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Development and Preliminary Validation of an Instrument to Measure Learners' Perceptions and Attitudes toward Translanguaging Strategy Use

Wanying Zhang
Sunchon National University
Dominador Dizon
Sunchon National University
Yousun Shin
ysshin@scnu.ac.kr

Sunchon National University

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Abstract

This study developed and preliminarily validated the *Learners' Translanguaging Strategy Disposition Questionnaire—Perceptions and Attitudes* (LTSDQ-PA), which consists of four domains: (1) General perception of translanguaging strategy use (GPE); (2) Perception of AI-integrated translanguaging strategy use (PAI); (3) General attitude toward translanguaging strategy use (GAT); and (4) Attitude toward AI-integrated translanguaging strategy use (AIA). A convenience sample of 328 students from the Philippines, South Korea, and China was recruited to conduct exploratory and confirmatory factor analyses, as well as reliability and validity testing. The analysis demonstrated excellent internal consistency (Cronbach's α = 0.936), with acceptable model fit indices (CFI = 0.917, RMSEA = 0.065) and satisfactory discriminant validity (HTMT < 0.85). While AVE values fell slightly below the recommended threshold of .5, they exceeded the squared inter-factor correlations, indicating acceptable convergent validity. By incorporating AI-integrated dimensions into the translanguaging strategy perceptions and attitudes, this study provides a validated instrument to preliminarily measure learners' dispositions across diverse educational contexts, laying the foundation for future research on cross-contextual comparisons.

1. Introduction

In the context of a global educational shift toward multilingualism, translanguaging strategies are gaining recognition as an innovative approach for transcending monolingual constraints and enhancing teaching effectiveness (Canagarajah, 2011). Whether instructors use their native language to explain complex concepts or students utilize multimodal resources to engage in meaning negotiation, the essence of these strategies lies in transforming the learner's entire linguistic repertoire into dynamic cognitive tools (García & Kleifgen, 2020; Makalela, 2018; Wei, 2018). Despite their growing prominence, theoretical research and practical applications explore the efficacy of translanguaging strategies continue to overlook a fundamental methodological issue: how can we accurately and systematically measure learners' perceptions and attitudes toward these strategies?

Existing research faces several measurement dilemmas. First, measurements of learners' perceptions and attitudes are often conflated, lacking a multidimensional theoretical framework to precisely capture this complex psychological construct (Batool et al., 2022; Rahmadani, 2023). Second, numerous instruments did not report comprehensive evidence of reliability and validity, with many lacking systematic validation of their internal structure through EFA and CFA (Ghaemi, 2025). Moreover, whilst focusing on the potential of generative AI, one may overlook cognitive biases that AI may introduce. Research should integrate AI within translanguaging to address this limitation (Jeon et al., 2025). However, learners' attitudes toward AI-integrated translanguaging strategies remain unexplored, as measurement of this dimension is rarely addressed.

Based on the aforementioned dilemmas, this study aims to develop and preliminarily validate a *Learners' Translanguaging Strategy Disposition Questionnaire-Perception & Attitude* (LTSDQ-PA). This study

specifically seeks to define and validate the multidimensional structure of the LTSDQ-PA through factor analysis. This questionnaire seeks to incorporate an emerging dimension measuring perceptions and attitudes toward AI-integrated translanguaging strategies, addressing the potential impact of generative AI on multilingual practice. This study endeavors to preliminarily validate the questionnaire across ESL, EFL and EMI settings, thereby offering empirical evidence for its reliability and validity across these educational contexts.

2. Literature Review

2.1 Theoretical Framework of the Survey Instrument

As shown in Fig. 1, this framework encompasses four major theories that converge on the central construct of LTSD-PA, collectively forming the conceptual basis and dimensional structure of the construct.

Figure 1. Theoretical Framework of the LTSD-PA Construct

To begin with, this research is fundamentally grounded in the translanguaging perspective, which forms the core conceptual foundation and value orientation. Williams (1994) first introduced the term “trawsieithu” (translanguaging) within the context of Welsh language education, describing a bilingual classroom practice where the teacher provides input in Welsh and learners generate output in English. Subsequently, translanguaging has been defined as the process by which bilingual or multilingual users transcend socially constructed linguistic boundaries (Baker, 2011), fluidly drawing on their entire linguistic, symbolic, and modal repertoire to construct meaning, negotiate understanding, and carry out communicative practices (Canagarajah, 2011; García & Wei, 2014). Its essence lies in the dynamic interplay between language, cognition, and social space, exhibiting a spatial turn (Wei, 2018).

The BALLI (Beliefs About Language Learning Inventory), proposed by Horwitz (1985), is the earliest systematic instrument for quantifying learner beliefs in foreign language education. This inventory categorizes beliefs into five dimensions, including foreign language aptitude, difficulty of language learning, nature of language learning, learning and communication strategies, and motivational beliefs and expectations. It employs Likert-type items to directly capture learners’ perceptions and attitudes toward linguistic phenomena. This study draws upon the ‘learning and communication strategies’ domain from BALLI as the prototype for the perception-attitude component. By contextualizing and adapting these items, it constructs the “general perception of translanguaging strategy use” (GPE) and “general attitude toward translanguaging strategy use” (GAT) domains, ensuring that the variables within the LTSDQ-PA are grounded in classical and cross-culturally validated theory.

Computer-Assisted Language Learning (CALL) theory regards technology as an indispensable cognitive and social mediator within the language learning ecosystem (Warschauer, 1996). When digital tools are embedded within learning tasks, learners internalize such machine language as part of their cognitive processing, thereby expanding the boundaries of their language use. With the advancement of AI, the

CALL theory further conceptualizes AI as an immediately accessible symbolic resource, and posits that learners' receptiveness to AI-assisted language strategies should align with their attitudes toward language strategies (Shadiev & Yu, 2024). This validates the inclusion of the 'AI-integrated translanguaging strategies' dimension into the questionnaire.

Psychometric theory provides the methodological foundation of this research (Nunnally & Bernstein, 1994). As the central framework for quantitative instrument validation, it requires rigorous testing for reliability (internal consistency) and validity (construct, discriminant, and convergent validity) to ensure scientific rigor and instrument dependability (Cook & Beckman, 2006). While reliability is necessary for validity, it is not sufficient on its own (Nunnally & Bernstein, 1994). This study strictly adheres to systematic questionnaire development process, aiming to deliver an instrument that meets psychometric standards.

