



ORIGINAL ARTICLE

Language anxiety does not affect the growth of L2 reading achievement: The latent growth curve model approach

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Abstract

Second language (L2) anxiety has been proposed to play a causal role in L2 achievement. However, most studies have failed to acknowledge confounding variables that may be relevant to the study of anxiety and L2 achievement or to investigate the causal effect of L2 anxiety using longitudinal data. For these reasons, we investigated the effect of *L1 reading achievement*, *L2 aptitude*, and *L2 anxiety* as covariates on the growth of L2 reading achievement across three time points. We used the latent growth curve model (LGCM) to estimate the growth trajectory of US secondary school students' L2 reading growth in Spanish ($N = 307$) over three school years. The findings showed that students' L1 reading achievement and L2 aptitude strongly and significantly predicted L2 reading achievement growth. However, L2 anxiety did not predict L2 reading achievement growth. Findings suggest that growth in L2 reading achievement depends on the language-related skills used for L1 reading and the language skills that comprise L2 aptitude, but not on anxiety. Similar to past cross-sectional studies, L2 anxiety related only to initial levels of L2 reading achievement, suggesting that anxiety reflects students' initial experience of L2 reading but not their L2 achievement.

Keywords: L2 anxiety; L1 reading; L2 aptitude; L2 achievement; latent growth curve modeling (LGCM)

Introduction

Numerous theories have been advanced by L2 educators to explain why some students display individual differences (IDs) in L2 achievement. One prominent affective explanation for these IDs has been that a “special” type of anxiety—foreign language, or L2 anxiety—purportedly manifests itself only for L2 learning. L2 anxiety has been the most studied affective factor in the L2 field (Papi & Khajavy, 2023). L2 anxiety is thought to produce negative emotional reactions and create

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problems with reading, writing, speaking, and comprehending a L2 (Gkonou, Daubney, & Dewaele, 2017). L2 researchers have developed surveys thought to determine the presence and amount of anxiety for L2 learning. The prominent scale in many L2 studies has been the Foreign Language Classroom Anxiety Scale (FLCAS; Horwitz, Horwitz, & Cope, 1986, which was designed by its authors to measure general anxiety for L2 learning. The Foreign Language Reading Anxiety Scale (FLRAS; Saito, Garza, & Horwitz, 1999) was introduced to determine anxiety for L2 reading.

Most studies conducted with FLCAS and FLRAS have failed to consider variables such as first language (L1) achievement, including L1 literacy and language skills, as well as L2 aptitude, that is, cognitive abilities essential for learning a second language, when investigating the relationship between anxiety and L2 achievement. Failure to include L1 variables and L2 aptitude in the study of L2 anxiety has certain consequences for empirical research (Sparks & Alamer, 2023; Sparks & Dale, 2023). For example, do students' levels of L1 achievement and/or L2 aptitude confound the relationship between anxiety and L2 achievement? In addition to overlooking these important variables, most empirical studies, including meta-analyses, have failed to consider longitudinal data in their analysis but relied mainly on cross-sectional data to draw their conclusions. With such data characteristics, one cannot be certain which variable impacts the other over time. That is, claiming causal relationships from cross-sectional data carries a risk of inappropriately attributing causality, even when using advanced statistical methods (Alamer & Alrabai, 2023; Collier, 2020).

Careful investigations on the L2 achievement–L2 anxiety relationship have implications for all areas of L2 education, including research, measurement, pedagogy, and theory. In particular, since reading is a language-based skill (see Koda, 2005; Snowling & Hulme, 2012; Stanovich, 2000), it is important for L2 teachers to know whether more and less successful L2 reading achievement is affected more by students' language skills and/or their anxiety. The purpose of the present study is to explore the effect of L1 reading achievement, L2 aptitude, and L2 anxiety on growth of L2 reading in a group of US L2 learners studying Spanish over three years of high school L2 courses. The study used latent growth curve modeling (LGCM) to estimate the growth trajectory of students' L2 reading achievement in a precise manner. In the literature review, we examine studies with the FLCAS and FLRAS that have supported the L2 anxiety hypothesis. Then, we review studies that have challenged the L2 anxiety hypothesis.

Literature review

Research with the FLCAS

The instrument used to measure anxiety for L2 learning for many years is the FLCAS (Horwitz, Horwitz, & Cope, 1986). Studies with this instrument have found negative relationships between learners' anxiety and their L2 course grades (Zhang, 2019; Zhao et al., 2013), L2 achievement levels (Marcos-Llinás & Garau, 2009), L2 oral proficiency, and L2 listening comprehension (Elkhafafi, 2005; Hewitt & Stephenson, 2012; Phillips, 1992). Other investigations have found that good L2 learners can also report high levels of anxiety on the FLCAS (Horwitz, 2010; Trang, 2012).

More recently, several meta-analyses on the L2 anxiety–achievement relationship in several L2s have reported the negative relationship between L2 anxiety and L2 achievement (Botes et al., 2020; Oteir & Al-Otaibi, 2019; Teimouri et al., 2019; Zhang, 2019). But, most of these meta-analyses did not include measures of L1 language achievement and L2 aptitude; thus, the results could not estimate the potential impact of these confounding variables on the L2 anxiety–L2 achievement relationship. Another critical point is that in quantitative research, correlations from cross-sectional data do not imply causation (Collier, 2020), and even results from a meta-analysis cannot determine causation if the data are cross-sectional. Hence, it remains unclear which one, language achievement or anxiety, affects the other when cross-sectional data are involved. Longitudinal investigations are more suited to answer such questions (Alamer & Lee, 2021). This issue was also highlighted by Botes et al. (2020) who proposed investigating the direction of the relationship between L2 anxiety and L2 achievement. Likewise, Li (2022a) recommended that moderators including L1 achievement and L2 aptitude be included when investigating the language achievement–language anxiety relationship.

