Annual Review of Applied Linguistics (2023), **43**, 64–87
doi:10.1017/S0267190523000090

CAMBRIDGE UNIVERSITY PRESS

RESEARCH ARTICLE

Modeling EFL learners' willingness to communicate: The roles of face-to-face and digital L2 communication anxiety

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Abstract

This study proposes and tests a comprehensive model (with demographics, informal digital learning of English, ideal/ought-to L2 self, L2 enjoyment, and self-perceived communication competence) of face-to-face and digital communication anxiety's relationship to willingness to communicate in a second language (L2 WTC) within in-class, out-of-class, and digital contexts. A structural equation model of survey responses from 1,269 Koreans learning English as a foreign language (746 secondary and 523 university students) showed that in all three settings, students with lower anxiety showed greater L2 WTC. Within in-class and out-of-class contexts, students with higher self-perceived English ability had lower face-to-face anxiety, which in turn yielded higher L2 WTC. In digital settings, students with a higher ideal L2 self (i.e., a more positive evaluation of their ability to attain the ideal L2 self) showed less overall anxiety (comprising face-to-face and digital anxieties), which yielded greater L2 WTC. These results suggest that future studies can test whether interventions to lower anxiety can increase L2 WTC across communication venues.

Keywords: Face-to-face L2 communication anxiety; digital L2 communication anxiety; willingness to communicate in a second language

To meet parents', teachers', and others' expectations in exam-oriented contexts, many English as a Foreign Language (EFL) students study English to pass exams but rarely speak it (Kim, 2021). As many of these EFL students do not speak English well, they often do not enjoy learning the language, lack confidence, and may feel anxious or reluctant to speak English (Kiaer et al., 2021). For example, Swedish students in multilingual, communicative-oriented contexts were more willing to communicate in a second language (L2 WTC) than Korean students in monolingual, exam-oriented contexts (Lee & Sylvén, 2021). Also, learners in student-centered, communicative-oriented contexts had higher L2 WTC in digital settings than those in less communicative-oriented, teacher-centered contexts (e.g., Korea; Lee et al., 2022).

L2 WTC, defined as "readiness to enter into discourse at a specific time with a specific person or persons, using an L2" (MacIntyre et al., 1998, p. 547), is a critical precursor of L2 communication (see meta-analysis by Jin & Lee, 2022). Past studies

suggest many potential antecedents of L2 WTC: *demographics* (age and academic year; MacIntyre et al., 2003), *informal digital learning of English* (IDLE; Lee et al., 2021), *ideal/ought-to L2 self* (Zhang et al., 2022), *L2 enjoyment* (Botes et al., 2022), *self-perceived English ability* (Lin, 2019), and *L2 communication anxiety* (Zabihi et al., 2021). However, no published study has simultaneously modeled these antecedents and specified their mechanisms for affecting WTC. Moreover, the number of contexts in which students may experience anxiety has increased, including in-class (i.e., academic), out-of-class, and digital (i.e., nonacademic) settings. However, past studies have not modeled potential differences across these contexts (Jin & Lee, 2022; Kruk & Pawlak, 2022).

To fill this research gap, this study proposes and tests a comprehensive model of how demographics, IDLE, ideal/ought-to L2 self, L2 enjoyment, self-perceived English ability, and face-to-face/digital L2 communication anxiety are simultaneously linked to one another and as well as L2 WTC in in-class, out-of-class, and digital settings. Specifically, we examine survey responses from 1,269 Korean EFL learners (746 secondary and 523 university students) from eleven schools in two cities via structural equation modeling.

Theoretical Framework

L2 Willingness to Communicate (WTC)

MacIntyre et al. (1998) proposed a fluid and comprehensive pyramid framework of trait-like and state-like factors that affect L2 WTC (see Fig. 1). Social and individual contexts (Layer VI in Fig. 1 below) represent stable intergroup climates and personality characteristics. For example, EFL students with more exposure to English or who have had more international experiences than others likely have a more developed international posture and, in turn, are more willing to initiate a conversation in English (Lee et al., 2021; Lee, 2018). The affective-cognitive context (Layer V) encompasses intergroup

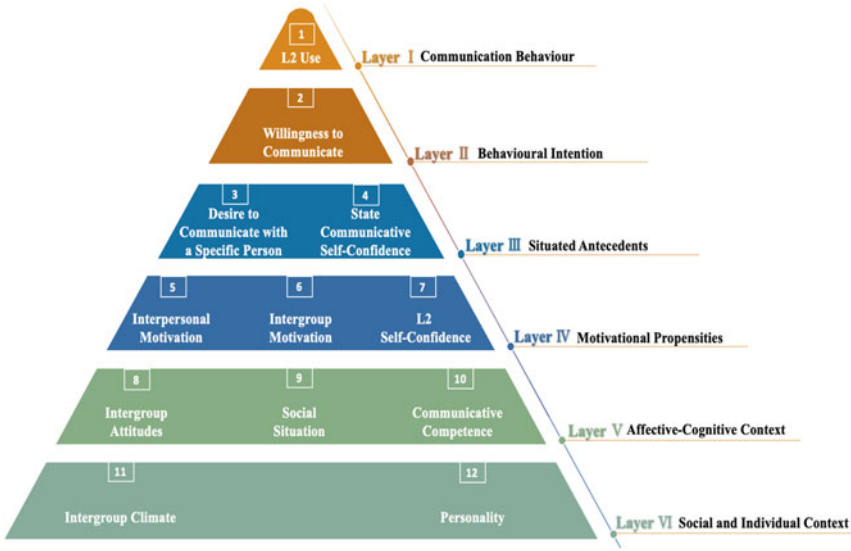

Figure 1. The pyramid framework of L2 WTC.

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attitudes, social context, and communicative skills. For example, students who have more confidence in speaking or who enjoy learning English more than others often have higher L2 WTC (Peng, 2019; Song et al., 2022).

Unlike the above attributes, motivational inclinations (Layer IV) are more vibrant and provisional. These attributes include interpersonal motivation, intergroup motivation, and L2 self-confidence. For example, EFL students who are less anxious to communicate in English than others have a higher L2 WTC (Lin, 2019; see meta-analysis by Shirvan et al., 2019).

In contrast to the above variables, situational antecedents (Layer III) are more context-dependent, and L2 WTC, or behavioral intention (Layer II), is a key antecedent of L2 communication behavior (Layer I; see meta-analysis by Jin & Lee, 2022). L2 WTC is also positively linked to L2 communicative outcomes, such as fluent L2 speaking (Fernández-García & Fonseca-Mora, 2022; Sato & Lam, 2021; Zabihi et al., 2021).

Past studies have examined L2 WTC within in-class, out-of-class, and digital settings (Lee & Hsieh, 2019; Lee et al., 2022; Mulyono & Saskia, 2021). Lee et al.'s (2022) structural equation model demonstrated that EFL learners' L2 WTC differed across these three settings. *L2 WTC in the classroom* indicates EFL students' willingness to speak in English with familiar interlocutors (e.g., teachers and classmates) about curriculum topics in controlled and predictable communication situations. By contrast, *L2 WTC outside the classroom* indicates EFL students' willingness to speak English in natural, unpredictable communication situations with familiar interlocutors (e.g., peers or friends) or unfamiliar ones (e.g., tourists) across a wide range of topics. Lastly, *L2 WTC in digital settings* indicates EFL students' willingness to speak or write about various topics with familiar or unfamiliar interlocutors (e.g., online gamers) in authentic, unpredictable digital communication scenarios.

