Proceeding of The International Conference on Global Education and Learning

E- ISSN: 3089-8072

Research Article

Bilingual Story Apps for Heritage Language Maintenance: Breaking Language Loss Barriers

Nurasia Natsir[1]*, Yuliyanah Sain[2]

[1] Institut Ilmu Kesehatan Pelamonia Kesdam XIV/ Hasanuddin, Indonesia; e-mail: nurasianatsir87@iikpelamonia.ac.id
[2] Universitas Muhammadiyah Kendari, Indonesia; e-mail: yuliana.sain@umkendari.ac.id
* Corresponding Author: Nurasia Natsir

Abstract: Heritage language loss among immigrant and diaspora communities represents a critical challenge to cultural identity, intergenerational communication, and cognitive diversity. Traditional heritage language maintenance approaches face significant barriers including limited resources, lack of qualified instructors, geographic dispersion, and competing demands of dominant language acquisition. This study investigates the effectiveness of bilingual digital story applications as innovative tools for heritage language maintenance among children aged 4-12 years. Through a 24-month longitudinal mixed-methods study involving 1,843 families across eight language communities (Spanish, Mandarin, Arabic, Korean, Tagalog, Vietnamese, Hindi, and Polish), we examined language proficiency development, cultural identity formation, family engagement patterns, and app usage behaviors. Quantitative analysis of pre- and post-intervention language assessments revealed statistically significant improvements in heritage language vocabulary (effect size d=0.68), listening comprehension (d=0.54), and oral production (d=0.47) among children using bilingual story apps for at least 20 minutes daily. Qualitative findings from parent interviews and child focus groups highlighted the apps' role in making heritage language learning enjoyable, facilitating parent-child interaction, connecting children to cultural narratives, and normalizing bilingualism. However, effectiveness varied substantially based on app design features, with interactive elements, culturally authentic content, parent involvement scaffolds, and adaptive difficulty showing strongest associations with outcomes. This research demonstrates that thoughtfully designed bilingual story apps can serve as accessible, scalable tools for heritage language maintenance, though they function most effectively as complements to rather than substitutes for rich home language environments and community connections. The study contributes empirical evidence to inform app development, family language planning, and policies supporting linguistic diversity in increasingly globalized societies.

Keywords: Bilingual Apps; Cultural Identity; Family Engagement; Heritage Language; Language Proficiency

Received: July 16, 2025
Revised: September 10, 2025
Accepted: November 5, 2025
Published: December 31, 2025
Curr. Ver.: December 31, 2025

1. Introduction

An estimated 75% of immigrant children in English-dominant countries experience significant heritage language attrition by adolescence, resulting in what researchers term "subtractive bilingualism" the loss of one language as another is acquired (Montrul, 2016). This phenomenon extends beyond linguistic concerns, affecting cultural identity, family cohesion, cognitive advantages of bilingualism, and connections to ancestral communities. Grandparents and grandchildren often cannot communicate effectively, creating painful intergenerational ruptures. Children lose access to cultural narratives, values, and worldviews encoded in heritage languages, experiencing what scholars describe as "cultural bereavement" (Eisenbruch, 1991). The global dominance of English and other major languages further accelerates linguistic homogenization, threatening the world's approximately 7,000 languages, many already endangered.

Heritage language maintenance faces multiple intersecting challenges. Families often lack access to heritage language schools, particularly for less commonly taught languages or in geographically dispersed communities. Where programs exist, they frequently operate on weekends or after regular school hours, competing with other activities and risking child

burnout. Quality instructional materials specifically designed for heritage learners who possess native-speaker intuitions but limited formal proficiency are scarce (Valdés, 2001). Parents, even when fluent heritage speakers, may lack pedagogical training and confidence to teach literacy skills. Additionally, societal pressures toward linguistic assimilation can make children resistant to heritage language learning, viewing it as barrier to peer acceptance rather than asset.

The COVID-19 pandemic intensified these challenges while simultaneously highlighting potential technological solutions. School closures and social distancing disrupted community-based heritage language programs, yet also normalized digital learning and increased families' comfort with educational technology. This context has renewed interest in mobile applications as accessible, flexible tools for heritage language maintenance that can operate within family routines rather than requiring separate institutional settings.

Storytelling represents humanity's oldest educational technology, transmitting language, culture, and values across generations through engaging narratives (Bruner, 1991). Stories provide meaningful contexts for language use, present vocabulary and grammar in natural patterns, engage emotional and cognitive systems that enhance memory, and connect learners to cultural heritage. Digital storytelling builds on these foundations by adding multimedia elements (illustrations, animations, audio narration, music), interactive features (touch-based activities, voice recording, games), and adaptive capabilities that respond to learner progress.

Bilingual story apps specifically designed for heritage language maintenance offer unique affordances. They can present stories simultaneously in heritage and dominant languages, allowing code-switching that mirrors bilingual communication patterns. Interactive features enable children to control pacing, replay sections, and engage actively with content rather than passively consuming media. Audio narration provides pronunciation models, particularly valuable when parents lack literacy skills in heritage languages or speak non-standard dialects. Embedded cultural content traditional folktales, customs, values explicitly connects language to heritage, addressing identity dimensions alongside linguistic development.

However, not all digital story apps are created equal. Many commercial language learning apps target foreign language learners rather than heritage speakers, employing pedagogical approaches inappropriate for children with existing aural comprehension and cultural familiarity. Apps developed without community input may contain cultural inaccuracies or present stereotypical representations that alienate target audiences. Technical design choices around interactivity, difficulty adaptation, and parent engagement scaffolds significantly impact effectiveness. Understanding which design features actually support heritage language maintenance remains an empirical question requiring systematic investigation.

This research integrates three complementary theoretical perspectives. First, Sociocultural Theory (Vygotsky, 1978) emphasizes that language development occurs through social interaction within cultural contexts. Heritage language maintenance thus requires not just exposure but meaningful communicative exchanges embedded in cultural practices. Digital story apps can facilitate such interaction when designed to promote parent-child co-engagement rather than solitary child screen time.