Research with the FLRAS

The FLRAS (Saito et al., 1999) was designed to measure anxiety for L2 reading. This anxiety was hypothesized to be distinct from general language anxiety. In their first study with the instrument, Saito et al. found that the FLRAS and the FLCAS shared 41% of the variance, that is, $r = .64$. Because the majority of the variance (59%) was not shared by the two instruments, they proposed that a general L2 anxiety was distinct from L2 reading anxiety.

The FLRAS has been used to measure L2 reading anxiety in numerous investigations since its introduction to the L2 literature. Zhao et al. (2013) found that L2 reading achievement was negatively correlated with L2 reading anxiety in their investigation with L1 English-speaking post-secondary students learning Chinese. In a study with post-secondary English-speaking students learning Spanish, Sellers (2000) reported that low anxious students recalled more passage reading content than students with higher levels of anxiety. In another study with university-level Spanish-speaking students learning English and English-speaking students learning Spanish, Brantmeier (2005) found that advanced-level L2 students were less anxious about reading Spanish but more anxious about writing and speaking the language. Ghaith (2020) reported that L2 reading anxiety negatively impacted Arabic-speaking university EFL learners' comprehension of text but also mediated their use of reading strategies. Liu and Dong (2022) found that Chinese university students' scores on the FLRAS were negatively and significantly correlated with their English reading achievement over three time points during an 18-week course. In a study with Arabic-speaking university students, Bensalem (2020) found that the students' self-perceived English achievement combined with their experience abroad and knowledge of a third language played a strong and significant role in predicting IDs their reading anxiety measured by the FLRAS. Zhang (2000) reported that Chinese-speaking male and female ESL students displayed different levels of anxiety on the FLRAS but found that language anxiety in both genders could be related to their low language achievement. Most studies

with the FLRAS have revealed negative correlations between learners' responses to the survey and their L2 reading achievement in several different L2s (e.g., see Hadidi & Barzegar, 2015; Matsuda & Gobel, 2004; Matsumara, 2001).

In a recent study, Li (2022a) conducted a meta-analysis using the average overall correlations between participants' FLRAS scores and two high evidence correlates, that is, language anxiety and reading performance, and two low-evidence correlates, that is, reading self-efficacy and reading strategies. The findings revealed a moderate correlation between reading problems and language anxiety, but the two low-level correlates had moderate to large effect sizes. Li found that "equally important" variables such as L1 achievement and L2 aptitude could not be included in the meta-analysis because most anxiety researchers did not include these types of measures as part of their testing instruments. In a recent literature review, Zhao (2023) summarized the conflicting evidence on L2 anxiety and L2 learning and concluded that it is important for L2 researchers investigating language anxiety to include language (L1) skills developed prior to L2 exposure to determine whether language skills are a confounding variable in the L2 anxiety–L2 achievement relationship [readers are referred to Zhao (2023) for details].

In the next section, evidence that challenges the L2 anxiety hypothesis is reviewed.

Challenges to the L2 anxiety hypothesis

Researchers have challenged the idea of a "special" anxiety for L2 learning and the notion of a causal relationship between L2 anxiety and L2 achievement. For example, Sparks and Ganschow (1991) hypothesized that students' native language (L1) skills and their L2 aptitude are confounding variables in the L2 anxiety–L2 learning relationship. Sparks and Ganschow analyzed the contents of the FLCAS and found that the 33 items reflect students' self-reports of their expressive and receptive language skills, verbal memory ability, and speed of language processing. They speculated that students who report lower levels of anxiety for L2 learning would demonstrate stronger language learning skills and language aptitude, and vice versa.

Sparks et al.'s studies using the FLCAS with English-speaking secondary (high school) and post-secondary (university) L2 learners have consistently shown that students who reported lower levels of anxiety exhibited significantly stronger L1 achievement, L2 aptitude [on the Modern Language Aptitude Test; MLAT (Carroll & Sapon, 1959, 2000)], and L2 achievement than students with higher levels of anxiety. In related studies, L2 teachers rated students who scored significantly lower on L1 achievement and L2 aptitude measures as having higher levels of anxiety in the FL classroom than students who scored significantly higher on L1 achievement and L2 aptitude measures (see reviews by Sparks, 2022a, b). Sparks et al. speculated that future investigations with the FLRAS would yield findings similar to results of studies with the FLCAS, that is, L2 learners who report lower levels of anxiety would exhibit significantly stronger levels of L1 achievement and L2 aptitude than students with higher levels of anxiety.

Two recent longitudinal studies confirmed their speculation. In one study, US L2 learners were followed through 2–3 years of high school Spanish and then divided

into low-average-high anxiety groups and compared on measures of L1 and L2 achievement (reading, writing, and listening comprehension) and the MLAT (Sparks et al., 2018). Findings showed that the low anxiety group scored significantly higher than the high anxiety group on all L1 measures (including L1 reading), all L2 achievement tests (including reading), and the MLAT. In the other study Sparks et al. (2018) found that the FLRAS accounted for unique variance in all L1 achievement skills, particularly L1 reading, and in L2 aptitude administered prior to L2 exposure. Similar to their analysis with the FLCAS, Sparks et al. contended that if the FLRAS measured a unique anxiety for L2 reading, then IDs in L2 anxiety should not be related to L1 reading achievement measured prior to engaging in L2 study, nor should the FLRAS predict unique variance in L1 reading achievement or L2 aptitude.

More recently, Sparks and Alamer expanded on previous studies by adopting SEM applications to investigate causal relationships between L1 and L2 variables, including L2 aptitude and L2 reading anxiety measured by the FLCAS and FLRAS. In one study over 10 years, they followed English-speaking US students from elementary to high school to investigate how their L1 achievement skills are linked to L2 anxiety on the FLCAS through two mediators, L2 aptitude and L2 achievement in Spanish, French, or German (Sparks & Alamer, 2022). Their findings revealed that the influence of L1 reading skills on L2 anxiety was mediated by the two factors, which suggested that the influence of L1 achievement on L2 anxiety is better observed through the mediators. A more recent longitudinal replication with English-speaking US students studying Spanish examined the effect of L1 achievement on L2 reading anxiety using the FLRAS via several mediators, including L1 metalinguistic knowledge, L1 working memory, L1 print exposure, L2 aptitude, and L2 achievement (L2 reading, writing, and listening comprehension) (Sparks & Alamer, 2023). Findings showed that the effect of L1 achievement, including reading, measured prior to L2 exposure on later L2 reading anxiety was direct and indirect through L1 metalinguistic knowledge, L2 aptitude, and L2 achievement.