L2 Communication Anxiety

Horwitz et al. (1986) coined the term Foreign Language Classroom Anxiety (FLCA) to capture concerns expressed by their L2 students (Gregersen & MacIntyre, 2022). FLCA consists of three parts: *communication anxiety*, *test anxiety*, and *fear of negative evaluation*. FLCA can impact any activity in the L2 classroom, but it is especially prevalent during speaking activities (Horwitz et al., 1986). L2 anxiety, a situation-specific construct, is defined as "the worry and negative emotional reaction aroused when learning or using a second language" (MacIntyre, 1999, p. 27). For example, competent EFL speakers suddenly asked a question by an English professor may become anxious or even unable to speak in English. Among L2 learner demographic groups studied in applied linguistics, Asians (mostly EFL learners) have reported the highest levels of L2 anxiety (Dewaele & MacIntyre, 2014). L2 learners with higher L2 anxiety showed less L2 WTC (see meta-analyses by Botes et al., 2022; Jin & Lee, 2022).

L2 communication anxiety (L2 CA) is L2 anxiety specific to communication and often reduces speaking competence and L2 WTC (Woodrow, 2006). While some studies found mild anxiety may improve performance (Scovel, 1978), most studies have found a negative correlation between L2 anxiety and language proficiency (Botes et al., 2020). According to Fredrickson's (2001) *broaden-and-build theory*, EFL learners' negative emotional states (e.g., L2 CA) can narrow their focus (e.g., worry about details), restrict their proactive behaviors (e.g., hesitate), and hinder their English speaking. L2 CA might differ across in-class, out-of-class, and digital contexts, but no past study has determined the relationship between the type of L2 communication and the type of

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context. Based on MacIntyre's (1999) definition, *face-to-face L2 CA* is defined as the worry and negative emotional reaction elicited when learning or using an L2 in face-to-face communicative situations. We propose that face-to-face L2 CA might especially reduce L2 WTC within in-class or out-of-class contexts. By contrast, *digital L2 CA* refers to the anxiety and negative emotional reaction that arises when learning or using the L2 in digital communicative situations.

Antecedents of L2 Communication Anxiety

Past research suggests several potential antecedents of L2 CA: demographics, past learning experiences, self-perceived language ability, enjoyment, and motivation to learn. Younger students (Luo, 2018) who had more schooling (MacIntyre et al., 2003) or studied abroad (Lee, 2018) had less L2 CA. Furthermore, those who engaged in more self-directed English learning experiences in out-of-class digital contexts (e.g., IDLE) reported less L2 CA (Lee et al., 2021). Students with higher self-perceived L2 ability reported less L2 CA (Jiang & Dewaele, 2020; Luo, 2018; Yim, 2014). In addition, those who enjoyed language learning had lower L2 CA ($r = -.31$, $k = 46$, $N = 20{,}946$; meta-analysis by Botes et al., 2022). Regarding motivation, students reporting higher ideal L2 self (i.e., more positive evaluation of their ability to attain their ideal L2 self) or lower ought-to L2 self (i.e., less pressure from others to learn the L2) had lower L2 CA (Papi, 2010; Peng, 2015).

Other Explanatory Variables

To reduce *omitted variable bias* (Cinelli & Hazlett, 2020), we included other L2 WTC-relevant explanatory variables in our explanatory model and statistical model, such as *demographics* (age, educational level, English study duration, English study abroad; Lee, 2018; MacIntyre et al., 2003), *IDLE* (benefits, frequency, productive IDLE, receptive IDLE; Lee et al., 2021), *self-perceived English ability* (Lin, 2019), L2 enjoyment (teacher appreciation, personal enjoyment, social enjoyment; Botes et al., 2022), and *L2 motivation* (ideal L2 self, ought to L2 self; Dörnyei, 2009; Lee & Lee, 2020; Lee & Lu, 2021; Peng, 2015; Zhang et al., 2022).

Research Questions

To address the above research gaps, this study proposes and tests a comprehensive model (including demographics, IDLE, ideal/ought-to L2 self, L2 enjoyment, and self-perceived communication competence) of whether face-to-face or digital communication anxiety is related to L2 WTC within in-class, out-of-class, or digital contexts. Specifically, we address the following research questions (RQs):

RQ1. Is face-to-face or digital communication anxiety related to L2 WTC in the classroom?
RQ2. Is face-to-face or digital communication anxiety related to L2 WTC outside the classroom?
RQ3. Is face-to-face or digital communication anxiety related to L2 WTC in digital contexts?

Unlike past studies examining a link between IDLE and L2 WTC via analyses of single variables (Lee et al., 2021) or between L2 WTC and affective characteristics of IDLE

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learners via person-centered clustering (Lee & Xie, 2022), this study examines L2 CA and L2 WTC via structural equation modeling.

Methods

Context and Participants

From November 2018 to October 2020, we surveyed 1,269 students in ten secondary schools and one university in two major Korean cities. A total of 746 secondary students (of whom 266 were male and 480 were female; $M = 17$ years [range: 14–18 years]) and 523 university and postgraduate students (of whom 179 were male and 344 were female; $M = 20.26$ years [range: 19–27 years]) participated in the study. For $\alpha = .05$ and a small effect size of 0.1, the statistical power for 1,269 participants is .95 (Cohen, 2013). This sample size also exceeded the minimum requirement of 440 for a structural equation model that accounted for at least 16% of the variance in the outcomes (Wolf et al., 2013). During the data collection period, COVID did not disrupt teaching much. Unlike other governments, the Korean government reacted quickly with masks, testing, treatment, and contact tracing, so few schools closed. Most schools quickly adapted and taught face-to-face lessons.

Variables

Survey items included *demographics* (age, educational level, English study duration, English study abroad), *IDLE* (benefits, frequency, productive IDLE, receptive IDLE), *self-perceived English ability*, *English enjoyment* (teacher appreciation, personal enjoyment, social enjoyment), *L2 motivation* (ideal L2 self, ought to L2 self), *L2 CA* (face-to-face, digital), and *L2 WTC* (digitally, in-class, out-of-class).

IDLE (Lee, 2022) has two subscales: (a) *receptive IDLE* (4 items; $\alpha = .869$; e.g., "I listen to songs in English") and (b) *productive IDLE* (6 items; $\alpha = .800$; e.g., "I chat with others in English via social media such as Facebook, Line, WhatsApp, and KaKaoTalk [Korea's most popular social media platform]"). Participants rated their IDLE experience ("How frequently have you engaged in the following IDLE activities over the six months?") on a Likert scale from *never* to *many times per day*. Additionally, participants rated IDLE's benefits (e.g., "How beneficial have IDLE activities been for your English communicative skills?") on a scale from 1 (*least*) to 10 (*most*). Finally, they rated their IDLE frequency (e.g., "How many hours did you spend daily on IDLE activities in the past six months?"); options were: (1) *none*, (2) *less than 1 hour*, (3) *1–2 hours*, (4) *2–3 hours*, and (5) *more than 3 hours*.

