Studies in Second Language Learning and Teaching
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SSLLT 0 (0). 2026. 1-28. Published online: 30.07.2026
https://doi.org/10.14746/ssllt.53127
http://pressto.amu.edu.pl/index.php/ssllt

Boredom profiles, digital competence, and informal digital learning of Chinese among New Zealand adolescents: A person-centered approach

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Abstract

Recognizing how the proliferation of digital technologies has expanded adolescents' opportunities to engage with additional languages beyond formal classrooms, this study investigates informal digital learning of Chinese (IDLC) among New Zealand adolescents through a person-centered lens. It focuses on

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learners' boredom and digital competence as key learner-internal factors closely associated with IDLC. Survey data were collected from 516 adolescent learners in six community schools and public high schools in Auckland. Using latent profile analysis, three boredom profiles were identified: low (31%), moderate (55%), and high (14%). Regression analyses showed that digital competence positively predicted IDLC overall, but the strength of this association differed across boredom profiles. Specifically, digital competence predicted IDLC only in the high-boredom profile, whereas the association was weak and nonsignificant in the low- and moderate-boredom profiles. Interestingly, heightened boredom proved to amplify the association between Chinese learners' digital competence and IDLC. The findings demonstrate that boredom heterogeneity is central to understanding if and when digital competence translates into IDLC practice and indicate the value of person-centered approaches for advancing informal language learning research on Chinese in Anglophone contexts.

Keywords: informal digital learning of Chinese; boredom; digital competence; latent profile analysis

1. Introduction

In the last 20 years, informal digital language learning (IDLL) has emerged as an important strand of research in computer-assisted language learning, foregrounding learners' autonomous and self-directed involvement with the target language through digital technologies beyond formal instruction (Dressman & Sadler, 2020; Lai et al., 2024). With the proliferation of mobile devices, social media, online platforms, and, more recently, generative artificial intelligence, learners are increasingly able to access authentic input and regulate their own learning trajectories in informal digital spaces (Lee & Lee, 2021; Liu & Zhao, 2026). Existing scholarship has documented a range of linguistic, motivational, and affective benefits associated with IDLL, as well as its antecedents and outcomes (Liu & Lee, 2026; Sundqvist, 2024). However, this growing body of research exhibits a strong and persistent language bias, with the vast majority of studies focusing almost exclusively on English as a target language (Dressman & Sadler, 2020; Soyoof et al., 2023). While this focus is hardly surprising given English's global status as a lingua franca and its omnipresence in digital spaces (Ushioda & Dörnyei, 2017), it risks narrowing the theoretical and empirical understanding of what digital technologies can offer second and foreign language (L2) education more broadly. Languages other than English (LOTEs), which often operate within different sociopolitical, institutional, and technological conditions, remain underrepresented in IDLL research (Guo & Lee, 2023). As a result, such research may not fully capture how informal digital learning behaviors unfold

for learners of languages such as Mandarin Chinese, or how learner-internal and contextual factors interact in these less-examined settings.

In New Zealand, learning Chinese[1] as a second or foreign language (CSL) has experienced steady growth over the past several decades (Wang, 2021), shaped by migration history and heritage language maintenance in the New Zealand context, along with the expanding economic and cultural ties with China (Wang, 2021; Wang & East, 2023). Despite this growth, Chinese continues to occupy a relatively peripheral position within the landscape of national language education, with limited curricular continuity and uneven institutional support across schooling levels (East, 2023; Wang & Mason, 2023). At the same time, the rapid expansion of digital technologies and the increasing accessibility of Chinese-language content on social media platforms and in other public digital spaces have fundamentally altered the ecology of learning Chinese (Huang, 2017; Li & O'Rourke, 2022). New Zealanders can now encounter Chinese beyond the classroom through short videos, online communities, entertainment media, and interactive applications, often in ways that are interest-driven and self-initiated (Qi et al., 2026; Wang, 2025). These developments suggest that IDLL may play an increasingly important role in sustaining learners' engagement with Chinese, particularly where formal instructional time is limited or pedagogically constrained. Yet, empirical research has rarely examined how New Zealand adolescents participate in informal digital learning of Chinese (IDLC), or what factors enable or constrain such learning practices. This gap points to a clear research niche at the intersection of IDLL and Chinese language education in Anglophone contexts.

This study is distinguished from existing scholarship in several ways. Language learning is an emotional process, inevitably intertwined with both positive and negative emotions (Khajavy et al., 2025; Kruk & Zawodniak, 2020; Li & Li, 2023; Pawlak et al., 2022). Current IDLL research has primarily examined enjoyment and anxiety (Lee & Xie, 2023; Rezai et al., 2025; Zhao et al., 2026), with boredom receiving comparatively little attention despite its prevalence and significance in L2 learning. Boredom, a negative, deactivating, and activity-related academic emotion (Li, 2021), is characterized by feelings of dullness, mind-wandering, task inattention, and superficial information processing, and is closely associated with learning performance and outcomes (Li et al., 2025; Pawlak et al., 2020). However, the debilitating role of boredom remains contested. While some studies emphasize its negative impact on learning outcomes (Kruk, 2022; Li et al., 2024; Wang et al., 2025), others report no significant effect (Dewaele, Botes, & Greiff, 2023; Tsang & Dewaele, 2024) or even a facilitating role (Elahi Shirvan et al., 2025). A further contribution of this study lies in its analytical approach. While

[1] Here we refer specifically to Mandarin Chinese or Putonghua.

most prior research has largely relied on variable-centered methods, studies using person-centered approaches to examine the role of emotion in IDLL remain scarce. Unlike variable-centered analyses, which assume uniform effects across learners, the person-centered approach (e.g., latent profile analysis) emphasizes individual patterns of emotional experience rather than averaged trends. In this study, digital competence is treated as a key antecedent of IDLC, reflecting learners' ability to independently locate, evaluate, and apply digital resources in loosely structured and technology-rich environments (He & Li, 2019; Mehrvarz et al., 2021). To capture the heterogeneity of boredom, we employ a person-centered approach (Berlin et al., 2014) because it allows for the identification of distinct boredom profiles and sheds light on the specific conditions under which, when, and for whom digital skills promote IDLC behavior. This study examines learners' boredom profiles, investigates the association between digital competence and IDLC, and explores the extent to which distinct boredom profiles moderate this association among Chinese language learners in New Zealand. It extends research on IDLL beyond English and advances a theory-driven understanding of informal Chinese learning in the digital era.