Horwitz (2010) has claimed it is “intuitive that anxiety would inhibit the learning and/or production of a second language (L2)” (p. 154). However, causal-oriented evidence has not supported her claim. Instead, the evidence has suggested that the idea of a unique anxiety for L2 learning is more similar to other “special” types of anxiety. For example, although test anxiety is a popular explanation for low scores on both standardized and classroom tests, empirical research has not found that test anxiety is a discrete entity (see Lovett & Nelson, 2017). Instead, evidence has shown that IDs in test anxiety are mediated by IDs in working memory (e.g., see Owens et al., 2014). A recent study with medical school students found that test anxiety does not predict performance on exams over and above students’ knowledge level when taking mock exams (Theobald, Breitwieser, & Brod, 2022). Likewise, while math anxiety is a familiar explanation for poor performance in math, researchers have found that students’ anxiety about math is negatively correlated with their math achievement (Chang & Beilock, 2016) and also that cognitive factors, that is, low math aptitude, low working memory, are associated with anxiety for math (Ashcraft & Krause, 2007; Finell et al., 2022). A three-wave cross-lagged panel study with Chinese secondary students found that math achievement negatively predicted math anxiety (Zhang et al., 2023). In their study with Arabic-speaking university students learning English as a L2, Alamer and Lee (2021) used a crossed-lagged

panel analysis and found that L2 achievement precedes language anxiety, not the other way around. Specifically, they illustrated that L2 achievement at Time 2 negatively predicted language anxiety at Time 3. These results suggest that when students' language skills grow, their sense of anxiety decreases, but the opposite direction was not observed. Such findings were replicated among Chinese-speaking students learning English as an L2 (Li et al., 2024; Liu & Dong, 2022; Zhao et al., 2023) and Arabic-speaking students learning English (Alamer et al., 2023; Almusharraf & Bailey, 2023; Hamada & Takaki, 2022). Together, these studies reveal the importance of going beyond cross-sectional data to corroborate cause-and-effect relationships between the variables using appropriate data collection and analysis.

Purpose of the study

Although past studies have investigated the effect of L1 and L2 achievement on L2 reading anxiety with advanced methods such as SEM (e.g., Sparks & Alamer, 2023), to our knowledge there are no studies dedicated to examining the trajectory of L2 reading achievement using the LGCM, and considering whether certain covariates, including anxiety, can affect such a trajectory. In the present longitudinal study, we investigated the potential effect of L2 reading anxiety, L1 reading achievement, and L2 aptitude on the trajectory (i.e., growth) of L2 reading achievement. The L1 reading achievement measures were included as a covariate because L1 reading achievement is strongly related to L2 reading achievement (see reviews by Sparks, 2022a, b). L2 aptitude was included as a covariate because the MLAT is a strong predictor of L2 achievement and is strongly related to the language skills necessary for acquisition of literacy (see Sparks & Dale, 2023; Sparks, Dale, & Patton, 2023). L2 anxiety was included as a covariate because the “classic view” of language anxiety claims that L2 anxiety can have a determinant impact on L2 achievement. This argument can be better assessed through LGCM with L2 reading anxiety as a covariate. Similarly, since evidence has shown that students' L1 skills and L2 aptitude impact students' L2 achievement generally, including L2 reading, this perspective is better tested by including these variables as covariates in the LGCM model. To our knowledge, this is the first study to use LGCM to address the question of whether language anxiety (among other language-related variables) affects the growth of L2 reading achievement. The findings of this type of study have the potential to move researchers closer to answering whether L2 anxiety is, or is not, a causal factor for L2 achievement.

Method

Data, analysis code, and study material information are available on the OSF website at <https://osf.io/s4t3v/>.

Participants

The study began with 307 participants chosen randomly from students enrolled in first-year Spanish courses at one of four high schools in a large suburban school district in the midwestern US near a metropolitan city. This large school district was

chosen in order to obtain a larger number of participants who could be followed, at minimum, over two years of L2 courses, and in some cases, three years. In the United States, some colleges and universities require only two years of L2 courses for admission, so the great majority of secondary students enroll in only two years of the same L2. There were 154 males and 153 females with a mean age of 15 years, 7 months (ranging from 13 years, 7 months to 17 years, and 6 months) enrolled in 9th, 10th, and 11th grades when the study began. Participants included 301 Caucasian, four African-American, and two East Asian students. Twenty-three of the 307 students did not complete first-year Spanish. Twelve students began but failed to complete second-year Spanish, and six students left the school district. Collectively, we had 295, 267 and 51 participants in Times 1, 2, and 3, respectively. We accounted for the decrease in number by using the full information maximum likelihood (FIML) method in the analysis. All participants were monolingual English speakers who had no prior experience with Spanish, were not routinely exposed to Spanish outside school, and spoke no language other than English. Participants were exposed to similar learning conditions, taught by the same L2 curriculum, and experienced one hour per day of L2 instruction in the classroom over the time that they were enrolled in Spanish courses. Parental permission was obtained for each participant.

The participants, testing measures, and data for the present study were drawn from the dataset analyzed in Sparks & Alamer (2023), Sparks et al. (2018), and Sparks et al. (2018), all of which investigated L2 anxiety using the FLRAS. The present study differs from those investigations because the focus is specifically on the trajectory of students' growth in L2 reading and the potential effect of covariates, including L2 anxiety, on L2 reading growth over three years of L2 instruction.

Instruments

L1 reading achievement

A description of each L1 instrument is provided in Appendix A. These standardized measures are not available for review as they are proprietary but can be accessed through the publisher.