Second, the Input Hypothesis and Comprehensible Input framework (Krashen, 1985) suggests language acquisition requires exposure to language slightly beyond current proficiency level (i+1). Effective bilingual story apps should provide appropriately challenging heritage language input with contextual supports (images, animations, dominant language scaffolds) that make content comprehensible while stretching learners' linguistic capabilities.

Third, Identity Theory in bilingualism (Norton, 2013) recognizes that language learning and identity construction are inseparable processes. Heritage language maintenance succeeds when children develop positive associations with heritage language and culture, viewing bilingual identity as asset rather than burden. Story apps can foster such identity by presenting culturally relevant content, featuring protagonists who share children's backgrounds, and celebrating bilingualism as normal and desirable.

This study aims to address several key research questions. First, it investigates the extent to which bilingual story apps support heritage language development in terms of vocabulary, comprehension, and oral production among children aged 4-12 years. Second, the study explores which app design features such as interactivity, bilingual presentation modes, cultural content, difficulty adaptation, and parent involvement scaffolds show the strongest associations with language outcomes. Third, it examines how bilingual story apps influence children's attitudes toward heritage language and cultural identity. The study also seeks to identify patterns of app usage across families and to understand how contextual factors, such as family language practices, parental involvement, and community support, may moderate the

effectiveness of the apps. Finally, the study gathers parents' and children's perspectives on bilingual story apps as tools for heritage language maintenance, including perceived benefits, limitations, and suggestions for improvement.

This research addresses critical gaps in literature at the intersection of heritage language education and educational technology. While substantial research exists on both heritage language pedagogy and digital learning generally, few studies systematically examine technology-mediated heritage language maintenance with rigorous longitudinal designs, multiple language communities, and attention to both linguistic and sociocultural outcomes. Most existing studies are small-scale pilots focused on single languages or short intervention periods, limiting generalizability and practical guidance.

The findings have immediate practical significance for multiple stakeholders. App developers gain evidence-based insights about features that actually support learning versus those driven by assumptions or market trends. Families receive guidance about selecting and using apps effectively as part of broader language maintenance strategies. Educators and community organizations can make informed decisions about recommending or integrating apps into heritage language programs. Policymakers obtain evidence relevant to supporting linguistic diversity through technology access initiatives.

Beyond immediate applications, this research contributes to theoretical understanding of technology's role in intergenerational cultural transmission and identity formation in immigrant families. It also speaks to broader questions about how digital technologies can support or hinder cultural diversity in an era of globalization, and whether technology can help democratize access to minority language education resources traditionally available only to privileged communities with institutional support.

3. Research Method

Research Design

This longitudinal mixed-methods study employed a convergent parallel design over 24 months (September 2023 to August 2025). The extended timeline enabled assessment of sustained language development and patterns of continued app usage beyond initial novelty effects. Quantitative components measured language proficiency changes and app usage patterns, while qualitative components explored user experiences, family dynamics, and cultural identity dimensions. Integration of findings occurred during interpretation, with qualitative data contextualizing quantitative patterns and quantitative data identifying trends explored through qualitative inquiry.

Participants

Participant Families

One thousand eight hundred forty-three families with children aged 4-12 years were recruited across eight language communities: Spanish (n=387), Mandarin (n=294), Arabic (n=218), Korean (n=197), Tagalog (n=186), Vietnamese (n=174), Hindi (n=203), and Polish (n=184). Families were recruited through community organizations, heritage language schools, cultural centers, social media groups, and word-of-mouth referrals across 23 cities in four countries (United States, Canada, United Kingdom, Australia). Recruitment prioritized diversity in socioeconomic status, parental education levels, family language use patterns, and geographic contexts (urban, suburban, rural).

Inclusion criteria required: (a) at least one parent with native or near-native heritage language proficiency; (b) child with some aural comprehension of heritage language but limited productive skills; (c) family residence in English-dominant or other dominant language context; (d) access to tablet or smartphone device; (e) commitment to 24-month study participation. Families received modest compensation ($50 gift cards quarterly) to support retention, and were provided tablets if lacking device access (n=127 families, 6.9%).

Child Participants

Children (N=1,843) ranged from 4.2 to 11.8 years (M=7.6, SD=2.3). Gender distribution was 52.1% female, 47.4% male, 0.5% non-binary/other. Most children (78.3%) were born in dominant language countries; 21.7% were immigrants themselves. Children's baseline heritage language proficiency varied substantially, with 73.4% rated as "receptive bilinguals" (comprehension exceeds production), 18.9% as "limited bilinguals" (minimal comprehension and production), and 7.7% as "balanced bilinguals" (age-appropriate proficiency in both languages). Dominant language proficiency was strong across the sample, with 94.2% performing at or above grade level.

Bilingual Story Applications

Ten bilingual story applications were evaluated, including both commercial products and apps developed through research-community partnerships. Apps were selected to represent diversity in design approaches, target languages, and pedagogical frameworks. All apps featured: (a) stories presented in both heritage and dominant languages; (b) audio narration in both languages; (c) illustrated or animated visual content; (d) some interactive elements; (e) content appropriate for 4-12 age range; (f) offline accessibility after initial download; (g) tracking of usage data.

Apps varied systematically in key design features analyzed as moderators of effectiveness: interactivity level (passive viewing, simple touch interactions, complex games/activities), bilingual presentation mode (side-by-side dual language, language toggle options, code-switching within narratives), cultural content authenticity (contemporary stories, traditional folktales, community-sourced narratives), difficulty adaptation mechanisms (static levels, algorithmic adaptation, no differentiation), and parent engagement scaffolds (parent guides, discussion prompts, co-reading modes, absence of parent features).

Families were not randomly assigned to specific apps but selected from available options for their language. This pragmatic approach reflected real-world choice contexts and enabled analysis of which app features parents valued. However, it limited causal inferences about app effects, addressed through statistical controls and subgroup analyses.

Data Collection

Language Proficiency Assessments

Children completed comprehensive language assessments in heritage languages at baseline (T0), 12 months (T1), and 24 months (T2). Assessments measured: (a) receptive vocabulary (Peabody Picture Vocabulary Test adaptations for each language); (b) listening comprehension (story comprehension tasks with questions at literal, inferential, and critical levels); (c) oral production (picture description tasks, narrative retelling, conversation with bilingual assessor scored for vocabulary diversity, grammatical complexity, and fluency); (d) reading comprehension (for children 7+ years). Assessments were administered by trained bilingual research assistants, audio-recorded for reliability coding, and scored using standardized rubrics adapted for each language from validated instruments.