Taken together, the translanguaging perspective provides a framework for identifying and delineating the scope of "translanguaging strategies," clarifying which strategies can be systematically measured within research contexts. BALLI (Beliefs About Language Learning Inventory) provides specific perception-attitude items while CALL theory offers theoretical grounding for introducing the new dimension of 'AI-integrated translanguaging strategies.' Psychometric theory guides dimension refinement, model fit, reliability, and validity testing. Therefore, the LTSDQ-PA is theoretically valid for exploring the perceptions and attitudes of learners in the Philippines, Korea, and China toward translanguaging strategies across diverse educational contexts (ESL, EFL, EMI).

2.2 Translanguaging Strategy Use in Different Educational Contexts

Over the past five years, translanguaging research has shifted from early ideological debates on L1 use to empirically grounded accounts, illustrating how multilingual resources are strategically deployed across diverse educational contexts (García-Mateus & Palmer, 2023; Rebusora & Alawi, 2025; Tai, 2024)

In English Medium Instruction (EMI) contexts, translanguaging mitigates the dual constraints imposed by dense subject knowledge and heavy linguistic load through multimodal strategies integrating visual, linguistic, and gestural resources (Lu et al., 2025). Zhou & Mann (2021) conducted a comparative study of business classrooms in universities in Beijing and Hong Kong. They found that instructors who explained key economic terms in Chinese, while simultaneously using line graphs and gestures, effectively co-activated students' prior economic schema and English vocabulary, thereby enriching subsequent case discussions. Ou and Gu (2022), in a video-based study of musical EMI classrooms, demonstrated how instructors juxtaposed musical notation, gestures, English, and Cantonese to construct a 'spatial resource repository.' This multimodal approach rendered abstract harmonic theory concrete and comprehensible, leveraging multiple channels of input to facilitate learning. The core function of EMI translanguaging remains subject-priority, with strategies instrumentalized for conceptual depth and classroom rapport. Despite its effective application, misalignment between policy and classroom practice has left translanguaging in a state of legitimacy deficit (Hao et al., 2025).

Within the context of English as a Second Language (ESL), translanguaging strategies emphasize 'three-dimensional' support for identity, affect, and learning (Canilao & De Los Reyes, 2023). Parba (2024) contended that the Philippines' ESL policy reflects its colonial history, positioning English as the default language for science and academia, and subsequently, suppressing indigenous languages and practices. Some researchers suggested that strategic L1 use in initial stages of ESL instruction can reduce anxiety and foster trust (Rivera & Mazak, 2017, 2019). However, they advocate gradual reduction of L1 as proficiency improves, balancing emotional support with enriched L2 input (De Los Reyes & Bagona, 2022). Unlike EMI, ESL translanguaging is student-centered, with instructors adapting strategies in real time to evolving classroom dynamics rather than following set patterns (Rebusora & Alawi, 2025).

Within the context of English as a Foreign Language (EFL), Fu and Zhang (2025) examined the translanguaging practices of five Chinese English learners as they produced multimodal videos on Chinese culture. Learners viewed translanguaging strategies as compensatory scaffolding that reduces non-native language limitations, aids comprehension of multimodal resources, clarifies communicative intent, and gradually builds experience with multimodal texts. Kim (2025)'s longitudinal study revealed that Korean learners flexibly adjusted their use of L1 during collaborative tasks. Initially, they used L1 to resolve linguistic issues, but as their confidence increased, its usage reduced. Nevertheless, learners continued to employ L1 strategically for lexical negotiation and affective support. Over time, their attitudes toward L1 evolved from initial hesitation to growing confidence, ultimately leading to intentional use as a communicative strategy.

In EMI classrooms, students encounter intensive subject-matter language exposure, but disciplinary density and English-only policy force translanguaging strategies to remain covert. In contrast, ESL learners, immersed in the target language and benefiting from extracurricular English, use classroom translanguaging for affective-identity support, decreasing social integration pressures. EFL settings, with scarce authentic language domains, rely on translanguaging as compensatory scaffolding to offset limited linguistic resources (Kim, 2025; Wang, 2019).

2.3 Integrating AI-tools in the Practice of Translanguaging Strategies

Advances in AI technology have inspired scholars to envision cross-linguistic possibilities for multilingual learners interacting with AI (Shafiee Rad & Roohani, 2025). For instance, researchers suggest that multilingual learners can fully utilize their linguistic resources to enrich their expressions during turn-based interactions with AI (Tai, 2023; 2024). However, while these technologies hold utopian potential for multilingual education, they also bring about dystopian consequences as described by Payne et al. (2024), noting that 'these technologies often reproduce dominant language ideologies that privilege standardized varieties (p. 553).'

As Bender et al. (2021) pointed out, humans often attribute meaning to language assuming communicative intent from the speaker, even when such language is generated by machines without intent (Kidd & Birhane, 2023; Jeon et al., 2024). Some researchers argue that this tendency may mislead

users into believing that AI-generated content represents authentic societal voices, because human-machine interactions evoke a sense of genuine interpersonal engagement. This cognitive bias can amplify perceived similarities and lead users to underestimate the limitations of AI language (Waluyo & Rouaghe, 2025).

In response, Jeon et al. (2025) propose that researchers and educators should leverage AI's potential through translanguaging while recognizing its limitations. For instance, Chinese EFL learners have been observed freely utilizing their complete linguistic repertoire including Mandarin, dialects, and internet slang while collaborating with AI during problem-solving writing tasks. Through iterative human-machine dialogue, these multilingual insights are progressively woven into final English compositions (Yang & Lin, 2025). In sum, it is imperative to systematically investigate learners' divergent perceptions and attitudes toward AI-integrated translanguaging strategies. Such inquiry enables researchers and educators to refine pedagogical design, mitigate risks, and address AI's limitations.

2.4 Learners' Perceptions and Attitudes on Translanguaging Strategy Use

Previous studies have identified a variety of translanguaging strategies. For instance, Wang & Shen (2024) outlined ways of using L1 to explain ideas, confirm participation, reconstruct background knowledge, and maintain classroom relationships. Zhang et al. (2024) highlighted embodied strategies, and hybrid strategies. Based on classroom ethnography, Canagarajah (2011) analyzed the translanguaging strategies used by a Saudi Arabian student, including recontextualization, interactional, and textualization strategies. Understanding learners' perceptions and attitudes toward translanguaging strategies is essential, as their views influence how effectively such strategies can be implemented and refined in classroom settings.