L1 word decoding. The measure of L1 word decoding was the Woodcock Reading Mastery Test-Revised/NU Basic Skills Cluster (Woodcock, 1998). The Basic Skills Cluster is comprised of two subtests, Word Identification, on which a student read aloud a list of increasingly difficult words, and Word Attack, on which a student read aloud a list of increasingly difficult pseudowords. For a response to be correct, the student had to produce a natural reading (pronunciation) of the word or pseudoword. The difficulty level of the words ranged from one-syllable to multisyllabic words.

L1 reading comprehension. The measure of L1 reading comprehension was the Stanford Achievement Test 10 (Pearson, 2007). The test is a timed, group-administered, standardized measure of reading comprehension. The student read passages silently and answered multiple choice questions after reading a passage.

The L1 Reading Achievement score was obtained by averaging a student's standard scores ($M = 100$, $SD = 15$) on the Woodcock Basic Skills Cluster and Stanford Achievement Test.

L2 aptitude

The measure of L2 aptitude was the MLAT (Carroll & Sapon, 1959, 2000). This standardized test measured L2 aptitude with a simulated format to provide an indication of the probable degree of success in learning a L2. The Long Form consists of five subtests: Number Learning, Phonetic Script, Spelling Clues, Words in Sentences, and Paired Associates. A description of the MLAT and its subtests is provided in Appendix A.

L2 reading achievement

A standardized measure of Spanish achievement, the *Batería III Woodcock-Muñoz Pruebas de aprovechamiento* (Woodcock, Muñoz-Sandoval, McGrew, & Mather, 2004) designed for students whose native language is Spanish, was used for measuring the participants' Spanish reading achievement.

(Spanish) word decoding. The measure of Spanish word decoding was the *Identificación de letras y palabras* subtest on which the student read aloud a list of increasingly difficult words. For a response to be considered correct, the student had to decode and pronounce the word correctly. The difficulty level of the words ranged from one-syllable (*vez, pan*) to two- and three-syllable (*joven, cuidado*) and multisyllabic (*desalmado, municipalidad*) words.

(Spanish) reading comprehension. The measure of Spanish-reading comprehension was the *Comprensión de textos* subtest. On the first four items, the student read a phrase (e.g., *casa grande*) and pointed to one (of four) pictures representing the meaning of the phrase. On the remaining items, the student read a short passage and identified a key missing word, that is, a cloze procedure, which made sense in the context of the passage, for example, *Luis y Rosa ____ amigos*. The items became increasingly difficult by removing picture stimuli and increasing passage length, level of vocabulary, and complexity of syntactic and semantic cues. Most items consist of 1–2 sentences.

The L2 reading achievement score was obtained by averaging a student's standard scores ($M = 100$, $SD = 15$) on the Spanish word decoding and Spanish reading comprehension measures. A description of the L2 reading measures is provided in Appendix A.

Foreign language (L2) reading anxiety

The FLRAS (Saito, Horwitz, & Garza, 1999) was used to determine participants' anxiety for reading in a foreign (L2) language. The FLRAS has 20 items to which students responded on a five-point Likert scale ranging from "strongly agree" (5) to "neither agree nor disagree" (3) to "strongly disagree" (1) with a forced-choice, balanced-design format. The reliability of the FLRAS was checked by calculating Cronbach's alpha, which was 0.73, and a composite reliability which was 0.85. The average variance extracted (AVE) was 0.65. A list of the items on the FLRAS is provided in Appendix B.

Procedure

The testing instruments were administered to participants at different times over the course of the study. The MLAT was administered in groups of 25–30 students by the first author in the first 3–4 weeks of the first-year Spanish course. The L1 word decoding measure was administered individually by the first author, a Spanish professor, and graduate students trained by the first author at the beginning of the Spanish course. The L1 reading comprehension measure was administered in 8th grade by the school district, and students' scores were obtained from school records. The FLRAS was administered near the end of the first-year Spanish course.

The measures of Spanish (L2) reading achievement were administered individually to the participants at the end of the first-, second-, and third-year Spanish courses by the first author, the Spanish professor, and graduate students trained by them. Participants' raw scores for the two measures were transformed to standard scores ($M = 100$, $SD = 15$) using the *Woodcock-Johnson-III* Normative Update Compuscore and Profiles Program Version 3.1 (Schrank & Woodcock, 2008). Because the *Woodcock-Munoz* is a standardized, norm-referenced test calibrated to measure the skills of native Spanish-speaking test-takers, norms were available for a wide range of grade levels, that is, participants' scores on the two subtests could be compared to native Spanish-speaking students ranging from 1st to 12th grades. For this study, participants' scores according to 9th grade native Spanish speaker norms were used.

In their factor analysis study of the FLRAS, Hamada and Takaki, 2021 showed that the instrument should be seen as multidimensional with three subfactors that they labeled *familiarity with vocabulary and grammar*, *reading confidence and enjoyment*, and *language distance* for factor 1, 2, and 3, respectively. We followed their findings and modeled the FLRAS with the three aggregated subfactors in the LGCM.

Statistical analysis

The LGCM is a useful tool for examining changes in a variable, such as L2 reading achievement, over time (Kline, 2016). It allows researchers to identify the trajectory of the variable (i.e., growth or reduction) as well as the difference between individuals in terms of their growth. LGCM is based on the property of SEM; thus, it carries all the advantages of SEM such as evaluating model fit indices, dealing with missing data using the FIML method, and including latent and or observed variables as covariates in the model (Alamer & Alrabai, 2023). In LGCM, the model produces three key parameters: (a) *the intercept*, which indicates the variance at the first time point, (b) *the slope*, which illustrates the growth of the variable, and (c) *the correlation* between the intercept and slope which shows the extent to which the growth is related to the initial level. This model is the unconditional model.

