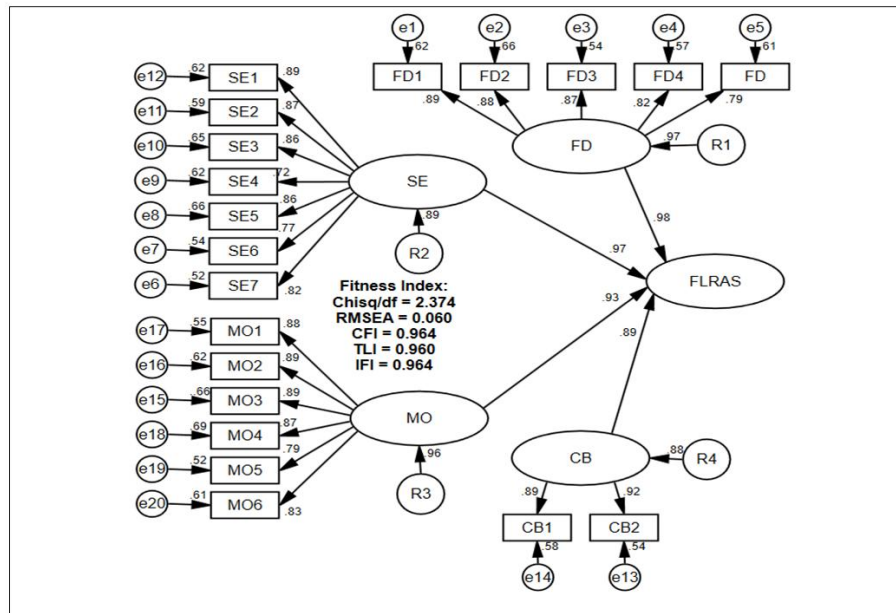


Figure 1. Result from Pooled CFA.

Based on the results presented in *Figure 1*, all constructs and items in the model were validated simultaneously using a pooled confirmatory factor analysis (Pooled-CFA), rather than conducting separate analyses for each construct. Notably, one construct (CB) contained only two items, which is fewer than the typical recommendation of at least four (4) items per construct. However, as highlighted by Awang et al. (2018), model identification is not an issue when Pooled-CFA is employed, as the inclusion of multiple constructs in a single analysis increases the overall degrees of freedom, thereby resolving identification problems. In other words, Pooled-CFA was used because it is more efficient and suitable than running individual CFAs for each measurement model. Moreover, it is the appropriate method for presenting the overall model fit (Awang et al., 2015; 2018).

Unidimensionality

Afterward, there is another essential procedure known as unidimensionality. It refers to a set of variables that can be explained by a single construct (Hair et al., 2014). Unidimensionality can be considered achieved when all measurement items for the constructs meet the minimum acceptable factor loading. Items that fail to reach this threshold due to low factor loadings should be considered for removal from the measurement model. This ensures that the fit indices of either the measurement model or the structural model can be achieved overall. Therefore, the factor loadings of items must be assessed before further analysis can proceed. (Afthanorhan et al., 2017; Awang,

2015; Hair et al., 2014). According to the rule of thumb, there are two general and strict regulations that must be complied with in unidimensionality: the researcher must ensure that 1) the factor loading for newly developed items must be 0.5 or higher, and 2) the factor loading for established items must be 0.6 or higher. However, some scholars have mentioned 0.4 as a threshold. Awang (2018) highlighted that 0.4 is considered unsuitable because it considered fails to demonstrate adequate convergent validity or contributes insufficient explanatory power to the construct. Therefore, researchers are advised to adhere to the more rigorous thresholds to ensure the robustness of the measurement model. As shown in *Table 4*, all items from each construct have exceeded the minimum threshold of 0.5, as suggested by Awang et al. (2018). In other words, all items can be retained, and no items need to be discarded in the present study.