2. Literature review

2.1. Proactive language learning theory and control-value theory

This study is grounded in proactive language learning theory (PLLT) and control-value theory (CVT). PLLT conceptualizes language learners as active agents who deliberately initiate, regulate, and sustain their learning across both formal and informal contexts (Papi & Hiver, 2025). It offers a theoretical lens to explain why some learners actively exploit informal opportunities, such as engaging with online videos, social media, or artificial intelligence-mediated platforms, while others remain passive consumers. Proactive learning behavior arises from the interaction between contextual factors (e.g., social support, institutional policies, and learning opportunities) and learner-internal capacities (e.g., knowledge and skills, personality, affective, and motivational dispositions, and cognitive abilities), which together shape how learners mobilize resources and strategically explore and engage in learning practices beyond formal settings (Papi & Hiver, 2025). A growing body of evidence suggests that social support and learner-related factors are pivotal to learners' self-directed learning (Liu, 2026; Liu & Fan, 2026; Liu & Lee, 2026; Zhao et al., 2026). Drawing on PLLT, Chinese learners' digital competence constitutes a key enabling learner-internal antecedent of their proactive learning beyond the classroom. Learners with higher digital competence

are better equipped to identify and utilize relevant digital resources and to translate behavioral intentions into actual practice with digital tools in informal learning contexts (He et al., 2021; Liu & Zhao, 2025). Concurrently, affective and motivational variables (e.g., emotions and motivation) are direct and key predictors of proactive behaviors (Papi & Hiver, 2025). In general, positive emotions are anticipated to foster proactive behavior, whereas their negative counterparts can hinder it by increasing perceived effort and associated costs (Parker et al., 2010).

CVT (Pekrun, 2006) posits that students' emotions in academic learning are shaped by their appraisals of control and value in the ongoing task or activity. Generally, when learners perceive high control and task value, they are more likely to experience positive activating emotions (e.g., enjoyment and curiosity), which, in turn, foster active engagement, enhance cognitive processing, and support more effective and goal-directed learning. Conversely, low perceived control or low task value can elicit negative deactivating emotions (e.g., boredom and hopelessness), which may undermine cognitive, motivational, and regulatory processes, ultimately impeding learning outcomes. Within this framework, students' digital competence can be conceptualized as a distal antecedent, influencing perceived control over learning activities. Learners with higher digital competence are better equipped to navigate, evaluate, and utilize digital resources, thereby reducing experiences of boredom and stimulating autonomous digital learning beyond formal instruction. In contrast, learners with lower digital competence may perceive diminished control over learning tasks, which can exacerbate boredom and, consequently, reduce the time, effort, and effectiveness of self-directed informal digital learning.

Nevertheless, boredom may generate positive effects, depending on the degrees of valence and arousal. For instance, searching boredom can stimulate curiosity and prompt learners to be open to or actively seek out alternative activities, resources, or strategies to re-engage with the learning task (Goetz et al., 2014). Boredom can play a facilitating role by stimulating teachers' creativity, encouraging them to design more engaging learning tasks, which, in turn, may reduce learners' boredom (Elahi Shirvan et al., 2025). In this way, boredom can potentially act as a catalyst, directing learners toward more personalized and self-directed informal language learning and positioning it as a dual emotional signal rather than merely a negative affective experience. This perspective aligns with CVT (Pekrun, 2006), which posits that the consequences of negative emotions, such as anxiety or anger, are not uniformly detrimental and may be either facilitative or debilitative depending on the context and the intensity of valence. These insights underscore the potentially complex and multifaceted role of boredom in informal digital L2 learning settings.

2.2. IDLC

Drawing on existing scholarship on informal digital learning of LOTE (Lee et al., 2025; Liu et al., 2024), we conceptualize IDLC as learners' self-directed engagement with Mandarin Chinese (Putonghua) through digital technologies beyond formal instructional settings. IDLC encompasses a wide range of activities, including interacting with Chinese speakers, consuming Chinese-language media, using language learning apps or digital resources to practice reading, writing, listening, and speaking, and exploring cultural content that reinforces L2 learning and use outside the classroom. Consistent with prior relevant research, IDLC is characterized by learner autonomy, interest-driven participation, and use of diverse digital resources beyond formal instruction (Liu & Lee, 2026; Soyoof et al., 2023). At the same time, IDLC unfolds within a distinctive linguistic and semiotic ecology: Unlike alphabetic languages such as English, learning Chinese involves a character-based writing system, tonal phonology, and dense connections between language use and sociocultural knowledge. These features may shape how learners select, interact with, and benefit from digital resources in ways that differ from those associated with learning English (Osborne et al., 2024).

Existing empirical studies related to IDLC may provide important, though still fragmented, insights into how IDLC unfolds in practice. Specifically, most existing research has focused on the affordances of social media and digital platforms, such as Rednote and WeChat, in supporting self-directed learning among CSL learners (Liu et al., 2025; Wang, 2025). For example, Huang (2017) examined the informal learning experiences of three American learners of Chinese through online video viewing, identifying affordances such as exposure to authentic conversational input, near-native pronunciation models, Chinese social realities, and opportunities for self-assessment. Similarly, Jin (2018) investigated seven study-abroad students' use of WeChat in Shanghai and showed how casual interactions with native speakers, meaning-focused communication, and access to linguistic and multimodal resources supported language development and identity construction. Importantly, Jin (2018) noted that these affordances were not uniformly realized but varied according to learners' proficiency levels and personal preferences for platform use, highlighting the role of individual differences in shaping variations in learners' IDLC practices. From a different perspective, Wang (2025) emphasized the institutional constraints surrounding informal learning, finding that despite access to diverse digital resources, CSL learners at a Japanese university continued to rely heavily on structured guidance. Extending IDLC research to gamified environments, Li et al. (2024) examined 103 Chinese language learners' experiences with Duolingo and reported that narrative and reward mechanisms enhanced engagement, whereas challenges,

progress indicators, and competitive elements promoted persistence and self-directed practice. Notably, narrative and visual design features were found to be particularly supportive of learners' comprehension and mastery of Chinese characters, underscoring the language-specific affordances of digital tools in IDLC contexts.