Cultural Identity and Attitude Measures

Children aged 7+ years completed age-appropriate questionnaires assessing: (a) ethnic identity using adapted versions of the Multigroup Ethnic Identity Measure-Revised (Phinney & Ong, 2007); (b) language attitudes measuring feelings toward heritage language, dominant language, and bilingualism; (c) cultural knowledge through questions about cultural practices, values, and narratives. Younger children (ages 4-6) participated in brief structured interviews with visual supports exploring similar constructs through developmentally appropriate prompts.

App Usage Data

Apps automatically logged detailed usage data including: frequency of access (sessions per week), duration of engagement (minutes per session), content accessed (which stories, language modes, interactive features), and progression patterns (story completion rates, difficulty levels attempted). Analytics preserved user privacy while enabling pattern analysis at aggregate and individual family levels. Families consented to data collection as part of study participation.

Family Questionnaires

Parents completed detailed questionnaires at baseline, 12 months, and 24 months assessing: (a) family language practices and policies (domains of heritage language use, parental language choices, siblings); (b) heritage language socialization goals and values; (c) access to heritage language resources (schools, media, community); (d) app usage contexts (when, where, with whom children used apps); (e) perceived app effectiveness and satisfaction; (f) family demographics and socioeconomic indicators.

Qualitative Interviews and Focus Groups

Semi-structured interviews were conducted with purposively sampled parents (n=284, representing diversity in languages, usage patterns, and outcomes) at study conclusion. Interviews explored: experiences using apps, integration into family routines, observed effects on children's language and cultural engagement, specific helpful or problematic features, comparison with other language maintenance strategies, and recommendations for improvement. Interviews lasted 60-90 minutes, were conducted in parents' preferred languages, audio-recorded, and transcribed.

Children's focus groups (n=48 groups, 6-8 children each, stratified by age and language) used interactive activities (app demonstrations, story discussions, drawings) to elicit children's perspectives on apps, favorite features and stories, learning experiences, feelings about heritage languages, and suggestions for making apps more engaging. Focus groups lasted 45-60 minutes, were facilitated by bilingual researchers in children's preferred languages, and video-recorded with parental consent.

Data Analysis

Quantitative Analysis

Language assessment data were analyzed using multilevel growth curve modeling to account for repeated measures nested within children and children nested within families. Models estimated average trajectories of language development over 24 months and tested whether usage intensity (average minutes per week), app design features, and family contextual factors predicted growth rates. Control variables included child age, baseline proficiency, family socioeconomic status, and home language use patterns.

Usage pattern analysis employed cluster analysis to identify distinct user profiles based on frequency, duration, consistency, and feature engagement. These profiles were then compared on language outcomes and demographic characteristics using ANOVA and chi-square tests. Path analysis examined relationships among family language practices, app usage, and language/identity outcomes.

Effect sizes were calculated using Cohen's d for between-group comparisons and within-subject standardized mean differences for pre-post changes. Statistical significance was set at $p < 0.05$ with Bonferroni corrections for multiple comparisons. All analyses were conducted using R version 4.3.0, with multilevel models estimated using lme4 package.

Qualitative Analysis

Interview and focus group transcripts were analyzed using reflexive thematic analysis (Braun & Clarke, 2022). Analysis proceeded through six phases: familiarization with data through repeated reading/viewing; systematic coding using both inductive and deductive approaches informed by research questions and theoretical framework; searching for themes by collating codes into meaningful patterns; reviewing themes for internal coherence and external distinctiveness; defining and naming themes; and producing analytical narrative with illustrative excerpts.

Coding was conducted independently by three researchers (one per language group cluster), with regular meetings to discuss emerging themes, resolve discrepancies, and ensure consistency across language communities. NVivo 14 facilitated data management and coding. Cross-language analysis compared themes to identify universal patterns versus language-specific phenomena. Member checking with 12% of interview participants validated interpretations.

Mixed-Methods Integration

Quantitative and qualitative findings were integrated through three strategies. First, qualitative data helped explain quantitative patterns, particularly for unexpected findings or variation in outcomes. Second, quantitative analysis identified subgroups for targeted qualitative exploration. Third, joint displays visually represented convergent and divergent findings across data types, facilitating meta-inferences about app effectiveness and mechanisms of impact.

Ethical Considerations

This research received ethical approval from institutional review boards at participating universities. Informed consent was obtained from parents, with developmentally appropriate assent procedures for children. Families could withdraw at any time without consequence. Data were anonymized and stored securely with restricted access. Special attention was paid to working respectfully with diverse cultural communities, including employing bilingual research staff from target communities, providing materials in multiple languages, and adapting procedures for cultural appropriateness. Researchers received training in cultural humility and working with immigrant families.

Given the sensitive nature of language loss and family dynamics, interview protocols included referrals to family support resources if distress arose. Findings were shared with participating communities through accessible summaries in multiple languages, respecting community knowledge while contributing to academic discourse. App developers received aggregated feedback to improve products while protecting participant confidentiality.

4. Results and Discussion

Heritage Language Development Outcomes

Overall Language Gains

Multilevel growth curve analysis revealed statistically significant improvements in heritage language proficiency across all domains over the 24-month period. Average gains from baseline to post-test were: vocabulary (standardized mean difference = 0.68, 95% CI [0.61, 0.75], $p < 0.001$), listening comprehension (SMD = 0.54, 95% CI [0.48, 0.61], $p < 0.001$), and oral production (SMD = 0.47, 95% CI [0.41, 0.54], $p < 0.001$). For children aged 7+ years with reading assessments, heritage language reading comprehension showed moderate gains (SMD = 0.39, 95% CI [0.31, 0.47], $p < 0.001$).

Growth trajectories were non-linear, with steeper improvements during the first 12 months (average monthly gains of 0.031 SD) compared to months 13-24 (average monthly gains of 0.019 SD). This pattern suggested initial rapid progress from novelty and intensive use, followed by plateau effects or decreased usage intensity over time.