Self-perceived English ability was measured using an item from McCroskey and colleagues' (1990) study: "How would you rate your English proficiency?" Participants were asked to respond using a scale from 1 (*lowest*) to 10 (*highest*).

English enjoyment (Dewaele & MacIntyre, 2014; Lee et al., 2021) was measured using three subscales: (a) *teacher appreciation* (3 items; $\alpha = .95$; e.g., "The English teacher is supportive"), (b) *personal enjoyment* (8 items; $\alpha = .90$; e.g., "I enjoy learning English"), and (c) *social enjoyment* (8 items; $\alpha = .94$; e.g., "We laugh a lot in English class"). The scales of English enjoyment, L2 motivation, and L2 CA ranged from 1 (*strongly disagree*) to 5 (*strongly agree*).

L2 motivation (Dörnyei, 2009; Lee & Lu, 2021) was measured using two subscales: (a) *ideal L2 self* (10 items; $\alpha = .94$; e.g., "I can imagine a situation where I am speaking English with foreigners") and (b) *ought to L2 self* (10 items; $\alpha = .91$; e.g., "My parents believe that I must study English to be an educated person").

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L2 CA (Lee et al., 2021; MacIntyre & Gardner, 1994) was measured using two subscales: (a) *face-to-face* (6 items; $\alpha = .91$; e.g., "I feel nervous when I speak English in front of other students") and (b) *digital* (8 items; $\alpha = .90$; e.g., "I feel nervous when I speak English with other fans in an online community").

The items measuring *L2 WTC* (Lee & Xie, 2022) asked participants to rate their WTC in a variety of situations on a scale of 1 (*definitely not willing*) to 5 (*definitely willing*). *L2 WTC* was measured using three subscales: (a) *digital* (5 items; $\alpha = .869$; e.g., "When you have a chance to talk with other foreign fans in English in an online community"); (b) *in-class* (5 items; $\alpha = .946$; e.g., "When you are given a chance to talk freely in an English class"); and (c) *out-of-class* (5 items; $\alpha = .902$; e.g., "When you have a chance to talk in a small group of strangers outside of school").

Data Analysis

We analyzed these data by addressing the following issues with specific statistics: (a) survey measurement errors with *confirmatory factor analyses* (CFA, Joreskog & Sorbom, 2018); (b) multiple outcomes with *structural equation models* (SEM, Joreskog & Sorbom, 2018); (c) simultaneous, indirect, mediation effects with SEM, with *bootstrapping resampling* (Chernick, 2011); (d) many hypotheses' false positives with the *two-stage linear step-up procedure* (Benjamini et al., 2006); (e) comparisons of effect sizes with *Lagrange multiplier tests* (Bertsekas, 2014); and (f) consistency of results across datasets (*robustness*) with separate single outcome models (Kennedy, 2008; see Table 1; for details, see Ahn et al., 2021).

A single survey question can be poorly worded, or an inattentive respondent might accidentally choose an unintended response (two types of measurement error). So, CFA of multiple survey questions regarding a single construct (e.g., anxiety) adjusts for such measurement errors to create an index with greater accuracy than any single variable (Joreskog & Sorbom, 2018).

As multiple outcomes are often correlated with one another, separate single-outcome models can yield biased results, so we use an SEM to model multiple outcomes simultaneously and yield unbiased results (Joreskog & Sorbom, 2018). Similarly, as mediators are often correlated with one another, separate single mediation models can yield

Table 1. Statistics Strategies to Address Each Potential Problem in the Analysis

Potential analysis problem	Statistics strategy
Data Set	
Measurement errors on surveys	• Confirmatory Factor Analysis (Joreskog & Sorbom, 2018)
Outcome variables	
Multiple outcomes (Y_1, Y_2, ...)	• Structural equation model (Joreskog & Sorbom, 2018)
Explanatory variables	
• Simultaneous, indirect mediation effects (X→**M**→Y)	• Structural equation model (Joreskog & Sorbom, 2018) with bootstrapping resampling (Chernick, 2011)
• Many hypotheses' false positives	• Two-stage linear step-up procedure (Benjamini et al., 2006)
• Compare effect sizes ($\beta_1 > \beta_2$?)	• Lagrange multiplier tests (Bertsekas, 2014)
• Consistency of results across data sets (Robustness)	• Separate single outcome models (Kennedy, 2008)

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biased results, so we properly model multiple mediators simultaneously via an SEM with bootstrapping resampling to yield unbiased results (Joreskog & Sorbom, 2018).

As statistically testing any single hypothesis always has a small probability of falsely yielding a significant result (false positive), testing many hypotheses (either separately or simultaneously) increases the probability of a false negative. Hence, the two-stage linear step-up procedure applies slightly stricter significance criteria, reducing the likelihood of a false positive, as shown in computer simulations (Benjamini et al., 2006).

When testing whether the effect sizes of explanatory variables differ, Wald and likelihood ratio tests do not apply at boundary points. Hence, we use Lagrange multiplier tests that apply to the entire dataset and show greater statistical power than Wald or likelihood ratio tests for small deviations from the null hypothesis (Bertsekas, 2014).

Lastly, we test whether the results remain stable despite minor changes in the analysis specification (i.e., robustness; Kennedy, 2008). As a mis-specified equation for any outcome in a multiple outcome model can introduce errors in otherwise correctly specified equations, we model each outcome variable separately to test whether the results remain similar.

Factor Analyses

We tested each construct's (e.g., *L2 enjoyment*) survey items for the type of factor structure (*single, multiple, hierarchical, nested/bi-factor*) with CFA (Joreskog & Sorbom, 2018). Bartlett factor scores yielded unbiased estimates of factor score parameters (Joreskog & Sorbom, 2018). To assess the fit of the CFA (and SEM) to the data, we used the comparative fit index (CFI), Tucker-Lewis index (TLI), root mean square error approximation (RMSEA), and standardized root mean square residual (SRMR). They minimized Type I and Type II errors in many computer simulations (Hu & Bentler, 1999), which specified two fit thresholds: good (CFI & TLI > .95; RMSEA < .06; SRMR < .08) and moderate (.90 < CFI & TLI < .95; .06 < RMSEA < .10; .08 < SRMR < .10).

Explanatory Model

We simultaneously modeled three student outcomes (*WTC in digital contexts*, *WTC in class*, and *WTC outside class*) with a structural equation model (Joreskog & Sorbom, 2018). To estimate the variance explained by each set of explanatory variables and to test for mediation effects (Kennedy, 2008), we entered sequential sets of explanatory variables in chronological order, including structural variables before process variables. Earlier variables can cause later variables but not vice versa. Likewise, fixed structural constructs (e.g., blood type) might affect processes (blood coagulation) but not vice versa.

We entered demographics (age, educational level), then past English study attributes (English study duration, English study abroad). Next, we entered IDLE (benefits, frequency, productive IDLE, receptive IDLE), followed by self-perceived English ability. After entering English enjoyment variables (teacher appreciation, personal enjoyment, social enjoyment), we added motivation (ideal L2 self, ought to L2 self) and then anxiety (face-to-face, digital) variables.