2.3. Digital competence

Digital competence (DC) is commonly understood as learners' capacity to use digital technologies efficiently, responsibly, and purposefully for communication, information access, and knowledge construction across diverse tools and platforms (Ferrari, 2012). Rather than referring solely to technical operational skills, digital competence is widely conceptualized as a construct that integrates information and communications technology expertise, ethical awareness, and higher-order cognitive abilities, enabling learners to evaluate, consume, and produce information in digitally mediated environments (Calvani et al., 2012; Hatlevik & Christophersen, 2013). Empirical research has consistently identified digital competence as a key antecedent of learners' participation in informal digital learning. For example, He and Li (2019) demonstrated that digital competence, alongside technology expectancy, plays a central role in facilitating participation in informal digital learning among Chinese and Belgian learners. Subsequent studies across diverse contexts have replicated this pattern, showing that higher levels of digital competence are associated with greater engagement in informal digital learning activities and, indirectly, with broader academic engagement and performance (Heidari et al., 2021; Mehrvarz et al., 2021). Evidence from L2 English learning research further suggests that digital competence is closely linked to learners' out-of-class English learning behaviors with technology (Barkati et al., 2025).

2.4. Boredom

Boredom has received increasing attention in second language acquisition (SLA) research due to its high prevalence and its association with maladaptive symptoms such as mind-wandering, drowsiness, and disengagement during L2 learning (Feng et al., 2025; Kruk et al., 2022; Li et al., 2024; Pawlak et al., 2025; Zhao et al., 2024). These experiences are commonly linked to reduced motivation, lower engagement, superficial information processing, reduced willingness to communicate, and weaker learning outcomes (Derakhshan et al., 2021; Feng et al., 2026; Pawlak et al., 2020; Zhao & Wang, 2025). From the perspective of CVT, boredom is conceptualized as a negative, low-arousal emotion that arises when

learners perceive learning tasks as either uncontrollable or overly predictable (Pekrun, 2006). Conceptually, a distinction can be made between trait boredom and state boredom, with trait boredom referring to a stable tendency to experience boredom across learning situations and state boredom capturing momentary, situational responses (Putwain et al., 2018). The present study measures boredom as a trait-like emotion, as it reflects CSL learners' typical and enduring affective experiences in Chinese learning, and is therefore more relevant for understanding enduring patterns of performance in informal learning contexts.

Empirical findings regarding the role of boredom in L2 learning and teaching, however, remain mixed. A number of studies have documented a negative association between boredom and L2 achievement across diverse contexts, including learners of English as a foreign language (EFL) in rural China (Li & Li, 2023), Moroccan EFL learners (Dewaele, Botes, & Meftah, 2023), and New Zealand CSL learners (Lan et al., 2023; Zhao et al., 2024). Meta-analytic and longitudinal evidence further supports the generally debilitating role of boredom in language learning (Li et al., 2024), while qualitative work has shown that boredom can permeate learners' behavioral, cognitive, and emotional engagement (Zhao & Wang, 2025). Other studies have reported nonsignificant relationships between boredom and engagement or proficiency, both among young learners and in Chinese language learning contexts (Dewaele, Botes, & Greiff, 2023; Tsang & Dewaele, 2024). In contrast, Elahi Shirvan et al. (2025) have provided empirical evidence that boredom can foster creativity among innovative language teachers, which in turn reduces learners' boredom levels. Inconsistencies are evident in digitally mediated settings, where boredom has been found not only to inhibit learning but also to correlate positively with digital media use, suggesting that bored individuals may turn to digital devices as alternative forms of engagement (Camerini et al., 2023; Dora et al., 2021). In a digital game-based learning setting, Li et al. (2025) reported that Chinese students majoring in English experienced high enjoyment and low boredom levels over a six-week period. Taken together, these mixed findings suggest that the role of boredom in L2 education, particularly in IDLL settings, extends beyond a uniformly negative interpretation and may vary depending on learners' personal resources and contexts.

2.5. The present study

Building on the existing literature and theoretical framework, this study adopted a person-centered approach to identify distinct boredom profiles among young Chinese learners in New Zealand. It further examined the association between DC and IDLC and explored whether these profiles shape the relationship between the two. The following research questions (RQs) guided this investigation:

RQ1: What boredom profiles can be identified among Chinese language learners?
RQ2: To what extent is DC associated with IDLC? To what extent do boredom profiles moderate the relationship between DC and IDLC?

3. Research methods

3.1. Contexts and participants

New Zealand constitutes a linguistically and culturally diverse society shaped by sustained immigration from Asia, the Pacific Islands, and beyond. This diversity means there is a wide range of heritage languages among New Zealanders, including Mandarin, Cantonese, Samoan, Tongan, Hindi, and Korean (Wang & East, 2023). For Chinese language learning, such a multilingual environment presents a paradox. While learners may encounter Chinese through family and community networks, the strong institutional and symbolic centrality of English in schooling, employment, and social mobility reduces the use of languages other than English outside specific linguistic communities.