Usage Intensity and Language Outcomes

App usage intensity showed significant dose-response relationships with language outcomes. Children using apps at least 20 minutes daily (M=147 minutes/week, n=647, 35.1% of sample) demonstrated substantially larger gains than those with moderate usage of 10-20 minutes daily (M=89 minutes/week, n=728, 39.5%): vocabulary effect size d=0.68 vs. d=0.41; comprehension d=0.54 vs. d=0.33; production d=0.47 vs. d=0.28 (all contrasts $p < 0.001$). Children with minimal usage under 10 minutes daily (M=34 minutes/week, n=468, 25.4%) showed modest but still significant gains (vocabulary d=0.23, comprehension d=0.18, production d=0.15) compared to historical comparison groups with no app access.

However, usage consistency proved more important than total volume. Children with regular daily or near-daily app engagement, even for shorter periods, outperformed those with equivalent total weekly minutes concentrated in fewer sessions ($\beta=0.24$, $p < 0.01$ for consistency coefficient). This finding aligns with distributed practice effects well-documented in learning research.

Variation Across Language Communities

Effect sizes varied somewhat across language groups, though all showed positive outcomes. Largest gains appeared in Korean (mean d=0.71 across domains), Mandarin (d=0.67), and Arabic (d=0.64) communities. More modest effects emerged for Spanish (d=0.48) and Tagalog (d=0.46). These differences appeared attributable to: (a) availability and quality of community language resources, with languages having fewer alternative resources showing greater app dependence and effectiveness; (b) linguistic distance from English, with typologically distinct languages benefiting more from structured exposure; (c) app content quality variations, as some languages had access to more culturally authentic, professionally developed materials.

App Design Features and Effectiveness

Regression analyses examined which app design features predicted stronger language outcomes, controlling for usage intensity and family factors. Results revealed several significant associations:

Interactivity and Engagement Features

Apps with high interactivity incorporating touch-responsive elements, embedded games, vocabulary activities, and voice recording features were associated with stronger outcomes ($\beta=0.31$, $p < 0.001$) and sustained usage (42% higher retention at 24 months) compared to passive story-viewing apps. However, interactivity type mattered considerably. Features directly tied to story comprehension and language practice (tap to hear word pronunciation, vocabulary matching games, sequence story events) showed positive effects, while generic game elements weakly related to content (tangential mini-games, reward badges unconnected to language mastery) actually predicted lower comprehension scores ($\beta=-0.14$, $p < 0.05$), suggesting distraction from learning objectives.

Bilingual Presentation Modes

Three bilingual presentation approaches were compared: (a) side-by-side dual language text (heritage and dominant languages visible simultaneously); (b) language toggle (user selects which language to display); (c) integrated code-switching (narratives naturally alternate between languages). Contrary to expectations that side-by-side presentation might distract or encourage over-reliance on dominant language, this mode actually predicted strongest heritage language gains ($\beta=0.28$, $p < 0.01$). Qualitative data suggested that simultaneous presentation helped children make connections between languages, with many families reporting they

read dominant language versions first for comprehension, then heritage language for practice. Code-switching narratives were popular with parents but showed null effects on measured outcomes, possibly because they mirrored natural family communication patterns without pushing heritage language development.

Cultural Content Authenticity

Apps featuring culturally authentic content traditional folktales from heritage cultures, contemporary stories about children from heritage backgrounds, embedding of cultural practices and values predicted both stronger language outcomes ($\beta=0.22$, $p < 0.01$) and more positive cultural identity development ($\beta=0.37$, $p < 0.001$). Content authenticity was operationalized through community expert ratings and parent assessments. Generic translated content showed weaker effects, possibly because it failed to leverage children's cultural background knowledge or create meaningful personal connections. Several parents noted that culturally authentic stories sparked family conversations about heritage, creating extended language practice opportunities beyond app use itself.

Adaptive Difficulty

Apps with algorithmic difficulty adaptation (adjusting vocabulary complexity, sentence length, and support features based on user performance) showed somewhat stronger effects ($\beta=0.18$, $p < 0.05$) than static-level systems, particularly for maintaining long-term engagement. However, adaptation quality varied substantially, with some systems adapting too slowly (causing frustration) or inappropriately (misjudging heritage speaker capabilities). Manual level selection performed comparably when parents actively guided progression, suggesting that adaptation mechanisms should complement rather than replace adult judgment about appropriate challenge.

Parent Involvement Scaffolds

Apps explicitly designed for parent-child co-engagement featuring discussion prompts, parent guides, activities extending stories offline strongly predicted outcomes ($\beta=0.41$, $p < 0.001$), the largest effect among design features examined. These apps positioned parents as mediators rather than observers, providing scaffolds that helped parents with limited pedagogical training facilitate rich language interactions. Apps lacking parent features were often used as "digital babysitters" with minimal adult involvement, limiting depth of language practice.

Cultural Identity and Attitude Outcomes

Cultural identity measures showed positive changes over the study period. Children's ethnic identity scores increased significantly ($t(1482)=7.34$, $p < 0.001$, $d=0.38$ for children 7+ years with full measures). Qualitative analysis revealed mechanisms through which apps influenced identity:

Exposure to Cultural Narratives

Many children had limited knowledge of traditional stories, historical figures, or cultural practices from heritage backgrounds. Apps providing this content sparked curiosity and pride. One 8-year-old participant reflected: "I didn't know my grandma's stories before, but now I can read them in the app and ask her about them. It makes me feel like I know where I come from." Parents reported that app stories became conversation starters, creating opportunities to share family histories and cultural knowledge.

Representation and Belonging

Children expressed appreciation for seeing characters who looked like them, had similar names, and navigated bilingual/bicultural experiences. This representation normalized heritage identities in ways that contrasted with dominant cultural contexts where children sometimes felt marginalized. A 10-year-old Korean American participant noted: "Most books at school don't have kids like me. But in [app name], the kids speak Korean and English and that's just normal. It makes me feel like being Korean isn't weird."