A *nested hypothesis test* ($\Delta\chi^2$LL) determined the significance of each set of explanatory variables (Tabachnick & Fidell, 2019). For greater precision and less multicollinearity, we omit nonsignificant variables (which do not cause omitted variable bias,

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Cinelli & Hazlett, 2020). We used an alpha level of .05 and analyzed residuals for outliers.

Results

Factor Analysis

All factors fit the data at least moderately with high-reliability coefficients (all Rc's exceeded .87; see Table 2; factor loadings and nested factor analysis results are in the appendix).

Summary Statistics

See Table 3 for summary statistics (see Appendix Table 5 for correlation-variance-covariance matrices).

Explanatory Model

The SEM showed a good fit (CFI = .974; TLI = .973; RMSEA = .060; IFI = .974; χ^2 [3,387] = 14,272; $p < .001$; SRMR = .082; RFI = .965; see Fig. 2 and Table 4).

WTC in Digital Contexts

Demographics (age, school), English study, IDLE, perceived English ability, English enjoyment, motivation, and anxiety were linked to WTC in digital contexts. Older students showed greater WTC in class (TE = 0.116), fully mediated via secondary school student (not university; IE = −0.152*−0.100 = 0.015), greater English study duration (IE = 0.424*0.097 = 0.041), more study abroad (IE = 0.138*0.145 = 0.020), greater perceived IDLE benefits (IE = 0.072*0.427 = 0.031) and more personal enjoyment (IE = 0.136*0.071 = 0.010). The indirect effect of explanatory variable X on outcome Y via mediator M [namely, X → M →Y] is the product of the standardized parameter linking X to M multiplied by the total effect of M on Y [namely, (X →M)*(M →Y)]. Full mediation occurs when X no longer has a separate link to Y after accounting for M. University students reported less WTC in digital contexts (TE = −0.100), fully mediated via perceiving less IDLE benefits (IE = −0.179*0.427 = −0.077) and less productive IDLE (IE = −0.070*0.297 = −0.023).

English study (duration, overseas) was also linked to more WTC in digital contexts. Students who studied English for longer durations showed more WTC in digital contexts (TE = 0.097), fully mediated by greater perceived IDLE benefits (IE = 0.175*0.427 = 0.075) and higher perceived English ability (IE = 0.130*0.168 = 0.022). Students who studied abroad showed more WTC in digital contexts (TE = 0.145), fully mediated by more productive IDLE (IE = 0.264*0.297 = 0.078), more receptive IDLE (IE = 0.166*0.267 = 0.044), and higher perceived English ability (IE = 0.132*0.168 = 0.022).

IDLE (perceived benefits, frequency, productive, receptive) was linked to more WTC in digital contexts. Students perceiving greater IDLE benefits showed more WTC in digital contexts (TE = 0.427, DE = 0.079), fully mediated by more productive IDLE (IE = 0.282*0.297 = 0.084), more receptive IDLE (IE = 0.383*0.267 = 0.102), higher perceived English ability (IE = 0.407*0.168 = 0.069), greater enjoyment of English (IE = 0.169*0.291 = 0.049), more personal enjoyment (IE = 0.082*0.071 = 0.006), and greater ideal L2 self (IE = 0.102*0.379 = 0.039). Students using IDLE more often reported

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Table 2. Goodness of Fit Measures for Congeneric Confirmatory Factor Analysis

Factor	#	R_c	α	SRMR	CFI	IFI	TLI	RMSEA	χ^2	*df*	*p*	AGFI	RFI
WTC digitally	5	.877	.869	.008	.999	.999	.998	.031	7	3	.088	.997	.996
WTC in-class	5	.974	.946	.032	.997	.997	.993	.079	45	5	.000	.993	.992
WTC out-of-class	5	.922	.902	.012	.998	.998	.994	.061	17	3	.001	.994	.993
Productive IDLE	4	.931	.869	.009	.999	.999	.998	.026	4	2	.159	.998	.996
Receptive IDLE	6	.880	.800	.035	.982	.982	.967	.057	41	8	.000	.989	.959
Enjoy English[a]	19	.957	.937	.098	.984	.984	.978	.064	775	126	.000	.982	.974
Anxiety[a]	14	.939	.905	.053	.999	.999	.998	.026	108	59	.000	.996	.995
Motivation[a]	20	.951	.928	.093	.996	.996	.995	.038	398	143	.000	.994	.992

Note: # = number of variables; Rc = reliability coefficient; α = Cronbach's alpha; SRMR = standardized root mean square residual; CFI = comparative fit index; IFI = incremental fit index; TLI = Tucker-Lewis index; RMSEA = root mean square error approximation; df = degrees of freedom; AGFI = adjusted goodness of fit index; RFI = relative fit index.
[a]Nested factor

Table 3. Summary Statistics ($N = 1,269$)

Variable	Mean	*SD*	Min.	Median	Max.
WTC digitally	2.914	1.172	1	3	5
WTC in-class	2.683	1.166	1	2.736	5
WTC out-of-class	2.688	1.143	1	2.676	5
Age (years)	18.343	2.146	14	18	27
University[a]	0.578		0	1	1
English study duration (years)	5.706	2.119	1.5	5.5	7.5
Study abroad (years)	0.189	0.596	0	0	3.5
IDLE benefit	5.604	2.491	1	6	10
IDLE frequency	1.166	1.030	0	0.5	3.5
Productive IDLE	1.669	0.950	1	1.290	5
Receptive IDLE	2.620	1.000	1	2.556	5
Self-reported English ability	5.008	2.225	1	5	10
CFA Bartlett factor scores					
• Enjoy English	3.043	0.842	1.024	3.033	4.976
• Personal enjoy	3.073	0.822	1.507	3.069	4.807
• Social enjoy	3.043	0.469	1.834	3.016	4.552
• Teacher appreciation	3.648	1.084	1	3.830	5
• Motivation	2.917	0.391	1.556	2.933	4.056
• Ideal L2 Self	3.308	0.801	1.281	3.390	4.834
• Ought to L2 self	2.708	0.596	1.138	2.675	4.357
• Anxiety	2.730	1.108	1.007	2.845	4.987
• Face-to-face Anxiety	3.442	1.058	1.033	3.482	5
• Digital Anxiety	2.883	0.391	1.182	2.919	4.719

[a]For a dichotomous variable, the mean indicates the proportion of participants with the attribute, and *SD* is not meaningful.

greater WTC in digital contexts (TE = 0.023), fully mediated by higher perceived English ability (IE = 0.139*0.168 = 0.023). Students with more productive IDLE showed greater WTC in digital contexts (TE = 0.297, DE = 0.263), partially mediated by higher perceived English ability (IE = 0.201*0.168 = 0.034). Students with more receptive IDLE also showed more WTC in digital contexts (TE = 0.267, DE = 120), partially mediated by greater English enjoyment (IE = 0.272*0.291 = 0.079), more personal enjoyment (IE = 0.207*0.071 = 0.015), and greater ideal L2 self (IE = 0.141*0.379 = 0.053).