Interest in Chinese language education in New Zealand has increased relatively recently, driven in part by China's expanding economic and geopolitical presence. Chinese has since become one of the most widely studied LOTEs nationwide (Wang & East, 2023), alongside the growth of Chinese community schools that provide supplementary instruction for learners from diverse linguistic and educational backgrounds. Nevertheless, Chinese language education in New Zealand continues to face persistent challenges, including limited availability of locally trained teachers and pedagogical practices that often prioritize rote learning over more sustainable and learner-centered methods (Wang, 2021). In this context, informal learning, particularly in digital spaces, offers an alternative pathway for learners to engage with Chinese in more flexible, interest-driven, and autonomous ways.

Focusing on six community schools and public high schools across three major regions of Auckland (North Shore, West Auckland, and East Auckland), the study comprised 516 participants aged 10 to 19 years (M = 13.60, SD = 1.90), with the majority (383, 74.22%) learning Chinese as a heritage language. The sample was relatively balanced in terms of gender (female: 275, 53.29%; male: 231, 44.77%; 10 preferred not to disclose). The sample also showed considerable diversity in terms of language and ethnicity. English was reported as the first language by 57.36% of participants, followed by Chinese (21.32%), Hindi (2.13%), and Korean (1.74%), with the remaining 17.45% indicating other languages (e.g., Japanese and Tongan). In terms of ethnicity, the largest group self-identified as Chinese (57.2%), followed by New Zealand European (19.0%), Māori (9.3%), Indian (4.7%), and Filipino (2.7%),

with the remaining participants (7.1%) representing a variety of other ethnic backgrounds, including Sāmoan, Korean, Fijian, Vietnamese, and Cambodian, among others. With respect to their Chinese language learning experience, the participants had been studying the language for an average of 3.64 years. Additionally, the participants showed strong digital readiness, with 95.35% reporting stable Internet access at both home and school and 81.98% owning two or three digital devices.

3.2. Instruments

Data for this study were collected via a two-part questionnaire. The first section gathered demographic information, including participants' gender, age, nationality, first language (L1), and years of Chinese language study. The second section assessed three core constructs, that is, digital competence, IDLC, and boredom. These constructs were measured using three distinct scales, with all items rated on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). No reverse-coded items were included in any of the scales, and higher scores consistently indicated higher levels of the target construct. The questionnaire was provided in both English and Chinese for participants' convenience.

3.2.1. Digital competence

Students' digital competence was measured using the scale reported in Liu and Zhao (2026), which comprises four items adapted from Wang et al. (2021). Sample items include "I can easily use digital devices (e.g., phones, computers, and tablets) to communicate and work with others online" and "I can quickly learn how to use new digital devices and technologies." Higher scores indicate greater perceived ability to use digital technologies effectively for learning Chinese in informal and self-directed contexts. The scale showed high internal consistency in the present study (Cronbach's $\alpha = .895$).

3.2.2. IDLC

The IDLC scale was adapted from Liu et al. (2024), being developed based on earlier measures proposed by Lee and colleagues (e.g., Lee & Drajati, 2019; Lee & Lee, 2021). In the present study, the wording was adapted from the broader LOTE context to the specific context of informal Chinese learning to capture both the frequency and diversity of digital learning activities engaged in by L2 Chinese learners. The final version comprised seven items, including "I browse content in Chinese or related

to Chinese language and culture through social media" and "I use mobile apps to practice and improve my Chinese pronunciation outside the classroom." Internal consistency reliability in the present study was high (Cronbach's α = .874).

3.2.3. Boredom

Participants' boredom was assessed using a subscale of the *Foreign Language Learning Boredom Scale* developed by Li et al. (2023), with a focus on general trait learning boredom. This scale was adopted because it has demonstrated robust psychometric properties and has been applied and validated in CSL learning contexts, supporting its suitability for the present study (Chen et al., 2024; Zhao et al., 2025). Trait boredom reflects a learner's dispositional tendency to experience boredom across tasks and contexts, rather than transient and momentary fluctuations, making it a relatively stable and reliable predictor of overall learning behaviors and outcomes across learning settings. In this study, the adapted subscale included five items tailored to the IDLC context. Sample items include "I'm forced to learn all the subjects, including Mandarin Chinese" and "Not only learning Mandarin Chinese, but studying is dull in general." Cronbach's α for the scale in the present study was .802, indicating high internal consistency reliability.

3.3. Procedure

All permissions and consent were obtained from the relevant stakeholders prior to data collection. Participation was entirely voluntary, and participants could decline to participate or withdraw from the study at any time without adverse consequences. They were also informed that the data would be used solely for research purposes. All responses were collected anonymously and treated as strictly confidential. The questionnaires were administered by instructors in paper-and-pencil format after class to minimize disruption to regular classroom activities. The questionnaire required approximately 5-10 minutes to complete. A total of 561 questionnaires were obtained between June and September 2025. The raw data from these questionnaires were then manually entered and coded using Microsoft Excel.

3.4. Data analysis

The study followed a stepwise analytical workflow, beginning with data screening and cleaning, followed by preliminary descriptive and reliability analyses in SPSS, and then a series of mixture-model analyses in Mplus (Figure 1).