Table 4. *Factor Loading of All Items.*

No	Construct/Item	Factor Loading
Form-driven Reading Anxiety (FD)		
1	I am worried about all the new characters I have to learn in Mandarin.	.89
2	When I read Mandarin, I get nervous when I do not understand every character.	.88
3	I get worried when I encounter unknown grammar while reading Mandarin.	.87
4	When reading Mandarin, I usually end up translating word by word without understanding the overall meaning.	.82
5	By the time I get past the characters in Mandarin, it is hard to remember what I am reading about.	.79
Self-efficacy and Confidence (SE)		
1	I get upset when I am unsure whether I understand what I am reading in Mandarin.	.89
2	When I am reading Mandarin, I get so confused that I cannot remember what I am reading.	.87
3	I get upset when I read Mandarin because I have to read things again and again.	.86
4	I enjoy reading Mandarin.	.72
5	I feel confident when I am reading in Mandarin.	.86
6	I am satisfied with the level of reading ability in Mandarin that I have achieved so far.	.77
7	I enjoy reading about the history and culture of Mandarin..	.82
Message-oriented Reading Anxiety (MO)		
1	When reading Mandarin, I understand the words but still cannot understand what the author is saying	.88
2	I feel intimidated whenever I see a whole page of Mandarin in front of me.	.89
3	Once i get used to it, reading Mandarin is not so difficult.	.89
4	The hardest part of learning Mandarin is reading.	.87
5	I would be happy just learning to speak Mandarin rather than having to learn to read as well.	.79
6	I do not mind reading to myself, but I feel very uncomfortable when I have to read Mandarin aloud.	.83
Culture-bound Apprehension (CB)		
1	Chinese culture and ideas seem very foreign to me.	.89
2	I have to know so much about Chinese history and culture in order to read Mandarin.	.92

Convergent Validity (Cv)

Convergent validity (CV) can be considered the extent to which a set of indicators accurately measures a specific construct (Hair et al., 2014; Awang, 2015; Awang et al., 2018). In other words, it refers to the strength of the relationships among items that are expected to represent a single latent construct. Convergent validity is typically assessed by calculating the average variance extracted (AVE), with a threshold value of 0.5 often considered acceptable (Awang et al., 2018; Awang, 2015; Hair et al., 2014). If the AVE values are lower than 0.5, it indicates that the items have underlying issues which must be addressed or reevaluated, and they are unable to proceed to further analysis. Based on *Table 5*, the AVE values for all constructs surpass the minimum threshold of 0.5. Therefore, it indicates that convergent validity is well established for the measurement model.

Table 5. *Average variance extracted for all constructs.*

Codes	Construct	AVE(Above 0.5)
FD	Form-driven Reading Anxiety	0.724

SE	Self-efficacy and Confidence	0.687
MO	Message-oriented Reading Anxiety	0.738
CB	Culture-bound Apprehension	0.819

Construct validity

Basically, construct validity refers to whether the fit indices for a model meet the required thresholds. To assess construct validity, three main categories of model fit indices are commonly considered: absolute fit indices, incremental fit indices, and parsimonious fit indices. Although there are many sub-criteria that can be considered, Awang et al. (2018) suggested that the most widely used indicators for evaluating model fit are the root mean square error of approximation (RMSEA), the comparative fit index (CFI), and the normed chi-square (χ^2/df) (Awang, 2015; Awang et al., 2018).

According to *Table 6*, the FLRAS scale demonstrated satisfactory performance across all three categories of fitness indices: (1) the root mean square error of approximation (RMSEA) value of 0.0601 indicated a good absolute fit; (2) the comparative fit index (CFI) value of 0.964 exceeded the recommended threshold of 0.90, confirming a strong incremental fit; and (3) the normed chi-square (χ^2/df) value of 2.374 met the criterion of being below 3.0, demonstrating a satisfactory parsimonious fit as suggested by Bentler (1990). Therefore, the construct validity of the FLRAS model can be considered successfully established in this study. *Table 6* illustrates that the FLRAS model has successfully established construct validity, since the three main categories of fit indices: absolute, incremental, and parsimonious, and it have all achieved their respective acceptable thresholds. Therefore, it can be confirmed that the measurement model possesses adequate construct validity.

Table 6. Fitness indices.

Name of category	Name of index	Level of acceptance	Result	Status
Absolute Fit Index	RMSEA	RMSEA < 0.08	0.0601	Achieved
Incremental Fit Index	CFI	CFI > 0.90	0.964	Achieved
	TLI	TLI > 0.90	0.960	
	IFI	IFI > 0.90 (Awang et al., 2018)	0.964	
Parsimonious Fit Index	Chi-Square/df	Chi-Square/df < 3.0 (Bentler, 1990)	2.374	Achieved