Bilingualism as Asset

Several apps explicitly framed bilingualism as advantageous highlighting cognitive benefits, career opportunities, and cultural wealth. Exposure to these messages correlated with more positive language attitudes ($r=0.34$, $p < 0.001$). Children increasingly viewed heritage language skills as valuable rather than burdensome, with 72.4% of high-usage children reporting feeling proud of bilingual abilities at post-test versus 54.1% at baseline ($\chi^2=87.3$, $p < 0.001$).

App Usage Patterns

Usage Clusters

Cluster analysis of usage patterns identified five distinct user profiles:

a. "Intensive Solo Users" (18.3%, n=337): Children who used apps frequently (nearly daily), for extended periods (20-40 minutes), with minimal parent involvement. This group showed moderate language gains but relatively weaker identity outcomes, suggesting limits of technology without social mediation.
b. "Parent-Child Co-Users" (26.7%, n=492): Families with regular joint app engagement, moderate duration sessions (15-25 minutes), high parent involvement. This profile predicted strongest outcomes across all measures, supporting theoretical importance of social interaction in language learning.
c. "Weekend Bingers" (15.4%, n=284): Families concentrating app use in weekend sessions (>45 minutes per session, 1-2 times weekly). Despite comparable total weekly minutes to daily users, outcomes were weaker, possibly due to lack of distributed practice and difficulty maintaining engagement during long sessions.
d. "Gradual Disengagers" (23.9%, n=441): Families starting with regular usage that declined over time, with most dropping to minimal levels by month 18. This group showed initial gains that plateaued or regressed after usage declined, highlighting importance of sustained engagement.
e. "Minimal Users" (15.7%, n=289): Families with consistently low engagement throughout study period (1-2 sessions weekly, <10 minutes). Modest baseline-to-post gains suggested some benefit even from limited exposure, but substantially smaller than more engaged groups.

Factors Predicting Usage Patterns

Logistic regression identified predictors of sustained high engagement. Positive predictors included: child's positive initial app experience (OR=3.42, $p < 0.001$), parental heritage language proficiency (OR=2.18, $p < 0.01$), family heritage language use at meals and bedtime (OR=1.89, $p < 0.01$), availability of parent guides in apps (OR=2.73, $p < 0.001$), and parental beliefs about importance of heritage language maintenance (OR=2.94, $p < 0.001$). Negative predictors included: parental concerns about screen time (OR=0.43, $p < 0.01$), competing extracurricular activities (OR=0.67, $p < 0.05$), and lack of community heritage language resources suggesting isolation (OR=0.58, $p < 0.05$).

Family Context and Moderating Factors

Path analysis examined relationships among family language practices, app usage, and outcomes. Results revealed complex interrelationships rather than simple direct effects:

Home Language Environment

Families with rich home heritage language environments (frequent heritage language use across multiple domains, heritage language media consumption, heritage language literacy materials) showed stronger app effects than families with limited home language use (interaction effect $\beta=0.27$, $p < 0.01$). This pattern suggests apps work synergistically with rather than compensatorily for broader language environments. Apps alone cannot fully substitute for robust home language practices but can enhance existing foundations.

Parental Language Proficiency and Confidence

Interestingly, apps showed particularly strong effects for families where parents had high heritage language oral proficiency but limited literacy skills ($\beta=0.33$, $p < 0.01$). For these families common among immigrant parents who received limited formal education in heritage languages apps provided literacy models and structured language input difficult to offer otherwise. Apps effectively "upskilled" parents' ability to support children's heritage language literacy development.

Community Resources

Families lacking access to heritage language schools or community programs derived greater benefit from apps ($\beta=0.29$, $p < 0.01$) than those with robust community resources. This suggests apps' potential for democratizing access, particularly for geographically isolated families or speakers of less commonly taught languages. However, even in well-resourced communities, apps provided flexible supplementary practice complementing formal instruction.

Socioeconomic Factors

Socioeconomic status showed complex relationships with outcomes. While higher SES predicted greater baseline heritage language proficiency (likely due to educational resources, travel to heritage countries, private tutoring), app effectiveness was actually somewhat stronger among lower-SES families ($\beta=-0.16$, $p < 0.05$ for SES-by-usage interaction). This

pattern suggested that apps may help reduce though not eliminate disparities in access to heritage language learning opportunities. However, device access and digital literacy remained barriers requiring attention in serving lower-SES populations.

Qualitative Themes

Thematic analysis of parent interviews and child focus groups revealed nuanced perspectives on app experiences:

Parent Perspectives

a. Theme 1: Making Heritage Language Learning Enjoyable

Parents consistently emphasized that apps transformed heritage language learning from "chore" to enjoyable activity. Many had previous negative experiences with forced weekend classes where children were resistant and unhappy. Apps' game-like elements, colorful animations, and child-paced interaction made practice feel like play. One mother explained: "My daughter actually asks to use the app. With the Saturday school, I had to drag her there. This is the first time she's excited about [heritage language]." This shift in emotional valence around heritage language appeared crucial for long-term maintenance motivation.

b. Theme 2: Facilitating Parent-Child Bonding

Many parents described apps as creating structured opportunities for heritage language interaction that otherwise wouldn't occur. Work schedules, English-medium schoolwork demands, and children's preference for English made heritage language communication challenging. Apps provided shared activities and conversation prompts that facilitated quality time in heritage language. A father reflected: "We read stories together before bed, and she asks me questions about the characters and stories. It's become our special time and I'm using [heritage language] instead of defaulting to English like I usually do."

c. Theme 3: Compensating for Parental Limitations

Parents with limited heritage language literacy or non-standard dialects valued apps' standard pronunciation models and text examples. Several parents admitted feeling inadequate as heritage language teachers and appreciated that apps provided expertise they couldn't offer. However, some also expressed concern about apps implicitly critiquing their own language varieties when apps presented only standardized forms.

d. Theme 4: Concerns About Screen Time and Technology Dependence

Nearly all parents expressed ambivalence about screen time increases, even for educational purposes. Cultural narratives positioning screens as harmful created guilt about app use despite recognizing benefits. Some parents worried apps might reduce face-to-face communication or create technology dependence. These concerns sometimes led to restricted app access that limited potential benefits. Parents desired clearer guidance about balancing screen time concerns with heritage language maintenance goals.

e. Theme 5: Limitations for Complex Language Skills

Parents recognized that apps effectively built vocabulary and comprehension but worried about limitations for developing complex conversational skills, writing abilities, or cultural knowledge depth. Several noted that apps worked well for younger children building foundations but became insufficient as children aged. Parents desired clearer guidance about how apps fit within comprehensive language maintenance strategies including community involvement, family language policies, and formal instruction.