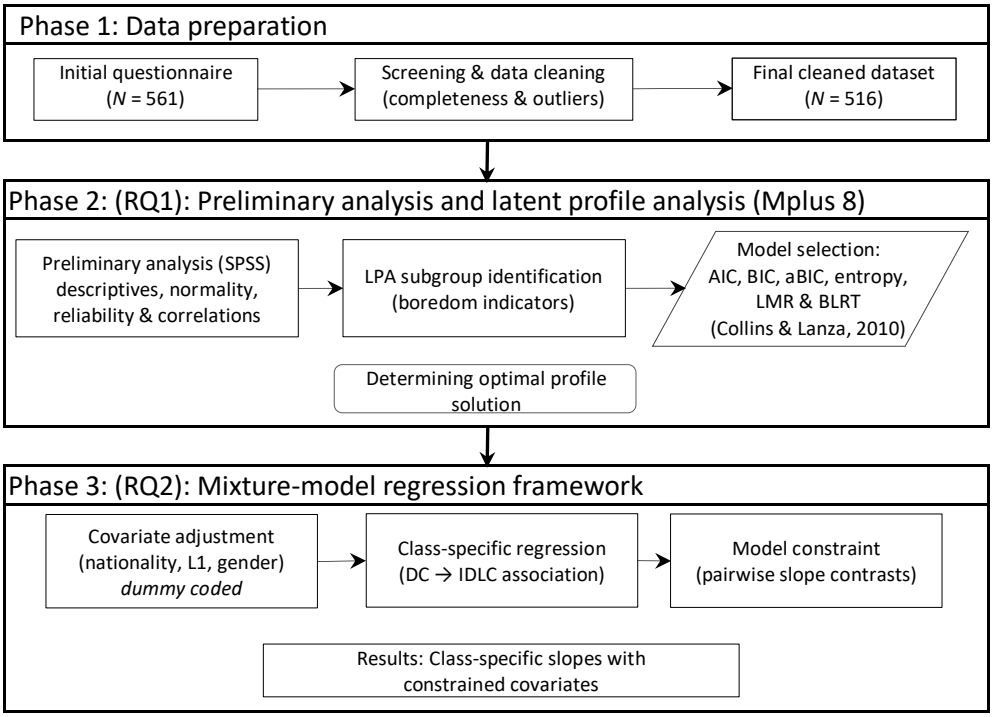


Figure 1 Analytical workflow of the present study

Initial data collection yielded 561 questionnaire responses (see Figure 1). Rigorous screening was then conducted to check data completeness and to identify multivariate outliers, and 516 questionnaires were retained for analysis. The cleaned dataset was analyzed using SPSS 26 to perform descriptive statistical evaluations, including the calculation of means, standard deviations, and normal distributions. Internal consistency and preliminary bivariate correlations were examined to evaluate the reliability of the key measures and the association among the variables.

Following the preliminary phase, all subsequent analyses were conducted in Mplus 8. First, a latent profile analysis (LPA) was undertaken to identify latent subgroups of participants based on their boredom indicators. LPA is a person-centered mixture modeling technique that identifies unobserved subgroups of individuals who show similar response patterns on a set of continuous indicators. Unlike variable-centered approaches that estimate average relationships across the whole sample, LPA focuses on heterogeneity by grouping participants into distinct latent profiles based on their indicator scores (Berlin et al., 2014). In the present study, LPA was used to capture meaningful patterns of boredom and to classify learners into boredom profiles, which provided a basis for examining whether the association between DC and IDLC differed across profiles. Competing models

with increasing numbers of classes were estimated and compared. Model selection relied on multiple criteria, including information criteria AIC (Akaike Information Criterion), BIC (Bayesian Information Criterion), and aBIC (sample-size adjusted BIC), classification quality assessed by entropy, and likelihood-based tests such as LMR (Lo-Mendell-Rubin Test) and BLRT (Bootstrap Likelihood Ratio Test) (Collins & Lanza, 2010; Masyn, 2013). Substantive interpretability and class size were also considered to avoid solutions with extremely small classes.

After determining the optimal profile solution, subsequent analyses examined the association between DC and IDLC while adjusting for key demographic characteristics. Specifically, nationality, L1, and gender were included as covariates; categorical variables were dummy-coded, with one category designated as the reference group. Building on this covariate-adjusted model, a mixture-model regression framework was then used to test whether the DC-IDLC association differed across boredom profiles. The focal regression path was estimated separately within each latent class to obtain class-specific slopes, and slope differences across classes were assessed using model constraints that specified pairwise contrasts of the class-specific regression coefficients. To ensure that any between-class differences reflected variation in the DC-IDLC association rather than differential covariate effects, the covariate coefficients were constrained to be equal across classes, thereby improving the comparability of class-specific estimates.

4. Results

The results are presented in three stages. First, descriptive statistics and bivariate correlations are reported to provide an overview of the study variables. Next, to address RQ1, LPA was conducted to identify distinct boredom profiles among participants. Finally, to address RQ2, moderation analyses were performed to examine whether the identified boredom profiles moderated the relationship between DC and IDLC.

4.1. Descriptive statistics and the association between DC and IDLC

Descriptive statistics and bivariate correlations are presented in Table 1. Regarding descriptive statistics, the mean scores were 3.22 (*SD* = 1.58) for IDLC, 5.83 (*SD* = 1.34) for DC, and 3.64 (*SD* = 1.33) for boredom. The skewness and kurtosis values for all three variables were within acceptable ranges, indicating no substantial deviations from normality and supporting the suitability of the data for subsequent parametric analyses (Kline, 2023).

Table 1 Descriptive statistics and correlations among IDLC, DC, and boredom

	DC	IDLC	Boredom
DC	—		
IDLC	.098*	—	
Boredom	-.008	-.138**	—
M	5.830	3.216	3.642
SD	1.349	1.577	1.334
Skewness	-1.411	.478	.068
Kurtosis	1.701	-.588	-.323

Note. *$p < .05$ (two-tailed), **$p < .01$ (two-tailed)

According to Cohen's (2013) guidelines, the observed correlations were small in magnitude. Specifically, higher levels of DC were associated with higher levels of IDLC ($r = .098$, $p < .05$), accounting for approximately 1% of the variance ($r^2 = .01$), whereas higher levels of boredom were associated with lower levels of IDLC ($r = -.138$, $p < .01$), accounting for approximately 2% of the variance ($r^2 = .02$). No significant association was observed between DC and boredom. These results suggest limited explanatory power at the bivariate level. The relatively weak associations also indicate potential heterogeneity in the relationships among variables, thereby providing preliminary support for subsequent profile-based analyses.

4.2. Boredom profiles identified by LPA

LPA was conducted to identify unobserved subgroups of students with distinct boredom patterns. One- to five-profile solutions were estimated and compared using the AIC, BIC, aBIC, entropy, LMR, and BLRT. The corresponding model fit indices are presented in Table 2.