Discriminant validity

In the present study, to assess the discriminant validity of the survey, a discriminant validity index summary was developed, as presented in *Table 7*. The diagonal values, indicated in bold, represent the square root of the average variance extracted (AVE) for each construct, while the off-diagonal values represent the correlation coefficients between pairs of constructs. This summary allows researchers to evaluate whether any redundant constructs exist in the model by comparing the correlation coefficients with the square roots of the AVE (Awang, 2015). Specifically, if the correlation between two constructs exceeds the square root of the AVE for either construct, it suggests a lack of discriminant validity, indicating that the constructs may be measuring the same underlying concept. The results are displayed in *Table 7*. As shown in *Table 7*, the discriminant validity of each construct was successfully achieved, as evidenced by the square root of its average variance extracted (AVE) being higher than its correlation value with other constructs in the model (*Table 6*) (Awang et al., 2018; Awang, 2015; Hair et al., 2014). The diagonal values (in bold) in the table represent the AVE for each

construct, and they are higher than any other value in their respective rows and columns. The achievement of discriminant validity is demonstrated by the fact that the diagonal values in *Table 7* meet the threshold for discriminant validity. This indicates that the constructs in the FLRAS are distinct from each other and do not share substantial common variance. Therefore, the survey has successfully established discriminant validity for all the constructs, ensuring their independence and contributing to the robustness of the measurement model.

Table 7. *Discriminant validity index summary.*

Construct/ Codes	FD	SE	MO	CB
Form-driven Reading Anxiety (FD)	0.724			
Self-efficacy and Confidence (SE)	0.130	0.687		
Message-oriented Reading Anxiety (MO)	0.386	0.3217	0.738	
Culture-bound Apprehension (CB)	0.312	0.371	0.103	0.819

Composite reliability

Composite reliability (CR) is defined as a measure used to assess the reliability of constructs within a Structural Equation Model (SEM) (Awang et al., 2018; Awang, 2015; Hair et al., 2014). A composite reliability value of 0.7 or higher indicates good reliability, while a value between 0.6 and 0.7 is considered acceptable (Awang, 2015; Hair et al., 2014). According to Hair et al. (2014), when employing Structural Equation Modeling (SEM) with AMOS, composite reliability is regarded as a more appropriate measure of reliability compared to Cronbach's alpha. This is because CR takes into account the factor loadings of the latent variables and provides a more accurate estimation of internal consistency reliability in SEM. Therefore, the researcher emphasized the use of CR over Cronbach's alpha in this study. The CR results for the present study are presented in *Table 8*. Based on the results presented in *Table 8*, the analysis revealed that the composite reliability scores for all constructs in the FLRAS exceeded the minimum acceptable threshold of 0.6. The construct with the highest composite reliability was Message-oriented Reading Anxiety (MO), with a score of 0.944, indicating strong reliability of the measurement items within this construct. Conversely, Culture-bound Apprehension (CB) obtained the lowest composite reliability score at 0.901; however, it still met the acceptable threshold. In other words, the FLRAS demonstrated satisfactory composite reliability across all constructs. These findings suggest that the measurement items within each construct are reliable and can be used with confidence in further analyses. The high composite reliability scores support the overall internal consistency and dependability of the FLRAS instrument, providing researchers with reliable data to examine the effects and test the hypotheses of interest.

Table 8. *Composite reliability.*

Codes	Construct	CR(Above 0.6)
FD	Form-driven Reading Anxiety	0.929
SE	Self-efficacy and Confidence	0.939
MO	Message-oriented Reading Anxiety	0.944
CB	Culture-bound Apprehension	0.901

Normality assessment

In the final step of the SEM analysis, the normality distribution of the items measuring the constructs in the FLRAS was evaluated. It is important for the skewness

and kurtosis values of the items to fall within an acceptable range, indicating a normal distribution (AsnawSi et al., 2019; Mohamad et al., 2019; Awang, 2015; Hair et al., 2014). Typically, the values ranging from -2 to +2 are considered acceptable. By examining the values of the items in the FLRAS, it can be determined whether the data significantly deviate from normality. If the respective values fall within an acceptable range, this indicates that the data distribution is relatively symmetrical and does not violate the assumption of normality. This is crucial for conducting statistical analyses and accurately interpreting the results. Assessing the values of the items in the FLRAS ensures that the data conform to the assumption of normality, establishing a robust basis for further analysis and interpretation of the study findings. The results of the analysis are presented in *Table 9*, demonstrating the adherence of the data to the assumption of normality. According to *Table 9*, the skewness and kurtosis values for all components in the model fell within the acceptable range of -2 to +2 (Hair et al., 2010). This indicates that the data distribution did not deviate significantly from normality. Therefore, the data distribution in the FLRAS met the requirement for normal distribution.