Regarding learners' perceptions and attitudes, Rivera and Mazak (2017) conducted a case study among Puerto Rican undergraduates, finding that students' evaluations of translanguaging instruction are mostly neutral to positive. The majority of students perceive translanguaging strategies as appropriate, standardized, and respectful. Moreover, Moody et al. (2019) found that American postgraduate students hold highly positive views of using translanguaging strategies in teaching, particularly in social settings and within the field of SLA. Wang (2019) reported that Chinese university students' attitudes toward monolingual and multilingual instruction were split almost evenly between positive and negative views. No significant attitudinal differences were observed across personal preferences, actual usage, and pedagogical expectations. Overall, students' attitudes toward translanguaging strategies are neutral or positive (Batool et al., 2022).

To date, a substantial body of studies using translanguaging-strategy questionnaires, have not examined the construct validity of their instruments (Rivera & Mazak, 2019; Wang, 2019; Zhang et al., 2024). Only a handful of studies have employed exploratory or confirmatory factor analysis (EFA/CFA) in the research context of translanguaging, none has focused specifically on translanguaging strategies. Mason Seng et al. (2024) developed and validated a bilingual-education perception questionnaire for 760 junior-high

students in Taipei. Extreme Groups Approach (EGA) and EFA confirmed high construct validity and internal consistency of the instrument. Ghaemi (2025) validated the Translanguaging Use in Education and Social Settings Questionnaire (TESS) with EFA and CFA. Results showed that six factors explained 76.5% of the variance and model fit was excellent. Structural equation modelling (SEM) also showed translanguaging practices enhance social support and learning self-efficacy. A review of literature suggests that there is a limited availability of standardized, psychometrically validated instruments for measuring learners' perceptions and attitudes toward translanguaging strategies across different contexts.

Most instruments focused on learners' perceptions and attitudes toward translanguaging practices rather than translanguaging strategies (Wang, 2019; Batool et al., 2022; Zhang et al., 2024). Few studies have validated the internal structure of instruments through EFA, CFA, or SEM. Moreover, only a few limited number incorporate the novel perspective of AI-integrated translanguaging strategy into their measurement. Thus, this study aims to address these research gaps through the following research questions:

1. Does the LTSDQ-PA exhibit acceptable internal consistency among learners?
2. What is the underlying factor structure of the LTSDQ-PA according to results from EFA and CFA, and does it confirm its construct validity?
3. Does the LTSDQ-PA provide evidence of acceptable convergent and discriminant validity across its factors?

3. Methodology

3.1 Context and Participants

This study recruited 328 students through convenience sampling from EFL, ESL, and EMI contexts in the Philippines, South Korea, and China during the Fall semester of 2024. Detailed demographic information is presented in Table 1. The Chinese sample comprised the largest proportion (n = 172, 52%), while the Korean sample was the smallest (n = 52, 16%). Females accounted for 63.0% (n = 203) while males accounted for 38.1% (n = 125). Learners at middle school level constituted the largest proportion (n = 134, 41%), while undergraduates represented the smallest proportion (n = 86, 26%). Consequently, the student sample emphasized secondary-school English learners, most of whom self-rated their language proficiency as intermediate.

Table 1
Demographic Profiles

Variables	Details	No. of Participants (n = 328)
Nationality	Philippines	104
	Korea	52
	China	172
Gender	Male	125
	Female	203
Age	Ave.	19.10
Educational level	Middle school	134
	High school	108
	University	86
Years of English Learning experience	Below 5 yrs	42
	Between 5 to 10 yrs	130
	Over 10 yrs	156
Educational context	ESL	93
	EFL	171
	EMI	64

Note. ESL = English as a Second Language; EFL = English as a Foreign Language; EMI = English Medium Instruction.

3.2 Survey Instrument

The questionnaire was constructed using a four-point Likert scale (1 = *Strongly disagree*, 2 = *Disagree*, 3 = *Agree*, 4 = *Strongly agree*) (Appendix 1). Neutral options were intentionally omitted to circumvent common response biases and encourage explicit preferences, thereby enhancing response differentiation (Vaske et al., 2017). This approach specifically addresses East Asians' culturally driven "middle-of-the-road" response tendency (Ju & Chen, 2025). Reducing scale options can shorten response time by 7–12% and decreases acquiescence bias (Ju & Chen, 2025).

3.3 Data Collection Procedures and Data Analysis

To ensure linguistic equality and cultural appropriateness, the original English questionnaire was translated into Korean and Chinese for corresponding participants. Translation accuracy was verified using a feasibility review, which involved native speakers reviewing and back-translating the items. Prior to the main data collection, LTSDQ-PA underwent pilot tested with a smaller sample to ensure clarity and

internal consistency, and feedback from this process was used to refine the questionnaire. The questionnaire were administered via online forms.

Data were analyzed using IBM SPSS and AMOS. The dataset met normal distribution and homogeneity of variance requirements, indicating good data quality. To validate the LTSDQ-PA, Cronbach's alpha testing, EFA, CFA, and SEM were performed to refine the items, evaluate internal consistency, and test construct validity. During the revision of this work, the authors used ChatGPT in all sections for refining and polishing writing. After using this tool, the authors reviewed and edited the content as needed, taking full responsibility for the content of the publication.

4. Results

4.1 Results of Exploratory Factor Analysis (EFA)

EFA was used to identify the underlying factor structure of the questionnaire and to provide preliminary evidence for its construct validity. Initially, each domain comprised ten items, totaling 40 items. Following an initial round of EFA, items with low factor loadings were removed, resulting in 22 items. EFA was then rerun on these remaining 22 items.

As shown in Table 2, the Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) for the questionnaire was 0.937, and Bartlett's test of sphericity (BTS) was significant (χ^2 = 3,499.816, p < 0.001), indicating the data met the criteria for further factor analysis.

Table 2
KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin measure of sampling adequacy		.937
Bartlett's Test of Sphericity	Approx. Chi-square	3499.816
	df	231
	Sig.	.000

Note. KMO = Kaiser-Meyer-Olkin measure of sampling adequacy; BTS = Bartlett's Test of Sphericity.

The scree plot in Fig. 2 confirmed retention of four factors with eigenvalues above 1. As the scree plot gradually flattens after the fourth factor, extracting four factors was considered appropriate.