Table 2 Model fit information for LPA

Nclass	AIC	BIC	aBIC	Entropy	LMR	BLRT	Class prevalence
1	10306.718	10349.179	10317.438	N/A	N/A	N/A	1
2	9720.51	9788.448	9737.661	0.775	0	0	.44, .56
3	9510.795	9604.21	9534.378	0.822	0.0014	0	.31, .55, .14
4	9463.218	9582.108	9493.231	0.827	0.2590	0	.48, .32, .06, .14
5	9578.005	9722.896	9614.972	0.830	0.7475	0	.21, .03, .42, .22, .13

For the three-profile solution, AIC, BIC, and aBIC were markedly lower than those of the one- and two-profile models, and entropy was .822, indicating acceptable classification precision. The corresponding class proportions (31%, 55%, and 14%) further suggested that each profile accounted for a non-negligible share of the sample, supporting interpretable profile solutions (Collins & Lanza, 2010).

Although the four-profile solution showed slightly lower information criteria and higher entropy than the three-profile solution, the LMR test was nonsignificant for the four- and five-profile models. Although AIC and BIC decreased in the four-profile model, such improvement is expected and does not itself indicate a meaningfully better solution. The LMR test, which directly evaluates whether adding a class yields a statistically significant improvement in fit, was therefore given more weight in the final selection decision. Moreover, the four- and five-profile solutions introduced small classes (approximately 31 and 15 participants, accounting for 6% and 3% of the sample, respectively), reducing parsimony and interpretability. Taken together, considering parsimony, interpretability, and the avoidance of trivial classes, the three-profile solution was retained for subsequent analyses. Building on the profile solution selected based on model fit indices (see Table 2), Figure 2 visualizes the estimated mean responses to the five boredom items across the three latent profiles.

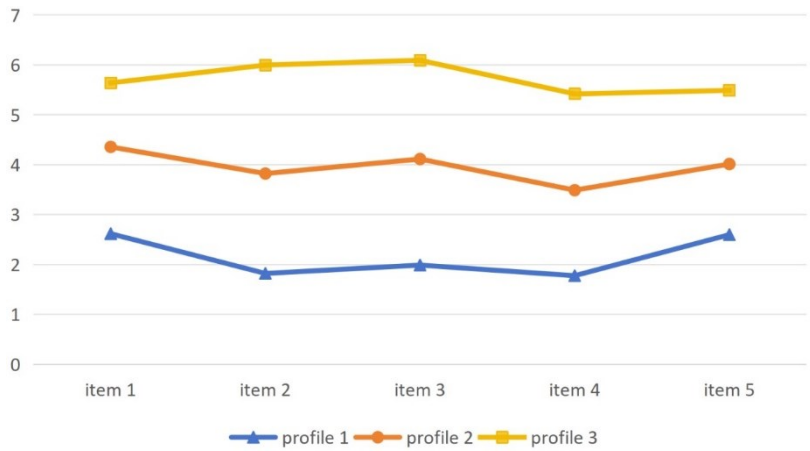


Figure 2 Estimated boredom item means across the three latent profiles

As illustrated in Figure 2, the profiles are primarily differentiated by overall levels of boredom rather than distinct response patterns across items. Specifically, the low-boredom profile is characterized by consistently low scores across all items, the moderate-boredom profile shows moderate scores with minor fluctuations across items, and the high-boredom profile exhibits consistently high scores across all indicators. Accordingly, the profiles were labeled *low boredom* (Profile 1), *moderate boredom* (Profile 2), and *high boredom* (Profile 3).

Regarding sample size adequacy, survey sample size is primarily determined by the desired precision (margin of error), confidence level, and population variability. In addition, it is the absolute sample size, rather than the sampling fraction, that supports the planned analyses. When the population proportion is unknown,

assuming p = .50 provides a conservative estimate (Taherdoost, 2017). In the present LPA solution, Profile 3 comprised 14% of the sample, indicating a non-trivial subgroup and providing sufficient information for the subsequent analyses.

4.3. Moderating role of boredom profiles

To establish a baseline for the relationship between DC and IDLC, a multiple regression analysis was conducted while controlling for nationality, first language, and gender. The results indicated that DC was positively and significantly associated with IDLC (B = .114, SE = .051, p = .027), although the overall model accounted for 2.3% of the variance in IDLC.

Given the small overall effect size in the regression, the association between DC and IDLC may have been averaged out across heterogeneous boredom subgroups. To examine this potential heterogeneity, a mixture-model regression was subsequently conducted to test boredom profile membership as a moderator of the DC→IDLC relationship by allowing the DC slope to vary across the three boredom profiles, while constraining the effects of nationality, gender, and L1 to be equal across profiles. As shown in Table 3 and Figure 3, the effect of DC on IDLC differed markedly across the three boredom profiles.

Table 3 Profile-specific effects of DC on IDLC across boredom profiles

Boredom profile	*B* (S.E.)	*p*	95% CI
Low boredom	.048 (.091)	.602	[-.130, .226]
Moderate boredom	.110 (.070)	.117	[-.027, .247]
High boredom	.342 (.139)	.014	[.070, .614]