Also, students perceiving greater English ability showed more WTC in digital contexts (TE = 0.168), fully mediated by greater English enjoyment (IE = 0.267*0.291 = 0.078), more personal enjoyment (IE = 0.314*0.071 = 0.022), and greater ideal L2 self (IE = 0.181*0.379 = 0.068). Greater English enjoyment (overall, personal) was linked to WTC in digital contexts. Students who enjoyed English more overall showed more WTC in digital contexts (TE = 0.291, DE = 0.169), partially mediated by greater ideal L2 self (IE = 0.323*0.379 = 0.122). Students with more personal enjoyment of English also showed more WTC in digital contexts (TE = 0.071), fully mediated by greater ideal L2 self (IE = 0.187*0.379 = 0.071).

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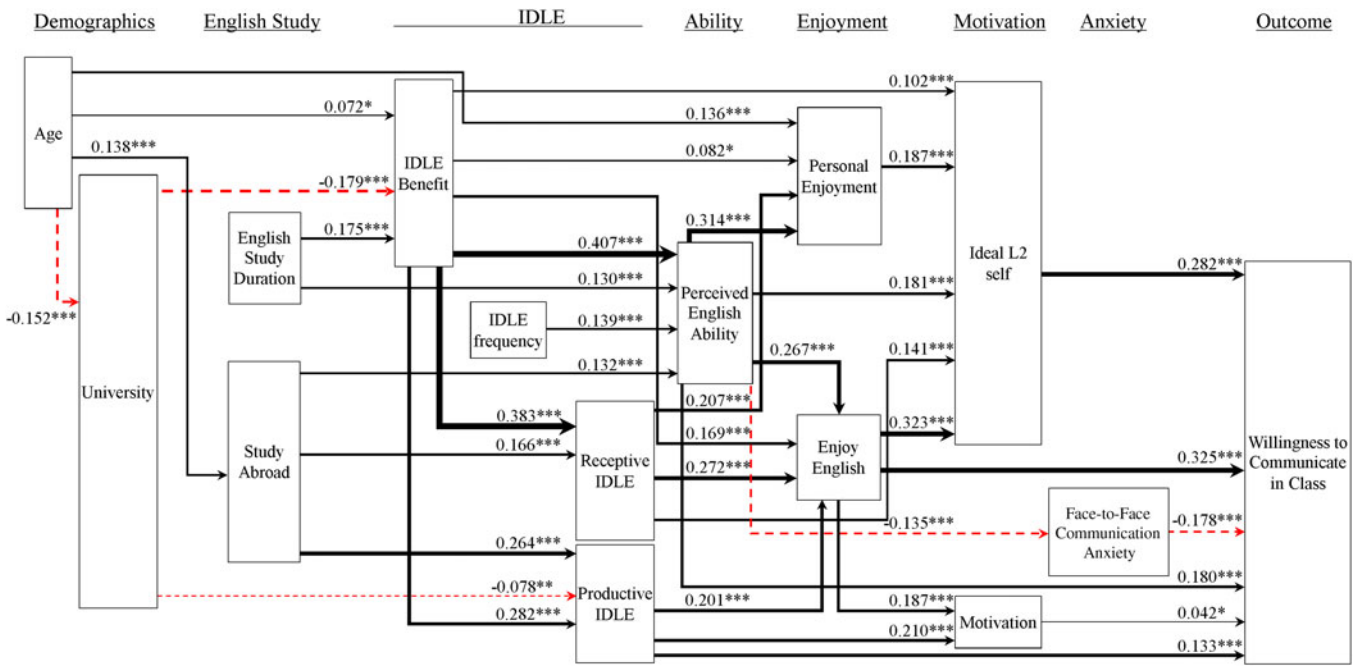

Figure 2. Structural equation model results.This single SEM with three panels demonstrating factors and explanatory variables related to EFL learners' L2 WTC in-class, out-of-class, and digital settings. We do not present observable construct measures because the results are complex. Rectangles are used for all constructs. Thicker arrows represent proportionally larger effect sizes. *p < .05, **p < .01, ***p < .001.

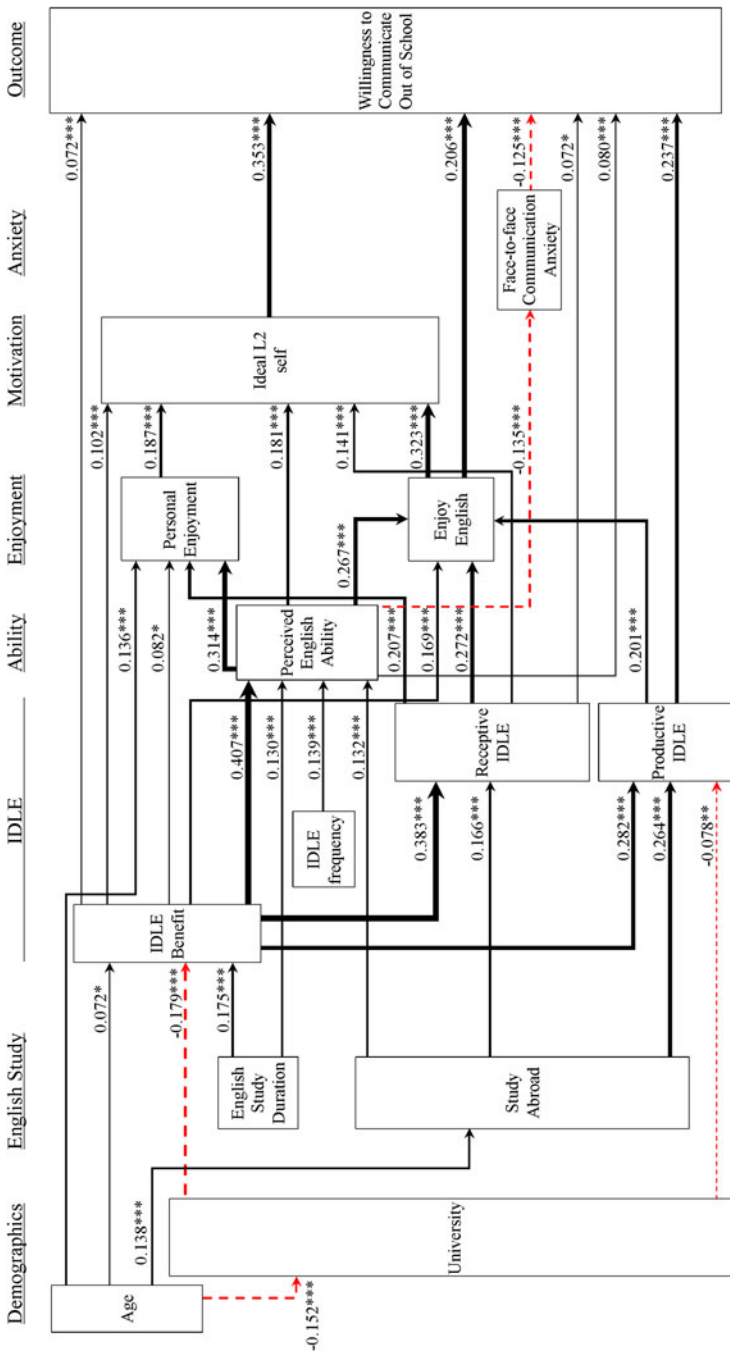

Figure 2. Continued.