Table 9. Normality assessment results.

No	Construct/Item	Skewness	Kurtosis
Form-driven Reading Anxiety (FD)			
1	I am worried about all the new characters I have to learn in Mandarin.	-0.62	0.17
2	When I read Mandarin, I get nervous when I do not understand every character.	-0.50	-0.13
3	I get worried when I encounter unknown grammar while reading Mandarin.	-0.81	0.39
4	When reading Mandarin, I usually end up translating word by word without understanding the overall meaning.	-0.66	-0.10
5	By the time I get past the characters in Mandarin, it is hard to remember what I am reading about.	-0.59	-0.28
Self-efficacy and Confidence (SE)			
1	I get upset when I am unsure whether I understand what I am reading in Mandarin.	-0.44	-0.31
2	When I am reading Mandarin, I get so confused that I cannot remember what I am reading.	-0.50	0.37
3	I get upset when I read Mandarin because I have to read things again and again.	-0.31	-0.81
4	I enjoy reading Mandarin.	-0.41	-0.20
5	I feel confident when I am reading in Mandarin.	-0.52	0.19
6	I am satisfied with the level of reading ability in Mandarin that I have achieved so far.	0.31	-0.81
7	I enjoy reading about the history and culture of Mandarin.	-0.17	-0.75
Message-oriented Reading Anxiety (MO)			
1	When reading Mandarin, I understand the words but still cannot understand what the author is saying	-0.35	0.49
2	I feel intimidated whenever I see a whole page of Mandarin in front of me.	0.28	-0.67
3	Once i get used to it, reading Mandarin is not so difficult.	-0.41	-0.60
4	The hardest part of learning Mandarin is reading.	-0.29	-0.58
5	I would be happy just learning to speak Mandarin rather than having to learn to read as well.	-0.35	0.62
6	I do not mind reading to myself, but I feel very uncomfortable when I have to read Mandarin aloud.	-0.34	-0.65
Culture-bound Apprehension (CB)			
1	Chinese culture and ideas seem very foreign to me.	-0.12	-0.96
2	I have to know so much about Chinese history and culture in order to read Mandarin.	-0.06	-0.91

Conclusion

This study was undertaken to validate a survey instrument for measuring Mandarin learners' Foreign Language Reading Anxiety Scale (FLRAS) in a critical context. Findings from the exploratory factor analysis (EFA) suggest that the instrument successfully assessed reading anxiety among Mandarin learners. The results of the EFA demonstrated that all items from the original version of the FLRAS were retained, with each item achieving the minimum factor loading of 0.50 based on the data obtained from the pilot study. However, the present study revealed a four-factor structure, which differs from the original version. Notably, this four-factor structure aligns with the

findings of Miyanaga (2005) and Hwang and Bae (2022), although the allocation of specific items to each factor differed. At the same time, The CFA then confirmed that the FLRAS fulfils the requirements for convergent validity, construct validity, and discriminant validity. Findings of the unidimensionality and normality assessments also indicate that the items in the FLRAS instrument are valid. Therefore, the results from the EFA and CFA have proven that the FLRAS instrument is reliable for measuring Mandarin learners' reading anxiety. In other words, the validation of the FLRAS for Mandarin learners contributes significantly to the field of foreign language acquisition by providing researchers and educators with a robust tool to identify and understand the specific dimensions of reading anxiety in this learner population.

Based on the findings and conclusions of this study, several recommendations can be proposed for future research and pedagogical practice. First, future studies should validate this four-factor FLRAS structure across diverse populations of Mandarin learners, including different proficiency levels and first-language backgrounds, to confirm its generalizability and stability. Second, researchers are encouraged to employ qualitative methods such as interviews to explore why specific items loaded onto particular factors, thereby uncovering the deeper causes of reading anxiety unique to Mandarin's logographic writing system. Pedagogically, instructors should leverage the validated instrument to diagnose specific dimensions of their students' reading anxiety and design targeted interventions, such as character recognition games or comprehension strategy training; to address each factor. Additionally, teacher training programs should raise awareness of these distinct anxiety dimensions, equipping educators to foster a supportive, low-anxiety classroom environment. Finally, curriculum developers could integrate these insights to create materials that gradually build learners' confidence, ultimately enhancing both the effectiveness of Mandarin instruction and students' overall reading experience.

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Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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