A conditional LGCM can be considered when an additional parameter, that is, a covariate, is included. In this case, two paths from the covariate to the intercept and slope are estimated to determine whether this covariate can affect the intercept and slope (see Figure 1 for an illustrative example). In our conditional LGCM model, three time-invariant covariates are estimated simultaneously, that is, L1 reading achievement, L2 aptitude, and L2 reading anxiety. LGCM should be first

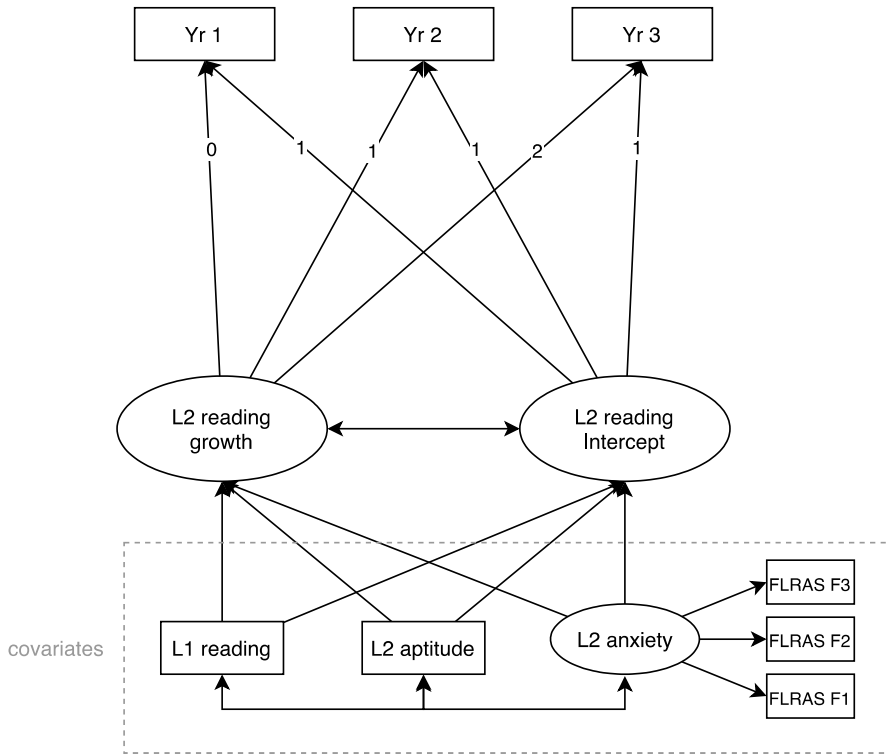


Figure 1. The conditional LGCM with covariates.

assessed by checking the model fit indices. This assessment includes exact fit of chi-square statistic, χ^2 , with its p -value. Other relative model fit measures are also considered such as the root mean square error of approximation (RMSEA) with its 90% confidence interval, standardized root mean square residual (SRMR), comparative fit index (CFI), and Tucker–Lewis index (TLI).

Results

Table 1 presents descriptive statistics, including the means and standard deviations for the L1 and L2 measures, and the correlation matrix. We then turn to the main analysis of the present investigation.

The LGCM offers rich details about the intra- and inter-individual changes across the sample over time. Table 2 presents the results of the unconditional LGCM (Model 1) and the conditional LGCM (Model 2) with L2 reading anxiety, L2 aptitude, and L1 reading achievement as covariates. First, the LGCM provided excellent fit indices to the data (i.e., $\chi^2 = 3.84$, $df = 1$, $p = .05$; CFI = .99; TLI = .95; RMSEA = .09, RMSEA 90% CI: [.00, .18]; SRMR = .13) and the conditional model provided acceptable fit to the data (i.e., $\chi^2 = 61.59$, $df = 18$, $p < .001$; CFI = .91; TLI = .87; RMSEA = .09, RMSEA 90% CI: [.06, .11]; SRMR = .14). Next, the parameters of the unconditional model were assessed.

Table 1. Correlations, mean, and SDs for L1 and L2 reading, L2 aptitude, and L2 anxiety measures

Variable	1	2	3	4	5	6	7	8
1. L1 reading	—							
2. MLAT	.28***	—						
3. L2 reading anxiety F1	-.30***	-.29***	—					
4. L2 reading anxiety F2	-.15*	-.22**	.41***	—				
5. L2 reading anxiety F3	-.13*	-.08	.38***	.33***	—			
6. L2 reading Year 1	.27***	.41***	-.31*	-.27***	-.23***	—		
7. L2 reading Year 2	.33***	.45***	-.40*	-.32***	-.24***	.62***	—	
8. L2 reading Year 3	.32*	.53***	-.32*	-.34*	-.10	.63***	.80***	—
Mean	107.98	97.39	19.01	9.24	16.52	28.75	38.56	53.94
SD	12.31	11.69	4.16	2.68	4.14	12.97	13.62	12.94

* $p < .05$, ** $p < .01$, *** $p < .001$.

Table 2. Results of the unconditional and conditional LGCMs

<i>Model 1: Unconditional LGCM</i>					
	Intercept		Growth		Correlation between intercept and growth
	Mean	Variance	Mean	Variance	
	29.01*	103.42*	9.20*	14.46*	.16
<i>Model 2: Conditional LGCM</i>					
	Intercept		Growth		Correlation between intercept and growth
	Mean	Variance	Mean	Variance	
	-59.30*	46.53*	-8.30	9.97	-.17
Effect of L1 reading		.45*		.58*	
Effect of L2 aptitude		.27*		.42*	
Effect of L2 reading anxiety		.32*		-.06	

* $p < .05$, ** $p < .01$, *** $p < .001$.

As illustrated in Table 2, Model 1 showed that students' inter-individual differences at the first year were significant ($Var_{Intercept} = .103$, $p < .001$, with a mean value of 29.01). Moreover, the analysis of LGCM shows notable growth in L2 reading achievement over three years ($M_{Slope} = 9.20$, $p < .001$) indicating intra-individual growth in students' scores in L2 reading achievement with an increase of 9.20 points, generally. However, the results indicate that the growth was not similar across the students ($Var_{Slope} = .1446$, $p = .01$), suggesting that students display inter-individual differences in L2 reading achievement. The results of the insignificant correlation ($r = .16$, $p = .36$) showed that the growth in L2 reading achievement is independent from students' first-year reading scores.