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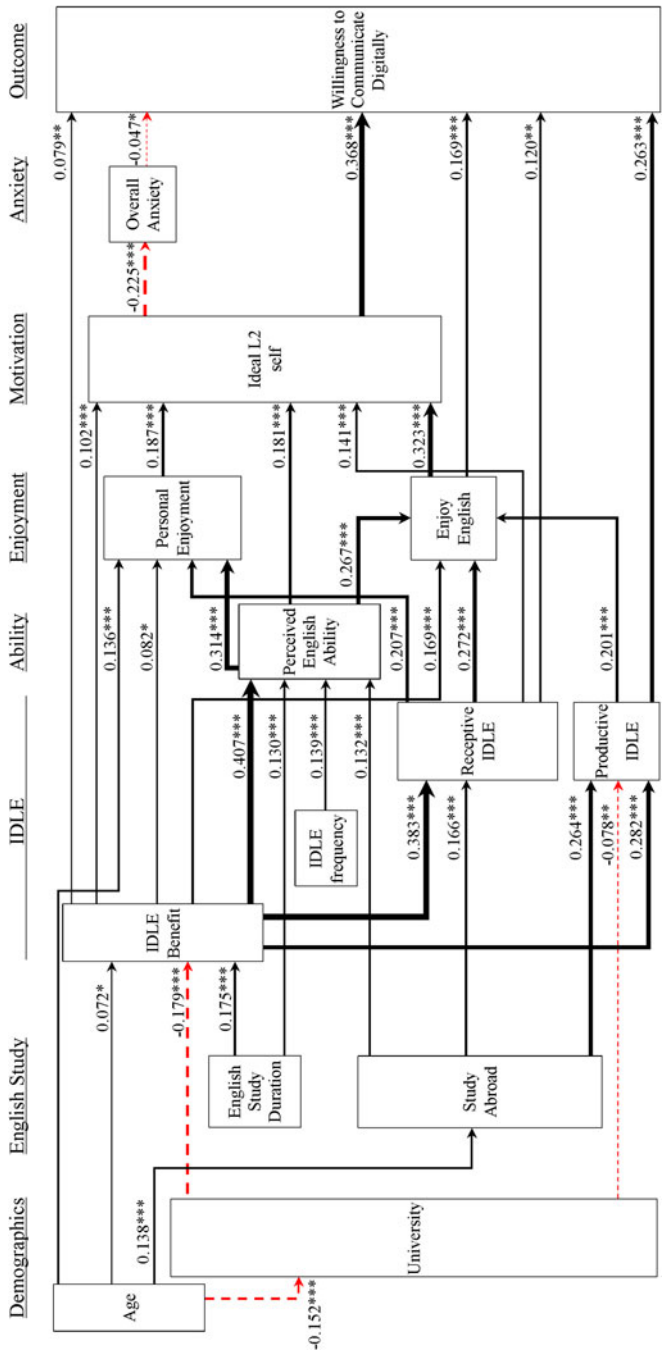

Figure 2. Continued.

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Also, the ideal L2 self and face-to-face anxiety were linked to WTC in digital contexts. Students with greater ideal L2 self (i.e., a more positive evaluation of their ability to attain their ideal L2 self) showed more WTC in digital contexts (TE = 0.379, DE = 0.368), partially mediated by less overall anxiety (IE = -0.225*−0.047 = 0.011). Students with less face-to-face anxiety showed more WTC in digital contexts (TE = DE = −0.047).

WTC In-Class and WTC Out-of-Class

As the WTC in-class and WTC out-of-class results are similar to those for WTC in digital contexts, we focus on the differences in anxiety results (see full results in Fig. 2 and Table 4). Whereas overall anxiety was linked to WTC in digital contexts, only face-to-face communication anxiety was linked to WTC in-class (TE = DE = −0.178) and to WTC out of class (TE = DE = −0.125). Unlike the antecedent of overall anxiety (ideal L2 self), perceived English ability was linked to face-to-face communication (TE = DE = −0.135).

Aside from the above results, all other explanatory variables and interactions were not significant. This SEM accounted for much of the variances (i.e., squared multiple correlations) in WTC in digital contexts (59%), WTC in-class (59%), and WTC out of class (62%). Analysis of residuals showed no substantial outliers. Robustness tests on single outcomes showed similar results.

Discussion

Unlike past studies, this study proposed and tested mechanisms for a comprehensive model of how face-to-face and digital L2 CA relate to L2 WTC in digital, in-class, and out-of-class contexts while accounting for demographics, IDLE, ideal/ought-to L2 self, L2 enjoyment, and self-perceived English ability. In digital contexts, students with higher ideal L2 selves showed less overall L2 CA, which in turn was linked to greater L2 WTC. Within in-class and out-of-class contexts, students with higher self-perceived English ability had lower face-to-face L2 CA, which in turn was linked to higher L2 WTC.

As students with lower L2 CA had higher L2 WTC, EFL secondary and university students with lower levels of L2 CA were more likely to initiate English conversations in digital settings, in-class, and out-of-class. Our findings align with past studies showing that lower L2 anxiety correlates with higher L2 WTC (Botes et al., 2022; Jin & Lee, 2022), but our results provide a more nuanced understanding of how overall L2 CA (including face-to-face and digital L2 anxiety) is linked to L2 WTC in digital contexts, while face-to-face L2 CA is linked to L2 WTC within in-class or out-of-class contexts.

In digital contexts, a greater ideal L2 self was linked to less overall L2 CA and greater L2 WTC. These findings suggest that EFL secondary and university students with more vivid ideal L2 self-images often felt less anxious in both face-to-face and digital communicative situations and more willing to start English conversations in digital settings. As receptive IDLE was positively related to the ideal L2 self, EFL students who consume a variety of English-language content related to their personal and/or professional interests on the internet and TV might strengthen their future L2 self-images (e.g., visualizing themselves speaking fluently about sports games in American radio programs; Lee & Lu, 2021; MacIntyre et al.'s [1998] motivational propensities). Future studies can test whether, by doing so, students can reduce their anxiety about face-to-face and digital English communication (see MacIntyre et al.'s [1998] affective-cognitive

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Table 4. Direct, Indirect, and Total Effects of Each Explanatory Variable on WTC in In-class, Out-of-class, and Digital Contexts

Explanatory	WTC digitally			WTC in-class			WTC Out of class		
Variable	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total
Demographics									
• Age		0.116	0.116		0.118	0.118		0.115	0.115
• University		−0.100	−0.100		−0.087	−0.087		−0.093	−0.093
English study									
• Duration		0.097	0.097		0.117	0.117		0.103	0.103
• Study abroad		0.145	0.145		0.136	0.136		0.146	0.146
IDLE									
• Benefits	0.079	0.348	0.427		0.393	0.393	0.072	0.318	0.390
• Frequency		0.023	0.023		0.052	0.052		0.037	0.037
• Productive	0.263	0.034	0.297	0.133	0.084	0.217	0.237	0.054	0.291
• Receptive	0.120	0.147	0.267		0.176	0.176	0.072	0.136	0.207
• Perceived English ability		0.168	0.168	0.180	0.194	0.374	0.080	0.187	0.267
Enjoy English									
• Overall	0.169	0.122	0.291	0.325	0.112	0.437	0.206	0.114	0.320
• Personal		0.071	0.071		0.060	0.060		0.066	0.066
Motivation									
• Overall				0.042		0.042			
• Ideal L2 Self	0.368	0.011	0.379	0.282	0.040	0.322	0.353		0.353
Anxiety									
• Overall	−0.047	0.000	−0.047						
• Face-to-face		0.116	0.116	−0.178		−0.178	−0.125		−0.125

context or situated antecedents; Papi, 2010; Peng, 2015) and increase their L2 WTC in digital settings (Lee & Lu, 2021; MacIntyre et al.'s [1998] behavioral intention). Unlike previous studies, our findings revealed mediation links, including ideal L2 self-image for WTC digitally, so future studies can test whether these are key mechanisms that can change WTC.