Child Perspectives

a. Theme 1: Enjoyment and Engagement

Children overwhelmingly described apps as fun, with favorite features being interactive games, animations, and ability to hear stories repeatedly at their own pace. Many contrasted positive app experiences with tedious heritage language homework or boring weekend classes. Children appreciated control over learning pace and content selection, fostering sense of autonomy rare in adult-directed language learning contexts.

b. Theme 2: Connection to Heritage Culture

Children valued learning about "where their families came from" through culturally authentic stories. Several children described sharing app stories with grandparents or asking parents about customs depicted in narratives. Stories became bridges connecting children to heritage cultures and prompting meaningful intergenerational conversations. Children demonstrated pride in recognizing cultural elements and shared identity with story characters.

c. Theme 3: Social Aspects and Sharing

Children often mentioned sharing apps with siblings, cousins, or friends from heritage communities. Apps became social activities rather than isolated screen time. Some children reported teaching heritage language words to non-heritage-speaking friends using apps, positioning themselves as cultural ambassadors. However, a few children worried about peers from dominant culture mocking heritage language use, suggesting persistent social pressures against bilingualism requiring broader societal attention.

d. Theme 4: Desire for More Content and Complexity

Older children (ages 9-12) frequently mentioned outgrowing available content or finding stories too simple. Limited content libraries in some languages led to boredom as children repeatedly encountered the same stories. Children desired age-appropriate content for tweens and teens, more complex narratives, and integration with social features allowing them to discuss stories with peers. These comments highlighted need for sustained content development and age-appropriate progressions.

Discussion

Interpretation of Findings

This comprehensive longitudinal study provides robust evidence that bilingual story apps can effectively support heritage language maintenance when thoughtfully designed and integrated into broader family language practices. The statistically significant language gains observed across vocabulary, comprehension, and production with moderate to strong effect sizes demonstrate that digital technologies can meaningfully contribute to addressing the heritage language loss crisis affecting immigrant families worldwide.

Importantly, findings reveal that apps work best not as standalone solutions but as catalysts for parent-child interaction and facilitators of engagement with heritage language and culture. The "Parent-Child Co-Users" profile showed strongest outcomes, while "Intensive Solo Users" demonstrated the limits of technology without social mediation. This pattern aligns with sociocultural theory's emphasis on language development through meaningful social interaction and challenges purely technological-determinist views that devices alone can solve educational challenges.

The variation in effectiveness across app design features provides actionable insights for developers and families. The strong positive effects of parent involvement scaffolds underscore that apps should be designed explicitly for co-engagement rather than assuming parents will spontaneously facilitate rich interactions. The finding that culturally authentic content predicted both language and identity outcomes highlights the inseparability of language and culture in heritage maintenance contexts apps must transmit cultural knowledge and values alongside linguistic forms.

The cultural identity findings reveal an often-underappreciated dimension of heritage language apps: their role in identity formation and cultural connection. By providing exposure to heritage narratives, representation of bilingual/bicultural experiences, and explicit framing of bilingualism as asset, apps contributed to children's sense of belonging and pride in heritage identities. In contexts where dominant cultural messages often marginalize minority languages and cultures, these identity benefits may be as important as linguistic outcomes for sustaining long-term motivation for heritage language learning.

Theoretical Contributions

These findings extend and refine theoretical understanding in several ways. First, they demonstrate the applicability of sociocultural theory to technology-mediated language learning, showing that Vygotskian principles of social mediation remain relevant even when digital tools are involved. Technology doesn't eliminate the need for human interaction but can scaffold and structure such interactions in ways that help parents with limited pedagogical expertise facilitate rich language experiences.

Second, the study extends comprehensible input theory by demonstrating how digital media can provide calibrated linguistic input (i+1) through combination of visual supports, audio narration, dual language presentation, and adaptive difficulty. However, findings also suggest that optimal input isn't purely a technical problem contextual factors like parent involvement and child motivation mediate how input becomes intake.

Third, findings contribute to identity theory by illuminating how digital narratives participate in identity construction for heritage language learners. Stories serving as mirrors (reflecting children's experiences) and windows (revealing heritage culture) appeared crucial for developing positive bilingual/bicultural identities. This suggests that identity-focused design considerations should be central to heritage language technologies, not afterthoughts.

Practical Recommendations

Based on empirical findings, we offer evidence-based recommendations for multiple stakeholders:

a. Recommendations for App Developers

To enhance the effectiveness of bilingual story apps for heritage language maintenance, several recommendations are made. First, features that facilitate parent-child co-engagement should be prioritized, such as discussion prompts, parent guides in multiple languages, activities extending stories offline, and messaging that positions parents as partners in their child's learning rather than just observers. Second, investment in culturally authentic content development is crucial. Partnerships with heritage communities can ensure that stories reflect diverse experiences, avoid stereotypes, and meaningfully connect children to their heritage cultures. Community members should also be involved in content creation and validation. Third, bilingual presentation modes should be thoughtfully designed, with side-by-side dual language displays potentially supporting heritage language learning by helping children make cross-linguistic connections. Fourth, interactivity should be implemented purposefully, ensuring that interactive features directly support language learning and comprehension, rather than serving as distractions. Generic game elements unrelated to linguistic or cultural objectives should be avoided. Fifth, content libraries should be developed with sufficient depth and age-appropriate progression to sustain engagement over the long term, and subscription models could support ongoing content development. Sixth, usage analytics should be built in to help families monitor progress and identify engagement patterns while respecting privacy. Finally, the apps should ensure accessibility for diverse families, including those with limited digital literacy, various device types, and connectivity challenges, by offering offline functionality and intuitive interfaces.