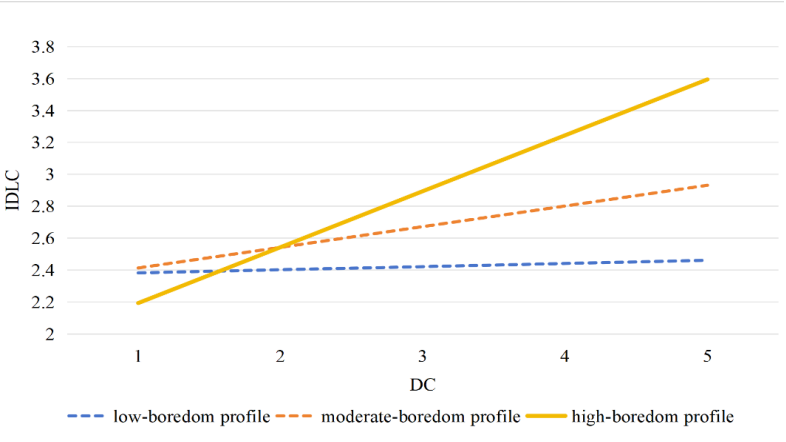


Figure 3 Profile-specific associations between DC and IDLC

As shown in Table 3, across the low and moderate boredom profiles, DC did not significantly predict IDLC, indicating a weak and nonsignificant association in these two groups. In contrast, a substantially different pattern emerged for the high boredom profile. In this group, DC exhibited a strong and statistically significant positive effect on IDLC, with the 95% confidence interval excluding zero. Moreover, the corresponding model explained 4.35% of the variance in IDLC (R^2 = .0435, p = .007). As further depicted in Figure 3, the regression slope for the high boredom profile was markedly steeper than those for the low and moderate boredom profiles, indicating that students experiencing high levels of boredom were particularly sensitive to variations in DC with respect to IDLC.

The moderation effect of latent classes was further confirmed by comparing the slope differences. The difference between the slopes of the low boredom profile and the high boredom profile (D13 = -.294, p = .069) reached marginal significance, suggesting that the predictive power of DC is more pronounced in the high boredom profile. In contrast, no significant difference was found between the low boredom profile and moderate boredom profile (D12 = -.062, p = .333), both of which exhibited a negligible relationship between DC and IDLC.

5. Discussion

The present study aimed to identify learners' profiles of boredom (RQ1), examine the association between DC and IDLC, and determine how those different profiles moderated the association between those two variables in the New Zealand context (RQ2). This study moves beyond the traditional view of boredom as an exclusively negative emotion in L2 learning and extends IDLL to the context of Chinese language learning. The discussion follows the sequence of the research questions before turning to the implications of the study.

The results for RQ1 identified three distinct boredom profiles: high boredom (N = 70), moderate boredom (N = 287), and low boredom (N = 159), highlighting heterogeneity in participants' boredom across these profiles. These findings differ from those reported by Li et al. (2025), who found that gameplay-based out-of-class language learning was characterized by consistently low levels of boredom and high levels of enjoyment. Similarly, studies in the Chinese language learning context have reported relatively low levels of boredom among Thai learners of Chinese and international students studying Chinese in China (e.g., Zhao et al., 2025; Zhao & Wang, 2025). These discrepancies may be partly attributed to differences in learner populations and learning contexts. Specifically, the learners examined in previous studies were university learners often driven by strong instrumental motivation, such as pursuing employment opportunities,

academic success, or scholarship attainment, which may have mitigated feelings of boredom (Zhao et al., 2025). By contrast, the young participants in this study were predominantly Chinese heritage learners enrolled in community schools, where attendance was largely driven by parental expectations rather than intrinsic motivation to learn Chinese (Li & Ma, 2017). Instruction in these schools, particularly for heritage learners, is also often constrained by a shortage of locally trained Chinese language teachers (Wang & East, 2023). Teaching in these community schools is typically teacher-centered, with a strong emphasis on rote memorization and repetitive Chinese character practice (Wang, 2021). Such instructional practices can undermine positive learning experiences and contribute to heightened boredom among Chinese language learners.

Another explanation for these discrepancies lies in the analytical approach. Prior studies using variable-centered methods have treated boredom as a single continuous construct, overlooking the internal heterogeneity among learners (Eerdemutu et al., 2026). By contrast, the person-centered approach adopted in this study identified three distinct boredom profiles, revealing patterns of persistently high, moderate, or low boredom among Chinese language learners, patterns that would remain hidden in sample-level analyses. These findings provide a more nuanced and fine-grained understanding of boredom in IDLC contexts.

RQ2 investigated the association between DC and IDLC, and whether boredom profiles moderated the relationship between these two variables. The findings show that DC was positively associated with IDLC, indicating that Chinese language learners with stronger digital skills are better equipped to seek out additional learning resources, self-direct their learning, and engage effectively with digital tools beyond the classroom (Liu & Zhao, 2026). One possible explanation for this positive association is that DC equips learners with the technical, cognitive, and metacognitive abilities needed to navigate diverse digital environments, select appropriate learning materials, and engage efficiently in self-directed learning (Hatlevik & Christophersen, 2013; Mehrvarz et al., 2021). This finding is also consistent with the assumptions of PLLT (Papi & Hiver, 2025), which proposes that learners' proactive learning behaviors are shaped by a combination of personal skills, affective states, and dispositional traits. Learners with stronger DC may be more capable of locating, evaluating, and effectively using digital learning resources, thereby reducing the technological barriers associated with technology-mediated language learning.

With regard to the moderating role of boredom profiles in the relationship between DC and IDLC, the findings reveal a complex pattern. While heightened boredom appeared to amplify the positive effect of DC on learners' participation in IDLC, the low and moderate boredom profiles did not show any significant moderating influence. This finding suggests that, for learners experiencing low or moderate levels of boredom, the emotional state is not strong enough to significantly

influence proactive learning behavior. In these cases, DC alone does not appear to significantly explain self-directed learning. In other words, when learners are already engaged or only mildly disengaged, boredom does not further affect how effectively DC translates into proactive learning. Previous studies have likewise demonstrated the nonsignificant role of boredom among L2 learners (Dewaele, Botes, & Greiff, 2023; Tsang & Dewaele, 2024).