Within in-class and out-of-class contexts, higher self-perceived English ability was linked to lower face-to-face L2 CA and higher L2 WTC. This result implies that EFL secondary and university students with more confidence in their English ability often felt less anxious in face-to-face communicative situations, so they were more eager to initiate English conversations both inside and outside of class. As IDLE frequency was positively related to self-perceived English ability, EFL students who regularly engage in IDLE may become more confident in their English ability (Lee, 2022; MacIntyre et al.'s [1998] affective-cognitive context), less nervous about their in-person, English communication (Jiang & Dewaele, 2020; Luo, 2018; MacIntyre et al.'s [1998] motivational propensities or situated antecedents; Yim, 2014) and have greater L2 WTC in face-to-face settings (Lin, 2019; MacIntyre et al.'s [1998] behavioral intention). In addition, our study is the first to systematically show mediation variables that link demographic variables to L2 WTC. Future experimental or longitudinal studies can test whether these mediation variables are mechanisms by which competent EFL learners with less face-to-face L2 CA can achieve higher L2 WTC.

Pedagogical Implications

These findings can inform teachers using teaching strategies to improve L2 WTC across contexts. As students who participated in IDLE activities more often than others reported higher self-perceived English ability, teachers can test whether encouraging and helping students plan and participate in IDLE activities helps them gain confidence in their English ability, reduce L2 CA in face-to-face settings, and raise their willingness to speak English in class and out of class.

As students who participated in receptive IDLE reported more vivid ideal L2 self-images, teachers can model their IDLE activities (e.g., watching TED talks) to foster students' ideal L2 self-images (e.g., sharing meaningful practice on a global stage). Teachers can also test whether having students share their IDLE activities (e.g., listening to baseball games) and corresponding ideal L2 self-related objectives (e.g., becoming an international baseball game broadcaster), resources (e.g., YouTube, Apple TV+), and strategies (e.g., watching a baseball game with subtitles, taking notes, googling unfamiliar English idioms; Lee, 2022) further cultivates students' ideal L2 self-images, reduces their L2 CA and helps them become more willing to communicate in digital settings.

Limitations and Implications for Research

This study's limitations include its narrow definition and measures of anxiety, cross-sectional data, single country, and limited contexts. We defined anxiety narrowly as an emotion, but anxiety can include physical manifestations (e.g., high blood pressure, stomachache), so future studies can use a broader definition and include physical measures. As this study's cross-sectional data cannot demonstrate causal links, future research can include qualitative, experimental, or longitudinal studies. This study only examined EFL learners in two cities in one country, so future studies can include students from more countries. As this study only considered three general settings

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(in-class, out-of-class, digital), future studies can examine specific settings (e.g., playgrounds, parties, work, etc.).

Conclusion

We proposed and tested a comprehensive model of how face-to-face or digital L2 communication anxiety affects L2 WTC in in-class, out-of-class, and digital contexts (with demographics, IDLE, ideal/ought-to L2 self, L2 enjoyment, and self-perceived communication competence). Our findings show that, overall, L2 communication anxiety differs from face-to-face L2 communication anxiety, so L2 researchers should revise their theoretical models accordingly. Specifically, higher self-perceived English ability was linked to lower face-to-face anxiety, which was also associated with higher L2 WTC both in-class and out-of-class. Also, a higher ideal L2 self was linked to less overall anxiety (comprising face-to-face and digital anxieties), which in turn yielded greater L2 WTC in digital settings. These results enhance our understanding of how different types of L2 communication anxiety may influence L2 WTC across contexts and suggest that future studies test whether interventions to lower anxiety can increase L2 WTC across communication venues.

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Cite this article: Lee, J. S., & Chiu, M. M. (2023). Modeling EFL learners' willingness to communicate: The roles of face-to-face and digital L2 communication anxiety. *Annual Review of Applied Linguistics*, *43*, 64–87. https://doi.org/10.1017/S0267190523000090

Appendix: Ancillary Analyses

Nested Factors

Table 1. Factor loadings, standard errors and uniqueness of congeneric factors

Variable		Standardized Factor Loadings	SE	Uniqueness
WTC in-class				
	WTC1	0.908	0.010	0.177
	WTC2	0.939	0.008	0.118
	WTC3	0.918	0.010	0.157
	WTC4	0.967	0.006	0.064
	WTC5	0.909	0.010	0.173
WTC out-of-class				
	WTC6	0.713	0.021	0.492
	WTC7	0.766	0.019	0.413
	WTC8	0.875	0.014	0.234
	WTC9	0.856	0.015	0.268
	WTC10	0.930	0.012	0.136
WTC digital				
	WTC11	0.706	0.025	0.502
	WTC12	0.837	0.019	0.299
	WTC13	0.881	0.018	0.224
	WTC14	0.697	0.024	0.515
	WTC15	0.719	0.023	0.483
Productive IDLE				
	IDLE18	0.894	0.013	0.200
	IDLE19	0.911	0.013	0.170
	IDLE20	0.829	0.021	0.313
	IDLE21	0.846	0.018	0.285
Receptive IDLE				
	IDLE9	0.793	0.018	0.372
	IDLE10	0.608	0.026	0.631
	IDLE13	0.572	0.025	0.672
	IDLE14	0.702	0.023	0.507
	IDLE15	0.738	0.021	0.456
	IDLE16	0.850	0.015	0.277

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Table 2. Lambda matrix of nested factor of overall anxiety with face-to-face anxiety and online anxiety

	Face-to-face Anxiety	Online Anxiety	Overall Anxiety
ANX1	0.704*** (0.021)		0.587*** (0.025)
ANX2	0.723*** (0.022)		0.564*** (0.026)
ANX3	0.727*** (0.021)		0.605*** (0.025)
ANX4	0.470*** (0.027)		0.659*** (0.023)
ANX5	0.398*** (0.030)		0.705*** (0.020)
ANX6	0.293*** (0.031)		0.708*** (0.021)
ANX7		−0.017 (0.042)	0.930*** (0.011)
ANX8		0.006 (0.044)	0.937*** (0.011)
ANX9		0.019 (0.042)	0.947*** (0.009)
ANX10		0.022 (0.042)	0.945*** (0.010)
ANX11		0.325*** (0.041)	0.834*** (0.018)
ANX12		0.326*** (0.043)	0.837*** (0.018)
ANX13		0.473*** (0.041)	0.881*** (0.019)
ANX14		0.426*** (0.040)	0.883*** (0.018)

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Table 3. Lambda matrix of nested factor of overall motivation with ideal L2 self and ought-to L2 self