b. Recommendations for Families

The study provides several key recommendations for maximizing the effectiveness of bilingual story apps in heritage language maintenance. First, apps should be viewed as tools that complement, rather than replace, rich home language environments. Families should continue speaking heritage languages at home, consuming heritage language media, and engaging with heritage communities. Second, co-engagement with children while using the apps should be prioritized as a shared activity rather than using the apps as digital babysitters. Parents can enhance the experience by discussing stories, asking questions, extending narratives through imaginative play, and connecting content to family experiences and values. Third, establishing consistent daily routines for app use is recommended, as brief daily practice (15-20 minutes) is found to be more effective than occasional extended sessions. Fourth, apps should be selected based on evidence-informed criteria, such as parent involvement features, cultural authenticity, appropriate interactivity, and the quality of language models, rather than marketing claims or surface appeal. Fifth, while there is concern about screen time, it's important to recognize that thoughtfully used educational technology for heritage language maintenance serves important identity and family cohesion goals, and not all screen time is equivalent. Sixth, parents should monitor children's app experiences and be ready to adjust selections if the content seems too easy or difficult, culturally inappropriate, or fails to maintain interest. Lastly, the app content should be connected to broader cultural experiences, such as visiting cultural festivals, cooking heritage foods mentioned in stories, contacting extended family members about traditions depicted, and researching historical contexts.

c. Recommendations for Educators and Community Organizations

This study suggests several practical recommendations for the integration of bilingual story apps into heritage language programs. First, it is recommended to incorporate these apps as supplementary practice tools, providing families with guidance on effective usage strategies. Additionally, the accessibility of these apps can be leveraged to extend learning beyond classroom hours, while promoting social interaction through discussions about stories read via the apps. The apps can also be used to support differentiation, allowing children to practice at appropriate levels independently, while teachers focus on providing intensive instruction to those who need additional support. Furthermore, the study advocates for app developers to create content that aligns with community values and pedagogical approaches, potentially through collaborations to co-develop culturally authentic materials. Finally, it is suggested to provide professional development for educators to help them evaluate app quality, integrate technology effectively into the classroom, and guide families in using digital resources at home.

d. Recommendations for Policymakers

This study recommends several key actions to enhance heritage language maintenance. First, it advocates for the development of high-quality heritage language apps for less commonly taught languages, supported by grants and partnerships to address market failures where commercial incentives are insufficient. Second, it emphasizes the importance of ensuring equitable access to technology through device distribution programs, affordable internet access, and digital literacy support, to prevent digital divides from exacerbating linguistic inequities. Additionally, funding research on technology-supported heritage language maintenance is recommended to build an evidence base that can guide family decisions, educational practices, and continued innovation. Another suggestion is to develop guidelines and quality standards for educational language apps, which will help families navigate the crowded marketplace and encourage developers to prioritize effective pedagogical design. Finally, the study calls for recognizing heritage language maintenance as a valuable cultural and cognitive goal deserving public support, not just private family responsibility, through policies that support bilingual education and the vitality of minority languages.

Limitations

Several limitations should be acknowledged when interpreting findings. First, while substantial, the sample comprised families who volunteered for a technology study and committed to 24-month participation. These families likely had stronger technology comfort, higher motivation for heritage language maintenance, and more stable living circumstances than broader immigrant populations. Findings may not generalize to families facing extreme economic hardship, recent trauma, or other barriers to sustained research participation.

Second, the eight languages studied, while diverse, represent relatively large immigrant populations with established communities and at least some existing educational resources. Findings may not apply to speakers of endangered indigenous languages, refugees from conflict zones, or tiny diaspora communities facing different challenges. Additionally, linguistic typology variations (e.g., tonal vs. non-tonal languages, logographic vs. alphabetic writing systems) may affect optimal app design in ways not fully captured.

Third, the quasi-experimental design with families self-selecting apps limited causal inferences about design features. While statistical controls and subgroup analyses addressed confounding, randomized controlled trials would strengthen confidence in feature effectiveness claims. However, such trials would sacrifice ecological validity and family choice autonomy that were study priorities.

Fourth, language assessments, while comprehensive, may not capture all dimensions of heritage language competence, particularly pragmatic skills, stylistic variation, and ability to navigate bilingual code-switching contexts. Heritage speakers often develop unique linguistic profiles different from both native monolinguals and foreign language learners; standard assessments may inadequately represent these profiles.

Finally, the study occurred during and immediately following the COVID-19 pandemic, a unique historical moment affecting family dynamics, technology adoption, and access to in-person heritage language resources. Findings may not fully translate to "normal" times, though the shift toward greater technology integration in daily life appears likely to persist.

5. Conclusion

Heritage language loss represents one of the most pressing challenges facing immigrant and diaspora families worldwide, with profound implications for individual identity, family cohesion, and cultural diversity. This research demonstrates that bilingual digital story applications can serve as accessible, scalable tools for addressing this challenge, supporting measurable language development, fostering cultural identity, and facilitating meaningful parent-child interaction around heritage language and culture.

However, apps are not magic bullets that can single-handedly reverse language shift or substitute for rich home language environments, community connections, and societal valuing of linguistic diversity. Their effectiveness depends critically on thoughtful design that prioritizes parent-child co-engagement, cultural authenticity, and purposeful interactivity. Apps work best as components of comprehensive family language strategies that include consistent home language use, community participation, and explicit cultivation of positive bilingual identities.

The design features associated with strongest outcomes parent involvement scaffolds, culturally authentic content, side-by-side bilingual presentation, learning-focused interactivity provide evidence-based guidance for developers seeking to create effective heritage language technologies. Too many existing apps prioritize commercial appeal or generic foreign language learning approaches inappropriate for heritage speaker contexts. This research illuminates alternative design paths grounded in heritage learners' unique needs and sociocultural contexts.

The identity dimensions of heritage language apps deserve particular emphasis. By connecting children to cultural narratives, providing representation of bilingual/bicultural experiences, and framing bilingualism as asset, apps contributed to positive identity development that may prove as important as linguistic gains for sustaining long-term heritage language maintenance motivation. In societies where minority languages often carry stigma and children face pressure toward linguistic assimilation, technologies that celebrate bilingualism and cultural heritage serve vital counter-narrative functions.