Figure 2. Scree Plot of Eigenvalues from EFA

Table 3 presents EFA results, showing four main factors: (1) General perception of translanguaging strategy use (GPE), 5 items; (2) Perception of AI-integrated translanguaging strategy use (PAI), 3 items; (3) General attitude toward translanguaging strategy use (GAT), 6 items; and (4) Attitude toward AI-

integrated translanguaging strategy use (AIA), 8 items. Factor loadings reflect the degree of correlation between each item and the factor to which it belongs. Factor loadings for AIA ranged from .485 to .738; GAT from .436 to .761; GPE from .627 to .769; PAI from .507 to .738, GPE showed strong loadings and PAI, although lowest, still exceeded 0.5.

Communality values reflected the extent to which each item is explained by the factor. The communality values ranged from .521 to .703, indicating that the factor provided a relatively good explanation of the items. Factor 1 explained 43.37% of variance. The four factors together explained 59.51% of the total variance, exceeding the social science threshold of 50% (Ghaemi, 2025), indicating that these four factors adequately represented the questionnaire structure.

Table 3
EFA Results of LTSDQ-PA

Factors	Item	Component				Communality	AVE	CR
		1	2	3	4			
Attitude toward AI-Integrated Translanguaging Strategy Use (AIA)	AIA1	.738				.644	.481	.866
	AIA2	.687				.595		
	AIA3	.667				.570		
	AIA4	.619				.540		
	AIA5	.612				.521		
	AIA6	.605				.558		
	AIA7	.524				.561		
	AIA8	.485				.557		
General Attitude toward Translanguaging Strategy Use (GAT)	GAT1		.761			.703	.499	.857
	GAT2		.685			.623		
	GAT3		.669			.611		
	GAT4		.573			.556		
	GAT5		.556			.550		
	GAT6		.436			.586		
General Perception of Translanguaging Strategy Use (GPE)	GPE1			.769		.668	.494	.830
	GPE2			.733		.618		
	GPE3			.674		.582		
	GPE4			.646		.579		
	GPE5			.627		.605		
Perception of AI-Integrated Translanguaging Strategy Use (PAI)	PAI1				.738	.651	.401	.654
	PAI2				.707	.598		
	PAI3				.507	.617		

Note. EFA = Exploratory Factor Analysis; AIA = Attitude toward AI-Integrated Translanguaging; GAT = General Attitude toward Translanguaging; GPE = General Perception of Translanguaging; PAI = Perception of AI-Integrated Translanguaging. AVE = Average Variance Extracted; CR = Composite Reliability. Factor loadings < .40 omitted.

Factors	Item	Component				Communality	AVE	CR
		1	2	3	4			
Sum of eigenvalues (total: 13.10%)		9.542	1.457	1.196	.897			
% variance explained ((total: 59.51%)		43.373	6.623	5.435	4.078			

Note. EFA = Exploratory Factor Analysis; AIA = Attitude toward AI-Integrated Translanguaging; GAT = General Attitude toward Translanguaging; GPE = General Perception of Translanguaging; PAI = Perception of AI-Integrated Translanguaging. AVE = Average Variance Extracted; CR = Composite Reliability. Factor loadings < .40 omitted.

4.2 Internal Consistency of the Scale

The results of Cronbach's alpha reliability testing for all four factors are presented in Table 4. Overall, the questionnaire demonstrated very high internal consistency (α = 0.936). Among the four subscales, three (AIA, GAT, GPE) showed excellent reliability (α > .8). Although the PAI factor showed relatively lower reliability, given its small number of items, this is considered as acceptable.

Table 4
Cronbach's Alpha Reliability Test

Factor	No. of items	Cronbach's Alpha	Overall Cronbach's Alpha
AIA	8	.878	0.936
GAT	6	.854	
GPE	5	.830	
PAI	3	.655	

Note. α = Cronbach's alpha coefficient.

After confirming acceptable internal consistency for four factors, Pearson correlation analysis was performed to examine the relationships among the subscales of LTSDQ-PA. Table 5 presents the Pearson correlations among the four factors, ranging from .508 to .777. These results indicate significant relationships among the subscales of the questionnaire.

Table 5
Inter-Factor Correlation Matrix (Pearson)

Factors	1	2	3
1. AIA	1		
2. GAT	.777*	1	
3. GPE	.631*	.676*	1
4. PAI	.576*	.558*	.508*

Note. **p < .01 (two-tailed). AIA = Attitude toward AI-Integrated Translanguaging Strategy Use; GAT = General Attitude toward Translanguaging Strategy Use; GPE = General Perception of Translanguaging Strategy Use; PAI = Perception of AI-Integrated Translanguaging Strategy Use.

4.3 Results of CFA and Evidence of Construct Validity

Subsequently, the stability of the factor structure and the construct validity were examined and verified through CFA. As presented in Table 6, the chi-square value (χ^2= 2.370) indicated a good model fit. CFI was .917 and TLI was .906, both exceeding the .90 cutoff for a good model fit. Additionally, RMSEA value was .065 (< .08), indicating a good model fit, while SRMR was .062 (< .08), reflecting a low average residual. These results indicate that the hypothesized factor structure fits the observed data well. The overall fit indices confirm that the model's strong and acceptable fit (Brown & Moore, 2012).

Table 6
Model Fit Indices for CFA

Fit Index	Value	Threshold	Interpretation
$\chi^2(df)$	2.370	< 3	Good fit
CFI	.917	> 0.90	Good fit
IFI	.917	> 0.90	Good fit
TLI	.906	> 0.90	Good fit
RMSEA	.065	< 0.08	Good fit
SRMR	.062	< 0.08	Good fit

Note. χ^2 = chi-square; df = degrees of freedom; CFI = Comparative Fit Index; TLI = Tucker-Lewis Index; IFI = Incremental Fit Index; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardized Root Mean Square Residual.

The standardized regression weights shown in Table 7 indicate the strength of association between latent variables and observed variables. Factor loadings ranged from .486 to .960, suggesting that the observed variables effectively reflected the latent constructs well. However, the relatively low loading for PAI 2 (.486) suggests a need for further validation or revision.