In relation to the conditional model, Model 2 in Table 2 presents the results related to the effect of L1 reading achievement, L2 aptitude, and L2 reading anxiety on the growth and intercept of L2 reading achievement. The results showed that all variables significantly affected students' L2 reading initial levels (i.e., the intercept). Specifically, the largest effect was found for L1 reading ($\beta = .33$, $p < .001$) followed by L2 reading anxiety ($\beta = .32$, $p < .001$) and L2 aptitude ($\beta = .27$, $p < .001$). However, not all covariates impacted the growth of L2 reading achievement. Particularly, L1 reading ($\beta = .58$, $p < .001$) and L2 aptitude ($\beta = .42$, $p < .05$) both had a significant effect on the growth of L2 reading achievement, while L2 reading anxiety failed to affect the growth of L2 reading achievement ($\beta = -.06$, $p = .77$). Given the effects of the covariates collectively, the growth mean ($M_{Slope} = -8.30$, $p = .19$) and its intercept ($Var_{Slope} = 9.97$, $p = .34$) were reduced markedly after controlling for the covariates. Having the mean growth turned to a negative direction and its variance showing no additional significance suggest that the covariates, that is, L1 reading achievement, L2 aptitude, and L2 reading anxiety, explained the growth trajectory of L2 reading achievement substantially but did so differently. That is, L1 reading achievement and L2 aptitude, but not L2 anxiety, impacted the growth of L2 reading achievement.

Discussion

The purpose of this study was to determine the potential effect of L2 reading anxiety (measured by the FLRAS), L1 reading achievement, and L2 aptitude (measured by MLAT) using LGCM to estimate the growth trajectory of L2 reading achievement over three years of high school Spanish. In contrast to regression or structural models, LGCM is capable of estimating the initial and growth trajectory and examining the effect of covariates simultaneously (Kline, 2016; Solhi et al., 2023). To the authors' knowledge, the present study is the first to examine the growth of L2 reading achievement while controlling for potential covariates via the advanced application of LGCM.

The findings of this study show that students display significant inter-individual differences in L2 reading achievement at the end of first-year Spanish (Year 1). This finding is consistent with Sparks et al.'s investigations, which have found significant differences among learners' L2 reading skills after one year (or more) of L2 courses (see Sparks, 2022a, b). This finding is unsurprising and consistent with longitudinal evidence from L1 research which shows that learners exhibit significant, and often wide, differences in their acquisition and development of reading skills that are due to the cognitive and linguistic skills found to be important for reading (Cunningham & Stanovich, 2017; Sparks et al., 2014; Stanovich, 2017). In general, students gained an additional 9.2 standard score points (0.60 SDs) from Year 1 to Year 3, that is, some students gained more than 9.2 points while others gained less than 9.2 points. In addition, our results showed that the growth in L2 reading achievement was not similar across participants, that is, some students made greater gains than others. This result is consistent with past studies in L1 reading, which have found that learners display significant differences in the development of their reading skills and also progress at different rates when learning to read their L1, largely because they display differences in the cognitive and linguistic skills necessary for learning to read alphabetic orthographies, that is, the skills implicated for word decoding and linguistic comprehension (see Petscher et al., 2020; Stanovich, 2017; Tunmer & Hoover, 2017). In the present study, participants' growth in learning to read Spanish was likely affected by inter-individual differences in the skills necessary for learning to read a new alphabetic orthography (see Sparks, 2015, 2021). Our speculation is supported by another longitudinal investigation with the participants in the present study, which found that students' levels of L2 word decoding and L2 linguistic comprehension in Spanish reflected their levels of L1 word decoding and L1 linguistic comprehension skills in English, that is, students with stronger L2 reading achievement also exhibited stronger L1 reading achievement (Sparks et al., 2019).

The findings of the conditional LGCM model (Model 2) revealed that students' L1 reading achievement prior to L2 exposure strongly and significantly influenced their initial level and growth in L2 reading achievement over three years of Spanish. L1 reading achievement shaped not only the growth (trajectory) of students' L2 reading achievement but also their initial level of L2 reading achievement (i.e., Year 1). These findings suggest that there are strong relationships between the skills necessary to read an alphabetic orthography in English and Spanish as L1 and L2. Sparks and his colleagues have shown that students with stronger L2 reading achievement (Spanish, French, and German) in secondary school demonstrated

stronger L1 reading achievement (English) prior to exposure to the L2 (see review by Sparks, 2022a, b; Sparks et al., 2019); early L1 literacy skills in primary school are strong predictors of L2 reading achievement in high school (Sparks et al., 2006); and early L1 word decoding and L1 reading comprehension accounted for significantly large amounts of variance in L2 word decoding and L2 reading comprehension (Sparks et al., 2008). These results have been supported by Kahn-Horwitz et al. (2005, 2006) in studies with L1 Hebrew students learning English. Further, the finding from the present study showing that the growth of L2 reading achievement in Spanish was determined by students' L1 reading achievement in English provides support for speculation that L1 and L2 reading skills for alphabetic orthographies depend on facility in similar components of language (Sparks, 2021).

In addition, the results showed that students' L2 aptitude measured by the MLAT strongly and significantly impacted their initial level of and growth in L2 reading achievement over three years of Spanish. Like L1 reading achievement, L2 aptitude shaped both the growth of L2 reading achievement and its initial levels. These results are supported by many years of research by Sparks et al., who have consistently shown that there are strong relationships between student's levels of L2 aptitude and their levels of L2 literacy achievement (Sparks, 2022b). Recent research has also found strong connections running from L1 literacy through L2 aptitude (MLAT) to L2 achievement, including L2 reading achievement (Sparks & Dale, 2023; Sparks, Dale, & Patton, 2023). This finding makes sense because the MLAT includes subtests that assess skills necessary for learning to read Spanish and English, that is, phonetic coding, grammar, vocabulary, and memory, all of which are important for reading achievement.