Contrary to the common assumption that boredom is a debilitating emotion (Li & Li, 2023; Li et al., 2024), the present findings suggest that high levels of boredom do not necessarily impede learners' participation in IDLC. Instead, boredom may function as a catalyst that motivates Chinese language learners to leverage their DC and engage more actively in IDLC. This interpretation is consistent with the findings of Camerini et al. (2023) and Dora et al. (2021), which indicate that boredom increases individuals' tendency to engage with digital devices. It also aligns with Elahi Shirvan et al. (2025), who demonstrated that boredom can foster creativity among innovative language teachers. More broadly, the present findings add to a growing body of evidence suggesting that negative emotions are not invariably maladaptive. For example, Zhao et al. (2026) found that anxiety, traditionally regarded as a detrimental emotion, positively predicted learners' engagement in informal English language learning when learners had access to abundant personal resources, such as social media and AI-powered tools.

From a theoretical perspective, this finding supports and extends CVT (Pekrun, 2006) within the IDLC context, illustrating that negative emotions are not inherently debilitating. Consistent with Goetz et al. (2014), boredom can be classified into four types (i.e., indifferent, calibrating, searching, and reactant boredom), differing in valence and arousal. Indifferent boredom, characterized by low arousal and slightly positive valence, may even promote feelings of relaxation during the L2 learning process. In contrast, searching boredom, marked by higher arousal and negative valence, reflects restlessness and an active search for alternative learning tasks or activities, which can drive proactive learning actions with digital resources beyond the classroom. Accordingly, high levels of boredom appear to foster self-directed digital exploration, whereas the moderate- or low-boredom profiles exhibited a nonsignificant association between DC and IDLC. Importantly, this pattern cannot be fully understood without considering the New Zealand instructional context. Many Chinese heritage learners attend community schools where instruction is often characterized by rigid approaches, limited pedagogical innovation, and insufficient integration of diverse learning resources, conditions that may contribute to learners' boredom and disengagement (Li, 2024; Wang & East, 2023). Such instructional conditions can make classroom learning dull and monotonous, reducing learners' intrinsic interest and engagement in Chinese language learning (Li, 2024). In this regard, boredom may function as a catalyst for

proactive learning behavior, prompting learners to seek alternative, autonomous, recreational, and self-directed learning opportunities beyond the classroom. These findings underscore the importance of considering emotional heterogeneity when designing interventions to enhance IDLC.

6. Conclusion

This study uncovered the nuanced role of boredom in shaping the predictive role of DC in IDLC among New Zealand adolescents. Through a person-centered analysis, three distinct boredom profiles (high, moderate, and low) were identified, highlighting substantial heterogeneity in learners' emotional experiences. Crucially, high boredom amplified the relationship between DC and IDLC, suggesting that a high level of boredom can act as a force that channels learners' digital skills into proactive informal language learning behavior, whereas low and moderate boredom showed no moderating effect. These findings underscore the importance of tailoring instructional strategies and interventions to learners' affective profiles, revealing how boredom can translate DC into autonomous and self-directed learning.

Given the identification of distinct boredom profiles and the moderating role of boredom in the association between DC and IDLC, the present findings offer several pedagogical implications for understanding and harnessing boredom in informal digital learning contexts. Considering that DC is positively linked to IDLC, one important implication is that teachers should create opportunities for students to develop and apply digital skills in meaningful ways (Dang et al., 2024). This can be achieved by integrating authentic digital tasks into instruction, such as evaluating online Chinese-language resources, participating in online discussion communities, creating multimodal content, and using digital tools to support Chinese language learning. Teachers can also provide guidance on how to search for, evaluate, and effectively use digital resources for autonomous Chinese learning. Such practices can strengthen learners' DC and confidence in navigating digital environments to promote IDLC participation. Regarding the distinct boredom profiles of Chinese learners, teachers should recognize that learners experience boredom in diverse ways rather than as a uniform emotional experience. For learners experiencing low, moderate, or high boredom, classroom instruction can incorporate collaborative learning, authentic communicative tasks, multimedia resources, and learner-centered activities that promote autonomy and sustained engagement. Such approaches may not only alleviate boredom but also encourage learners to extend their Chinese learning beyond formal instruction. Rather than viewing boredom as an emotion that must always be eliminated, teachers should recognize that it may also serve an adaptive function by motivating learners to seek

alternative learning opportunities in digital environments. Accordingly, pedagogical efforts should focus not only on reducing boredom but also on equipping learners with the DC needed to channel boredom into proactive IDLC. However, one important consideration is that increased use of digital technologies raises concerns about adolescents' screen time. Rather than limiting technology use, educators and parents should promote purposeful and balanced digital learning by establishing clear expectations regarding screen use. Such collaborative guidance may maximize the learning benefits of digital technologies while minimizing their potential drawbacks in technology-enhanced language learning contexts (Liu, 2026).

Despite its contributions, this study has several limitations that warrant further investigation. First, while the use of LPA allowed for the identification of distinct boredom profiles and their moderating role, the underlying mechanisms through which boredom shapes the relationship between DC and IDLC remain unclear. Future research should incorporate qualitative methods, such as in-depth interviews, to explore learners' subjective experiences and provide richer insights into how different boredom profiles shape engagement in IDLC. Second, longitudinal studies are needed to examine the stability of boredom profiles over time and to track how changes in boredom and DC jointly influence IDLC trajectories. One further limitation of this study is the reliance on self-report questionnaires, which may lead to response biases and limit the generalizability of the findings. Future research could employ multi-method approaches to triangulate the data. Finally, the sample was drawn primarily from Chinese heritage learners in New Zealand community school contexts, which may limit the generalizability of the findings. Expanding research to diverse cultural and educational settings can extend these results. Future empirical investigations should also examine the potential mechanisms underlying the relationship between DC and IDLC by considering possible mediators, such as learner-internal factors (e.g., learner autonomy, agency, self-efficacy, and enjoyment) and learner-external factors (e.g., parental and institutional support), to deepen the understanding of IDLC.

Acknowledgments

We would like to thank the local Chinese teachers for their assistance with data collection and all the participants for taking the time to complete the survey. We are also grateful to the three anonymous reviewers for their insightful and constructive feedback, as well as to the editorial team for their valuable comments and guidance.

This work was supported by the Fundamental Research Funds for the Central Universities (No. 14380001).

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