	Ideal L2 Self	Ought to L2 self	Motivation
MOT1	0.849*** (0.018)		0.486*** (0.031)
MOT2	0.850*** (0.018)		0.503*** (0.030)
MOT3	0.863*** (0.018)		0.494*** (0.030)
MOT4	0.865*** (0.018)		0.483*** (0.031)
MOT5	0.851*** (0.019)		0.508*** (0.031)
MOT6	0.794*** (0.022)		0.555*** (0.031)
MOT7	0.739*** (0.024)		0.577*** (0.030)
MOT8	0.513*** (0.032)		0.639*** (0.029)
MOT9	0.702*** (0.026)		0.603*** (0.030)
MOT10	0.722*** (0.026)		0.615*** (0.029)
MOT11		0.525*** (0.041)	0.592*** (0.036)
MOT12		0.793*** (0.028)	0.419*** (0.042)
MOT13		0.801*** (0.029)	0.462*** (0.041)
MOT14		0.503*** (0.041)	0.656*** (0.033)
MOT15		0.630*** (0.037)	0.642*** (0.035)
MOT16		0.730*** (0.035)	0.571*** (0.040)
MOT17		0.324*** (0.044)	0.729*** (0.028)
MOT18		0.454*** (0.046)	0.780*** (0.030)
MOT19		0.388*** (0.047)	0.818*** (0.027)
MOT20		0.675*** (0.036)	0.599*** (0.037)

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Table 4. Lambda matrix of nested factor of overall English enjoyment with personal enjoyment, social enjoyment, and teacher appreciates me

	English enjoyment			
	Personal	Social	Teacher appreciates me	Overall
ENJOY1	−0.058 (0.041)			0.769*** (0.016)
ENJOY2	0.113* (0.051)			0.701*** (0.018)
ENJOY3	0.288*** (0.035)			0.883*** (0.011)
ENJOY4	0.276*** (0.033)			0.922*** (0.009)
ENJOY6	−0.103** (0.036)			0.901*** (0.011)
ENJOY11	0.105** (0.039)			0.779*** (0.016)
ENJOY12	0.396*** (0.040)			0.913*** (0.011)
ENJOY13	0.174*** (0.035)			0.806*** (0.015)
ENJOY5		−0.023 (0.025)		0.835*** (0.014)
ENJOY7		0.003 (0.021)		0.889*** (0.011)
ENJOY8		0.096* (0.048)		0.900*** (0.010)
ENJOY9		0.653* (0.302)		0.921*** (0.010)
ENJOY10		0.021 (0.024)		0.949*** (0.007)
ENJOY14		−0.059 (0.038)		0.868*** (0.012)
ENJOY18		−0.073 (0.040)		0.942*** (0.008)
ENJOY19		−0.072 (0.041)		0.888*** (0.011)
ENJOY15			0.407*** (0.029)	0.866*** (0.013)
ENJOY16			0.513*** (0.026)	0.832*** (0.014)
ENJOY17			0.487*** (0.026)	0.842*** (0.014)

https://doi.org/10.1017/S0267190523000090 Published online by Cambridge University Press

Table 5. Correlations, variances, and covariances on the lower left, diagonal, and upper right matrices

	Variable/factor	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	Willingness to Communicate																		
1	WTC in class	**1.36**	0.99	0.85	0.28	−0.10	0.52	0.17	1.20	0.22	0.45	0.47	1.44	0.61	0.50	0.17	0.52	−0.21	−0.28
2	WTC outside	0.74	**1.30**	1.01	0.42	−0.10	0.52	0.18	1.28	0.22	0.52	0.53	1.30	0.54	0.48	0.14	0.54	−0.23	−0.22
3	WTC digital	0.62	0.75	**1.37**	0.27	−0.07	0.49	0.12	1.22	0.23	0.52	0.56	1.12	0.51	0.46	0.14	0.54	−0.24	−0.11
	Demographics																		
4	Age	0.11	0.17	0.11	**4.60**	−0.16	1.92	0.18	0.92	−0.25	0.03	0.05	0.73	0.24	0.42	0.05	0.41	−0.22	0.05
5	University	−0.18	−0.18	−0.13	−0.15	**0.24**	−0.06	−0.06	−0.25	0.00	−0.09	−0.06	−0.25	−0.07	−0.08	−0.03	−0.07	0.02	0.03
	English study																		
6	Duration	0.21	0.22	0.20	0.42	−0.06	**4.49**	0.16	1.14	0.14	0.22	0.28	1.23	0.27	0.33	0.05	0.49	−0.17	0.05
7	Study abroad	0.24	0.27	0.17	0.14	−0.19	0.13	**0.36**	0.20	0.09	0.17	0.12	0.38	0.10	0.08	0.03	0.10	−0.05	−0.04
	IDLE																		
8	Benefits	0.41	0.45	0.42	0.17	−0.20	0.22	0.14	**6.20**	0.44	0.75	0.93	2.94	0.94	0.86	0.22	0.87	−0.25	−0.21
9	Frequency	0.19	0.19	0.19	−0.11	0.00	0.06	0.15	0.17	**1.06**	0.15	0.22	0.60	0.21	0.20	0.05	0.14	−0.02	0.01
10	Productive	0.41	0.48	0.47	0.01	−0.19	0.11	0.30	0.32	0.15	**0.90**	0.52	0.81	0.30	0.23	0.10	0.25	−0.09	−0.08
11	Receptive	0.40	0.46	0.48	0.02	−0.13	0.13	0.20	0.37	0.22	0.55	**1.00**	0.77	0.35	0.29	0.12	0.30	−0.03	−0.04
12	Perceived English ability	0.56	0.51	0.43	0.15	−0.23	0.26	0.28	0.53	0.26	0.38	0.34	**4.95**	0.95	0.90	0.22	0.89	−0.41	−0.45
	Enjoy English																		
13	Overall	0.62	0.56	0.52	0.13	−0.16	0.15	0.19	0.45	0.24	0.37	0.41	0.51	**0.71**	0.50	0.13	0.36	−0.04	−0.02
14	Personal	0.53	0.52	0.48	0.24	−0.21	0.19	0.17	0.42	0.24	0.29	0.35	0.49	0.73	**0.67**	0.10	0.34	−0.10	−0.07
	Motivation																		
15	Overall	0.37	0.31	0.30	0.06	−0.16	0.07	0.14	0.22	0.12	0.28	0.30	0.25	0.40	0.32	**0.15**	0.06	0.03	0.01
16	Ideal L2 Self	0.55	0.59	0.57	0.24	−0.18	0.29	0.21	0.44	0.17	0.32	0.38	0.50	0.53	0.52	0.20	**0.64**	−0.18	−0.08
	Anxiety																		
17	Overall	−0.16	−0.19	−0.18	−0.09	0.04	−0.07	−0.07	−0.09	−0.02	−0.09	−0.03	−0.17	−0.05	−0.11	0.08	−0.20	**1.23**	0.65
18	Face-to-face	−0.22	−0.18	−0.09	0.02	0.06	0.02	−0.07	−0.08	0.01	−0.07	−0.03	−0.19	−0.02	−0.09	0.03	−0.09	0.56	**1.12**