The conditional LGCM also indicated that L2 reading anxiety affects students' initial levels of L2 reading achievement but not their growth in L2 reading. These findings imply that although L2 reading anxiety is associated negatively with students' early L2 reading achievement, anxiety does not predict their progress in learning to read the L2. As L2 reading anxiety was measured shortly before the Year 1 measure of L2 reading was administered, this finding suggests that students with lower L2 reading achievement in Spanish report higher L2 reading anxiety, and vice versa. Nonetheless, L2 reading anxiety does not predict or influence growth in L2 reading achievement. This finding suggests that students' L2 reading skills increase regardless of whether they reported high, average, or low anxiety on the FLRAS. The results support recent studies which have established that language achievement predicts language anxiety, not the other way around, and also supports findings which have shown that increasing L2 vocabulary knowledge, a key component of successful reading, decreases language anxiety (Alamer & Lee, 2021; Alamer, Al Khateeb, & Jenó, 2023; Sparks & Alamer, 2022, 2023).

The claim of a "special" anxiety for L2 reading conflicts with L1 reading research, where there are no operable theories maintaining that anxiety is pertinent for learning to read or for growth in reading achievement, nor is anxiety implicated in L1 reading problems and low reading achievement. Instead, robust evidence over many years has shown that reading is a language-based skill; reading problems have been shown to be causally related to cognitive and linguistic factors, that is, word decoding, oral language comprehension (Petscher et al., 2020; Seidenberg, 2017); and cognitive and linguistic skills, that is, grammar knowledge, vocabulary

knowledge, word decoding, listening comprehension, are related to the development of L2 reading achievement (see Jeon & Yamashita, 2014; Verhoeven & Perfetti, 2017; Sparks, 2021).

In sum, L2 reading anxiety did not appear to explain students' growth in L2 reading skills over time. Anxiety was only negatively associated with students' initial levels of L2 reading achievement, which is understandable given the exposure to a new language. Anxiety for learning to read a L2 may not explain growth in reading achievement because, unlike L1 reading and L2 aptitude, anxiety instruments such as the FLRAS do not measure *directly* the language skills needed for successful L2 reading. Instead, students' responses on the FLRAS are likely to be a reflection of IDs in their levels of reading skills (and their reading-related cognitive and linguistic skills), their accurate self-perceptions of their reading skills, or both.

Limitations

The type of data and selected analysis are unique in the L2 reading literature because it used LGCM to examine the potential effects of L2 reading anxiety, L1 reading achievement, and L2 aptitude on the growth trajectory of L2 reading achievement over three years. Likewise, this type of study is rare in the L2 anxiety literature because the test battery included potential confounding variables, in this case L1 reading achievement and L2 aptitude measures used to scrutinize the potential effect of L2 anxiety on L2 reading achievement. A limitation of the study is that other variables such as students' previous educational experiences and their motivation for L2 learning were not included as additional covariates. Another limitation would be the smaller sample size in Time 3, that is, third-year L2 reading. In addition, the only L2 included in the analysis was Spanish. Additional research should replicate this study with other L2s. Even so, there are some important implications for the teaching of L2 reading and for consideration of the language anxiety hypothesis.

Implications and conclusions

First and foremost, language educators should focus on teaching students the language skills necessary for learning to read a L2. It is well known that reading is a *language-based* skill and that growth in reading relies on students' facility with the language-related skills necessary for mastering a written code. In this study, growth in Spanish reading achievement was substantially determined by the language-related skills for L1 reading achievement, that is, word decoding and language comprehension, and those language-related skills measured by the MLAT, for example, phonetic coding, grammar, vocabulary, but not by anxiety. Our recommendation to focus on teaching language skills is consistent with evidence showing that IDs in L1 achievement, including reading, are detected as early as 1st grade, persist across time, and are evident when students begin L2 courses. While IDs in anxiety may be related to students' initial level of L2 reading achievement, anxiety seems unlikely to determine their growth, or lack of growth, in reading.

Second, L2 researchers should consider that language anxiety instruments such as the FLRAS may be a reflection of students' levels of language achievement and

language aptitude or both (Alamer & Lee, 2021). Although these surveys will likely reveal IDs in students' perceived anxiety in the L2 classroom, they appear unlikely to explain *growth* in reading achievement because they do not assess explicitly the skills necessary for learning to read a L2. A recent review of L2 anxiety and L2 learning maintained that L2 educators should consider both anxiety reduction and improvement of L2 skills to facilitate students' L2 learning effectively (Zhao, 2023).

Third, a related implication is for language researchers to confront the confounding variable problem inherent in L2 anxiety research. A confounding variable is one that a researcher fails to control, or eliminate, that damages the internal validity of a study. To date, proponents of the anxiety hypothesis have not considered whether a third variable such as language achievement and/or language aptitude might affect students' responses to the items on L2 anxiety surveys (e.g., see Alamer & Lee, 2021; Sparks & Alamer 2022, 2023). Most empirical studies on language anxiety have not controlled for IDs in participants' language learning skills and language aptitude assessed by measures such as the MLAT. Moreover, recent meta-analyses of L2 anxiety investigations conducted by Teimouri et al. (2019), Zhang (2019), and Li (2022) could not analyze the role of IDs in language ability because researchers did not administer measures of L1 skills and/or L2 aptitude in their data. The L2 anxiety hypothesis continues to generate considerable attention, but to date, the authors are unaware of studies that have avoided the confounding variable problem except for those conducted by Sparks, Alamer, and their colleagues.