Table 7
Standardized Regression Weights

AIA			**Estimate**
	←	**Translanguaging Strategy**	**.928**
GAT	←	Translanguaging Strategy	.960
GPE	←	Translanguaging Strategy	.814
PAI	←	Translanguaging Strategy	.849
AIA1	←	AIA	.697
AIA2	←	AIA	.693
AIA3	←	AIA	.643
AIA4	←	AIA	.721
AIA5	←	AIA	.676
AIA6	←	AIA	.709
AIA7	←	AIA	.713
AIA8	←	AIA	.668
GAT1	←	GAT	.697
GAT2	←	GAT	.715
GAT3	←	GAT	.718
GAT4	←	GAT	.748
GAT5	←	GAT	.689
GAT6	←	GAT	.670
GPE1	←	GPE	.723
GPE2	←	GPE	.711
GPE3	←	GPE	.698
GPE4	←	GPE	.686
GPE5	←	GPE	.695
PAI 1	←	PAI	.831
PAI 2	←	PAI	.486

Note. AIA = Attitude toward AI-Integrated Translanguaging; GAT = General Attitude; GPE = General Perception; PAI = Perception of AI-Integrated. All factor loadings significant at $p < .001$.

AIA			Estimate
	←	**Translanguaging Strategy**	**.928**
PAI 3	←	PAI	.525

Note. AIA = Attitude toward AI-Integrated Translanguaging; GAT = General Attitude; GPE = General Perception; PAI = Perception of AI-Integrated. All factor loadings significant at p < .001.

The path coefficient between AIA and the Translanguaging Strategy was 0.928, indicating a strong relationship. This result suggests that learners with a positive disposition toward translanguaging strategies were much more likely to accept AI-integrated translanguaging strategies. The path coefficients from GPE, and PAI to the second-order factor were also strong (0.814, and 0.849, respectively).

4.4 Evidence of Convergent Validity

Convergent validity assesses whether the indicators accurately measure the same construct (Fornell & Larcker, 1981). Because EFA allows cross-loadings and oblique rotations, factor pattern coefficients can often be inflated. Therefore, convergent validity should be evaluated using STDYX, CR, and AVE (Fornell & Larcker, 1981).

As shown in Table 8, CFA standardized loadings (STDYX λ) for all items ranged from .432 to .766, with *t*-values greater than 8.0 ($p < .001$). Most items met the .50 significance threshold, except GAT 6 (.431) and AIA 8 (.483). Composite Reliability (CR) values for the four factors all exceeded the .60 benchmark (AIA = .860, GAT = .856, GPE = .830, PAI = .654), indicating good internal consistency. The Average Extracted Variance (AVE) for three factors approached but did not reach .50 (AIA = .480, GAT = .495, GPE = .488) while PAI was notably lower at .401. Although most factor loadings were significant and CR exceeded .60, all AVEs ranged from .401 to .495, below the conventional .50 threshold. Thus, convergent validity was marginal for AIA, GAT, and GPE, whereas the PAI domain requires further refinement or additional items to improve its convergent validity.

Table 8
Results of STDYX and AVE (CFA)

Factor / Item	STDYX λ	t-value	CR	AVE(CFA)
AIA	.483-.736	9.5–14.1	.860	.480
GAT	.431-.758	9.1–14.3	.856	.495
GPE	.623-.766	11.6–14.4	.830	.488
PAI	.503-.736	9.0–14.0	.654	.401

Note. STDYX = standardized estimates; t-values > 1.96 significant at p < .05. AVE = Average Variance Extracted; CR = Composite Reliability.

As shown in Fig. 3, SEM revealed a distinct causal hierarchy. In the model, Translanguaging Strategy served as a second-order factor representing learners' perceptive and attitudinal disposition to both general and AI-integrated translanguaging strategies, reflected by four first-order factors (AIA, GAT, GPE, PAI). GAT, as the most proximal first-order factor, exhibited a high path coefficient (.96) with the second-order factor, implying metric near-equivalence ($\lambda \geq 0.95$), and acting as a primary manifest variable of the Translanguaging Strategy construct. Thus, learners' GAT nearly fully determines their preference and evaluation of translanguaging strategies.

Figure 3. SEM Path Model

In sum, these findings confirmed that the second-order model was robust ($\lambda = 0.81 \sim 0.96$), showing solid convergent and structural validity in line with the theoretical hierarchy. The higher path coefficients for attitude indicators (GAT/AIA) compared to perception indicators (GPE/PAI) positioned the attitude factors at the core of the construct, providing empirical support for further item weighing or questionnaire refinement. Importantly, the AI-integrated domains (AIA/PAI, $\lambda = 0.84–0.93$) were retained within the second-order factor. This indicates that the integration of AI does not constitute a distinct dimension but functions as part of the broader translanguaging strategy framework.

4.5 Evidence of Discriminant Validity

The discriminant validity of the LTSDQ-PA was fully supported based on the results of CFA Heterotrait-Monotrait Ratio (HTMT) matrix and Fornell–Larcker criteria. As shown in Table 9, the AVE values for all four factors (.401-.495) were greater than the maximum squared inter-factor correlation ($r^2 = .239$), thus satisfying the Fornell–Larcker criterion.

Table 9
Fornell–Larcker Criterion: AVE and Factor Correlations

Factor	AVE	AIA	GAT	GPE
AIA	.480	—	.224	.201
GAT	.495	.224	—	.239
GPE	.488	.201	.239	—
PAI	.401	.183	.216	.197

Note. Diagonal values are AVE. Off-diagonal values are squared inter-factor correlations. AVE = Average Variance Extracted.

The HTMT ratio in Table 10 ranged from .68 to .80, all below the conservative threshold of .85. This demonstrates that the variance explained by each factor consistently exceeded the variance shared with other factors, suggesting no excessive similarity between factors. As a result, the four factors demonstrated satisfactory discriminant validity.

Table 10
HTMT Heterogeneous-Monolithic Ratio Matrix

Factor			
AIA	—		
GAT	.74	—	
GPE	.71	.80	—
PAI	.68	.78	.75

Note. HTMT = Heterotrait-Monotrait ratio. Values < .85 indicate acceptable discriminant validity (Henseler et al., 2015).

5. Discussion and Conclusions

5.1 Theoretical Implications of the Four-Factor Structure

The four-factor structure yielded by EFA (GPE, GAT, PAI, AIA) maps onto a clear theoretical logic. GPE and GAT capture learners' cognitive evaluation and affective orientation toward general translanguaging strategies, respectively, while PAI and AIA replicate this perception-attitude distinction in the AI context. This distinction is consistent with the BALLI tradition (Horwitz, 1985), which treats learners' psychological constructs as inherently multilayered.