Fourth, L2 educators and researchers should reconsider their belief that anxiety is a causal factor for L2 achievement, including reading achievement. Negative cross-sectional correlations between L2 anxiety and L2 achievement have mistakenly been interpreted by L2 researchers to mean that IDs in language anxiety may cause IDs in language achievement (see Teimouri et al., 2019). However, a long line of evidence has shown that early scores on L1 achievement and L2 aptitude are strongly and significantly related to later L2 achievement, including L2 reading achievement. In addition, recent studies in the L2 literature have reversed the assumption that language anxiety is a causal factor for L2 achievement by showing that language achievement precedes language anxiety (e.g., see Alamer et al., 2023; Alamer & Lee, 2021; Almusharraf & Bailey, 2023; Hamada & Takaki, 2022; Sparks & Alamer, 2022, 2023; Zhao et al., 2023). These findings from the L2 literature are similar to those in other areas of study cited earlier which have found that test anxiety does not predict performance on mock medical exams over and above students' knowledge level (Theobald et al., 2022), math achievement precedes math anxiety (Ashcraft & Krause 2007; Chang & Beilock, 2016; Finell et al., 2022; Zhang et al., 2023), and working memory capacity moderates the relationship between anxiety and cognitive test performance (Owens et al., 2014).

Based on our longitudinal LGCM analysis, we conclude that L2 reading anxiety does not appear to be a causal factor in L2 reading development. In our view, increased anxiety is better viewed as a reflection of lower language-related skills and vice versa. What matters most for a successful L2 reading journey is learning the language-related skills required for L2 reading achievement. Thus, educators should turn their focus from dealing directly with students' anxiety, per se, to teaching directly and explicitly the language skills necessary for learners to grow and flourish in their L2 reading development.

Replication package. Data, analysis code, and study material information are available on the OSF website at <https://osf.io/s4t3v/>.

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Appendices

Appendix A

Testing measures for the assessment of L1 reading achievement, L2 aptitude, and L2 reading achievement.

Test/subtest	Description
<i>Word decoding</i>	
Woodcock Reading Mastery Test-Revised/NU Basic Skills cluster (WRMT-R) (Woodcock, 1998)	Test-retest reliability reported by test's authors of .96
<i>Word identification subtest</i>	Ability to read and pronounce increasingly difficult (real) words correctly
<i>Word attack subtest</i>	Ability to read and pronounce increasingly difficult pseudo (nonsense) words correctly that conform to English spelling rules
<i>Reading comprehension</i>	
Stanford Achievement Test 10 (Pearson, 2007)	Timed, group-administered standardized measures of reading comprehension skills and/or language ability. The student reads passages/items silently and answers multiple choice questions. Test-retest reliability reported by test's authors of .87
Test/subtest	Description
<i>L2 aptitude</i>	
Modern Language Aptitude Test (MLAT)	Test designed to provide indication of student's probable degree of success in learning L2 includes five subtests. <i>Number Learning</i> : learning numbers in an artificial language made from nonsense words formed from English sounds. <i>Phonetic Script</i> : learning phonetic symbols for English sounds and retaining the associations through a syllable recognition task. <i>Spelling Clues</i> : selecting a partial definition of a stimulus word that has an incomplete phonetic spelling and matching the word to its meaning. <i>Words in Sentences</i> : selecting an underlined word in a sentence that matches the grammatical role of a designated word in a stimulus sentence. <i>Paired Associates</i> : learning a small set of words pseudowords and matching them to a real word from memory. Test-retest reliability reported by test's authors of .90 for males and .91 for females.
<i>L2 Word decoding</i>	
Woodcock Muñoz Identificación de letras y palabras subtest	Ability to read and pronounce correctly increasingly difficult (real) Spanish words, one syllable to multisyllabic words. The difficulty level of the words ranged from one-syllable (<i>vez, pan</i>) to two- and three-syllable (<i>joven, ciudadano</i>) and multisyllabic (<i>desalmado, municipalidad</i>) words. Test-retest reliability reported by test's authors of .91.
<i>L2 reading comprehension</i>	
Woodcock Muñoz Comprensión de textos subtest	Ability to read increasingly difficult short passages with modified cloze procedure and identify missing key Spanish word that makes sense within context, for example, <i>Luis y Rosa ____ amigos</i> . Test-retest reliability reported by test's authors of .90.

Appendix B

FLRAS items

Directions: Statements 1 through 20 refer to how you feel about *reading* Spanish. For each statement, please indicate whether you (1) strongly agree, (2) agree, (3) neither agree nor disagree, (4) disagree, or (5) strongly disagree by writing the appropriate number on the line by each statement. Write an answer for every statement.

- ___ 1. I get upset when I'm not sure whether I understand what I am reading in Spanish.
- ___ 2. When reading Spanish, I often understand the words but still can't quite understand what the author is saying.
- ___ 3. When I'm reading Spanish, I get so confused I can't quite remember what I'm reading.
- ___ 4. I feel intimidated whenever I see a whole page of Spanish in front of me.
- ___ 5. I am nervous when I am reading a passage in Spanish when I am not familiar with the topic.
- ___ 6. I get upset whenever I encounter unknown grammar when reading Spanish.
- ___ 7. When reading Spanish, I get nervous and confused when I don't understand every word.
- ___ 8. It bothers me to encounter words I can't pronounce while reading Spanish.
- ___ 9. I usually end up translating word by word when I'm reading Spanish.
- ___ 10. By the time you get past the funny letters and symbols in Spanish, it's hard to remember what you're reading.
- ___ 11. I am worried about all the new symbols you have to learn in order to read Spanish.
- ___ 12. I enjoy reading Spanish.
- ___ 13. I feel confident when I am reading in Spanish.
- ___ 14. Once you get used to it, reading Spanish is not so difficult.
- ___ 15. The hardest part of learning Spanish is learning to read.
- ___ 16. I would be happy just to learn to speak Spanish rather than having to learn to read as well.
- ___ 17. I don't mind reading to myself, but I feel very uncomfortable when I have to read Spanish.
- ___ 18. I am satisfied with the level of reading ability in Spanish that I have achieved so far.
- ___ 19. Spanish culture and ideas seem very foreign to me.
- ___ 20. You have to know so much about Spanish history and culture in order to read Spanish.

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