The AI-integrated dimensions did not remain peripheral but were firmly subsumed under the second-order factor (path coefficients = .849 and .928), a finding that warrants closer examination. Research on educational technology acceptance has frequently documented a "dual-pathway" phenomenon (Ertmer et al., 2010), whereby beliefs about pedagogy and beliefs about technology operate independently. However, the participants in this study did not appear to activate a separate technology evaluation framework when confronted with AI-integrated translanguaging strategies. Instead, they treated AI as a natural extension of translanguaging itself. This raises the question of whether the boundary between technology acceptance and pedagogy acceptance is thinning in learning environments where AI has become commonplace. The generalizability of this interpretation remains to be tested, and for populations less experienced with technology or more skeptical of AI, PAI and AIA might well exhibit greater independence.

5.2 Reliability and Validity: Robustness and Limitations

With respect to reliability, the overall Cronbach's α was .936, and the CR values or all four subscales exceeded .60, including PAI with only three items (.654), indicating acceptable internal consistency across dimensions. Convergent validity requires a multifaceted assessment. The AVE values (.401∼.495) fell below the conventional .50 threshold, yet the CR values for all four factors exceeded .60, and each AVE surpassed the squared inter-factor correlations (maximum r^2 = .239), satisfying the relaxed criteria outlined by Fornell and Larcker (1981). Such AVE performance is not without precedent:

Ghaemi (2025) reported comparable findings during validation of the TESS and subsequently improved them by expanding the item pool. The translanguaging strategy construct itself carries a degree of abstraction, and learners struggle to form precise and uniform cognitive representations when evaluating such strategies, and this construct-level characteristic inevitably propagates into the measurement indices.

Discriminant validity presents a clearer picture. The HTMT ratios (.68~.80) fell below the conservative .85 threshold, and the Fornell-Larcker criterion was met, indicating that the four factors retained sufficient distinctiveness while sharing a common higher-order construct. Model fit was likewise satisfactory: CFI = .917, TLI = .906, RMSEA = .065, SRMR = .062. It should be noted that the factor loadings for GAT6 and AIA8 were comparatively modest in the EFA (.436 and .485, respectively). These items touch on identity tensions between language competence and self-evaluation, and between English dominance and L1 tolerance, rendering substantial individual variation in responses unsurprising.

5.3 The Distinctive Profile of PAI

Among the four factors, PAI displayed the most distinctive profile. Only three items, the lowest AVE (.401), and the weakest reliability (α = .655). This pattern of uniformly depressed indices should not be hastily attributed to design flaws; it more likely reflects a fundamental reality—learners have not yet developed a mature and stable cognitive framework for AI-integrated translanguaging strategies.

An examination of item content reveals that the three PAI items address the perceived usefulness of strategic L1 use in AI-assisted English learning, the alternation between L1 and English when using AI tools, and the use of L1 to deepen reflection on AI-generated content. The limited coverage fails to reach potential dimensions such as learners' trust in AI-generated content and cultural sensitivity regarding AI-L1 interaction; the restricted item set naturally depressed the AVE.

Yet this very "weakness" constitutes a unique contribution of the LTSDQ-PA. It provides the first quantitative indication that learners' perceptions of AI-integrated translanguaging strategies remain at an early stage of development. In marked contrast stands AIA (eight items, AVE = .480, CR = .860), suggesting that while learners have formed relatively stable positions at the attitudinal level— "Do I accept this strategy?"—they have not developed equally refined cognitive structures at the evaluative level— "How do I assess its usefulness?" In educational technology research, the typical sequence is cognition preceding attitude; the reversal observed here—attitude preceding cognition—may reflect a specific consequence of AI's rapid penetration into language instruction. Learners rendered affectively favorable judgments before they had fully reasoned through what AI-assisted translanguaging was actually "good for." This carries direct implications for the design of AI pedagogical tools. Developers should go beyond providing technical channels for multilingual switching and help users build a cognitive foundation of "I know why it works" rather than leaving them at the intuitive level of "I feel it works."

5.4 Implications of the Study

Theoretically, this study constructed and preliminarily validated the multidimensional construct of LTSDQ-PA, integrating the perceptions and attitudes toward translanguaging strategies into a single unified psychometric model. This construct synthesized translanguaging perspective, BALLI (Beliefs About Language Learning Inventory), CALL theory, and psychometric theory, providing an operationalized and quantifiable framework for translanguaging strategy research. In addition, this research extends the scope of translanguaging studies into the realm of AI integration by introducing and theorizing the domain of AI-integrated translanguaging strategies. These findings indicate that learners do not necessarily view 'AI-integrated translanguaging strategies' as a fundamentally distinct construct requiring additional cognitive effort. Rather, once learners develop a positive attitude toward translanguaging strategies, they tend to adopt AI-integrated strategies within the same value orientation. In other words, learners do not engage in a dual evaluation, distinguishing technology from method. This finding offers an alternative view to the dual-pathway phenomenon, which differentiates between pedagogical belief and technology belief and is frequently reported in prior research on educational technology acceptance (Ertmer et al., 2010; Tondeur et al., 2017). Accordingly, this study provides a psychological basis for designing and implementing AI-integrated translanguaging strategies which are closely aligned with learners' pedagogical orientations.

Practically, the study provides preliminary quantitative evidence that may inform educational policy discussions on students' perceived usefulness and attitudinal acceptance of translanguaging strategies. These findings from the analysis confirm that LTSDQ-PA can serve as an effective instrument for instructors, enabling them to assess learners' receptivity to translanguaging strategies and inform instructional design decisions. Moreover, these findings equip educational technology developers with data to evaluate students' acceptance of new technologies, refine the integration of AI tools in language learning, and enhance the cultural sensitivity and pedagogical appropriateness of these tools. Methodologically, this study developed and validated a cross-cultural, multi-contextual LTSDQ-PA which demonstrated strong reliability, construct, and discriminant validity, thus filling a gap in quantitative research instruments regarding translanguaging strategies.

5.5 Limitations and Future Directions

Several limitations were identified in this study. First, the sample lacked sufficient balance and representativeness. Specifically, the Korean sample was relatively small, resulting in statistically inadequate weighting, which could possibly limit the generalizability of group-level interpretations. The PAI domain exhibited lower convergent validity and was measured by only three items. The limited number of items may have restricted coverage of key concepts, which could have resulted in an underestimation of learners' actual perceptions of AI-integrated translanguaging strategies. Although this study reported a good model fit for the total sample, it did not conduct a multi-group CFA to test configural, metric, and scalar invariance. EFA and CFA utilized the same convenience sample, thereby failing to achieve rigorous cross-validation. Whilst this is reasonable during the exploratory phase of scale development, the resulting factor structure may be subject to sample-specific biases. Lastly, criterion-related validity remains to be established. The relationship between LTSDQ-PA scores and

theoretically relevant variables—such as actual translanguaging strategy use frequency or language learning motivation—was not examined in this initial validation phase and should be addressed in future research.

For future research, including control groups of native English speakers (such as those in Singapore and Hong Kong) could facilitate a 2×4 design – region (native vs. non-native groups) by context (L1, ESL, EFL, EMI) – thereby allowing examination of the questionnaire's structural stability in settings where English anxiety is minimal or absent. Researchers are also advised to collect additional demographic covariates, including L1, standardized measures of English proficiency, and digital literacy, to provide a stratified sampling basis for subsequent measurement invariance testing. Furthermore, the use of dynamic structural equation modelling (DSEM) could reveal bidirectional causality between attitudes and behaviors, thereby addressing the causal inference limitations inherent in cross-sectional studies.

Declarations

Competing interests:

The authors declare no conflicts of interest.

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Author Contribution

WZ managed data collection and analysis and drafted the manuscript. YS conceptualized and designed the study, contributed to data analysis, and revised the manuscript. DZ contributed to the writing of the introduction and literature review. All authors reviewed and approved the final version of the manuscript.

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Human Ethics and Consent to Participate declarations: This cross-national study was conducted across three educational contexts (the Philippines, South Korea, and China) with the cooperation of the participating educational institutions. The Institutional Review Board of Sunchon National University served as the central ethics oversight body for all three involving nations, given the absence of a unified cross-national IRB. The study was carried out in accordance with the Declaration of Helsinki. Participants were fully informed of the study's purpose, procedures, and their rights prior to completing

the questionnaire. Consent was obtained through voluntary participation in the online survey. For participants under the age of 18, consent was facilitated through the participating schools and classroom teachers.

Data Availability

Data from the study are available upon request.

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Figures

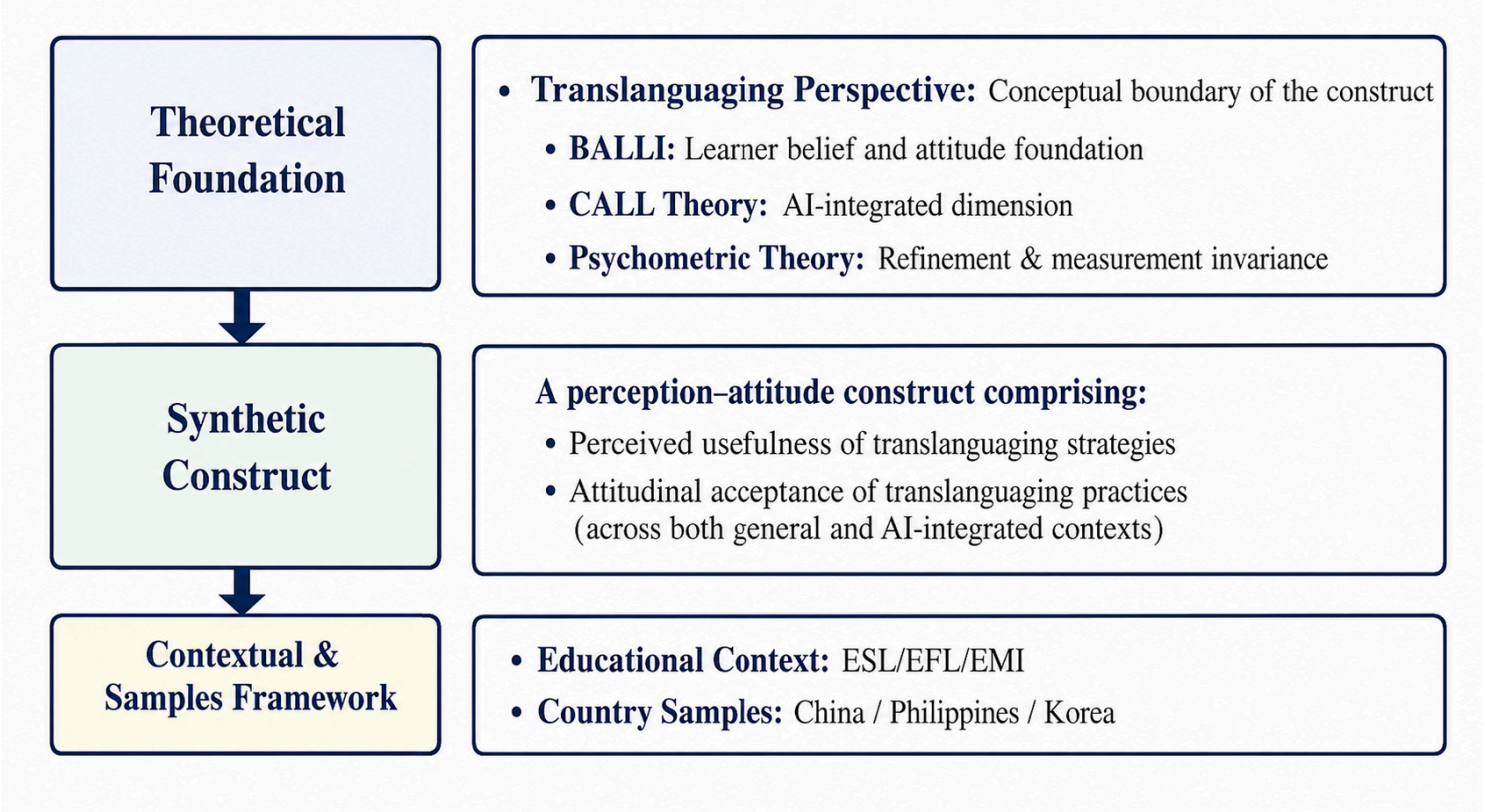


Figure 1

Theoretical Framework of the LTSD-PA Construct

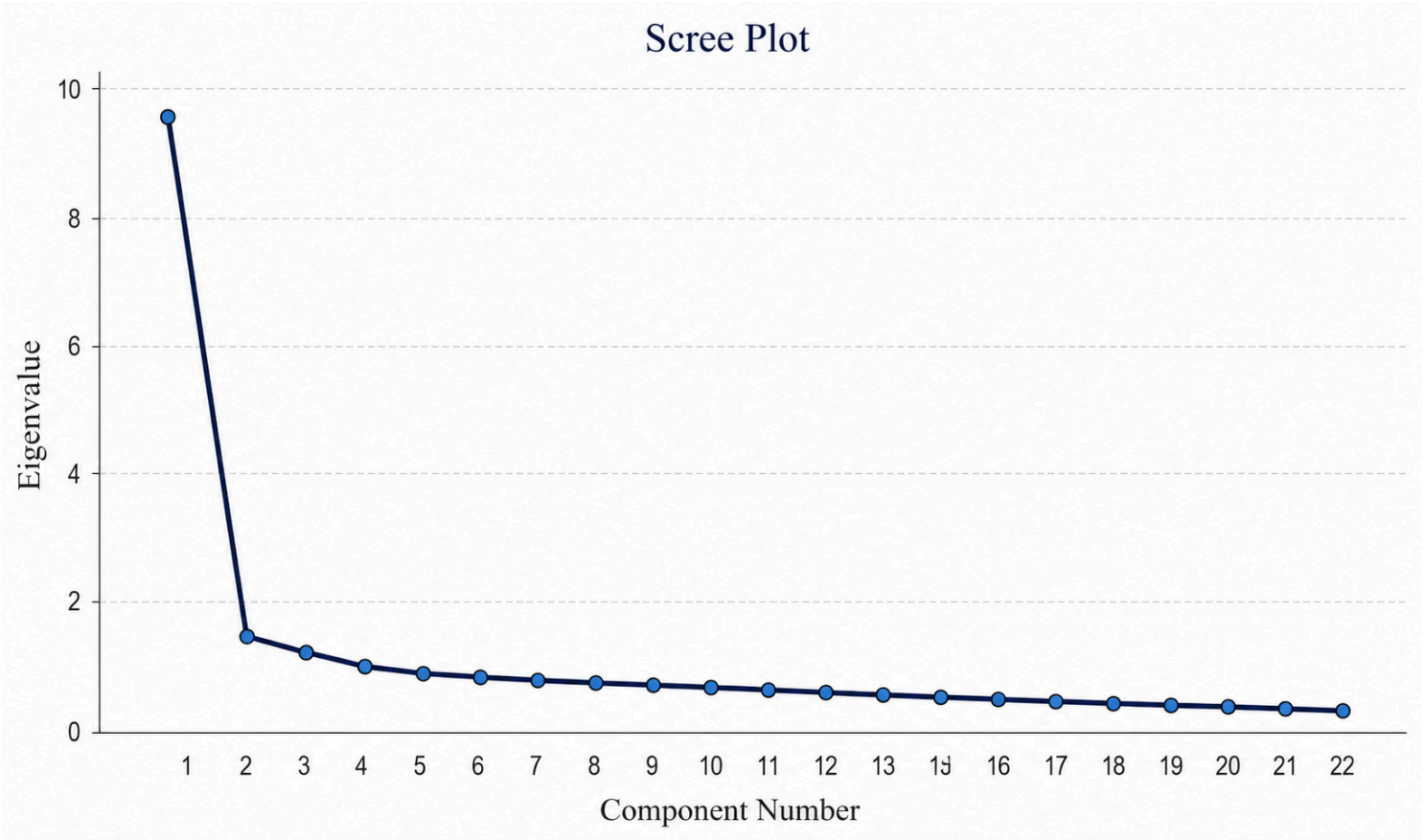


Figure 2

Scree Plot of Eigenvalues from EFA

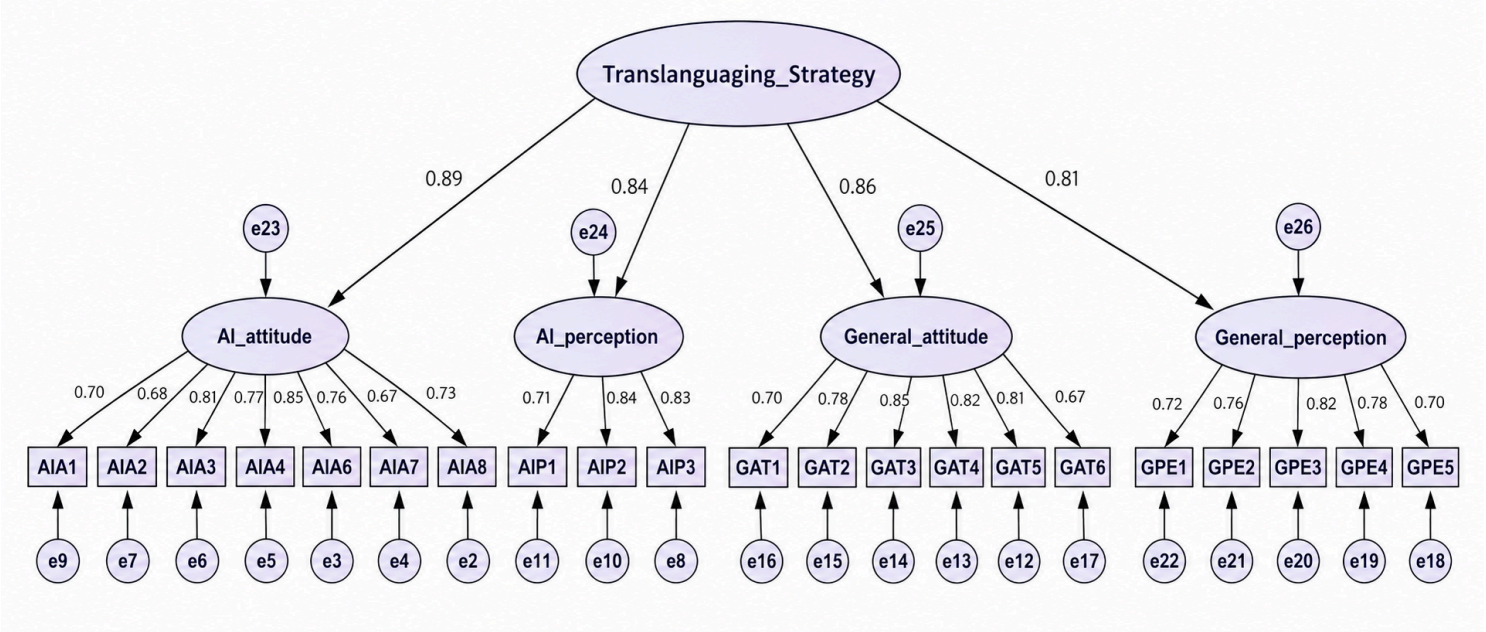


Figure 3

SEM Path Model

Supplementary Files

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- APPENDIX1.docx