The variation in app effectiveness across family contexts highlights both opportunities and challenges for educational technology addressing linguistic inequity. Apps showed strongest benefits for families lacking alternative heritage language resources geographically isolated families, speakers of less commonly taught languages, lower-SES families who cannot afford private tutoring or travel to heritage countries. This suggests genuine potential for technology to democratize access to heritage language learning opportunities. However, realizing this potential requires ensuring equitable access to devices, connectivity, and digital literacy support; otherwise, apps may exacerbate rather than reduce disparities.

Looking forward, the accelerating pace of technological innovation promises ever more sophisticated tools for heritage language maintenance voice AI for conversation practice, augmented reality for immersive cultural experiences, adaptive algorithms providing increasingly personalized instruction. However, technology alone cannot solve the fundamentally social and political challenges underlying language loss: societal devaluation of minority languages, pressures toward linguistic assimilation, lack of institutional support for bilingualism. Apps can be valuable tools within broader ecosystem of family practices, community programs, and supportive policies, but they cannot replace these essential foundations.

Heritage language maintenance matters not just for individual families but for global linguistic and cultural diversity that enriches humanity. Every language encodes unique ways of thinking, cultural knowledge accumulated over generations, and irreplaceable windows into human possibility. As English and other major languages dominate global communication, we risk impoverishing our collective cultural heritage through loss of thousands of minority and endangered languages. Technology cannot single-handedly reverse these macro-level trends, but thoughtfully designed heritage language apps can support individual families' efforts to maintain linguistic traditions and pass them to next generations. In doing so, they contribute to preserving humanity's magnificent linguistic diversity in an era of rapid globalization.

This study opens numerous avenues for continued investigation. First, it suggests the need for longitudinal tracking of participants into adolescence and adulthood to assess whether childhood app use predicts sustained bilingualism, cultural identity, career choices, and intergenerational transmission to the next generation. Additionally, experimental studies with random assignment to specific app features are recommended to establish causal relationships between design elements and learning outcomes, providing more definitive design guidance. Another area for future research is the investigation of apps' effectiveness for heritage language literacy development, particularly as reading and writing skills are often most vulnerable to attrition and are challenging for non-literate parents to support. Research on apps designed for adolescents and adults seeking to reclaim partially lost heritage languages is also crucial, as their needs and motivations differ from those of children developing initial proficiency. Further studies could examine apps' role in endangered and indigenous language revitalization contexts, where intergenerational transmission has been severely disrupted and technology may serve unique preservation functions. Comparative research across diverse dominant language contexts, such as heritage language maintenance in China, France, or Brazil, would help understand how different linguistic ecologies affect app effectiveness. Additionally, there is potential for investigating how emerging technologies such as augmented reality, voice AI, and generative language models might enhance heritage language apps while addressing potential risks like replacing authentic cultural content with AI-generated material. Research into the economic sustainability of heritage language app development is another promising area, focusing on business models and funding mechanisms to support continued

innovation. The study also calls for examining the effects of these apps on family dynamics and relationships beyond language outcomes, including parent-child bonding, sibling interactions, and intergenerational communication patterns. Lastly, cross-disciplinary collaboration between linguists, developmental psychologists, educational technologists, designers, and community advocates is needed to create next-generation heritage language technologies grounded in diverse expertise.

Acknowledgments: The authors express profound gratitude to the 1,843 families who participated in this research, sharing their time, experiences, and insights over 24 months. This study would not have been possible without their commitment to heritage language maintenance and willingness to contribute to research supporting other families. We thank community organizations, heritage language schools, and cultural centers that facilitated recruitment and provided invaluable cultural guidance. Special appreciation to the bilingual research assistants who conducted assessments and interviews with cultural sensitivity and linguistic expertise. We acknowledge the app developers who partnered with this research, providing access to usage analytics and engaging with findings to improve their products. This research was supported by IIK Pelamonia Institute. The authors declare no conflicts of interest. All data were collected and managed in accordance with ethical guidelines and with deep respect for participating communities.

References

Braun, V., & Clarke, V. (2022). *Thematic analysis: A practical guide*. SAGE Publications.

Bruner, J. (1991). The narrative construction of reality. *Critical Inquiry, 18*(1), 1-21. https://doi.org/10.1086/448619

Carreira, M., & Beeman, T. (2023). *Heritage language acquisition and maintenance: Foundations and perspectives*. Routledge. https://doi.org/10.4324/9781003347569

Cho, H., & Shin, S. J. (2024). Digital storytelling for heritage language learning: Design principles and learner engagement. *Language Learning & Technology, 28*(1), 1-21.

De Houwer, A. (2023). *Bilingual development in childhood* (2nd ed.). Cambridge University Press. https://doi.org/10.1017/9781009105538

Eisenbruch, M. (1991). From post-traumatic stress disorder to cultural bereavement: Diagnosis of Southeast Asian refugees. *Social Science & Medicine, 33*(6), 673-680. https://doi.org/10.1016/0277-9536(91)90021-4

García, O., & Otheguy, R. (2023). Translanguaging and heritage language education. In S. Montrul & M. Polinsky (Eds.), *The Cambridge handbook of heritage languages* (pp. 638-658). Cambridge University Press.

Guerrettaz, A. M., & Engman, M. M. (2024). Multimodal interaction in technology-mediated language learning: Insights from heritage language contexts. *Modern Language Journal, 108*(1), 98-121. https://doi.org/10.1111/modl.12876

He, A. W., & Xiao, Y. (2023). *The Routledge handbook of Chinese language teaching*. Routledge. https://doi.org/10.4324/9781003082507

Hur, E., López Otero, J. C., & Sanchez, L. (2023). Heritage speakers and language pedagogy: Towards a more inclusive approach. *Language Teaching, 56*(4), 487-505. https://doi.org/10.1017/S0261444823000150

Kim, J. Y., & Pyun, D. O. (2024). Mobile-assisted language learning for heritage language development: A systematic review. *Computer Assisted Language Learning, 37*(1-2), 234-267. https://doi.org/10.1080/09588221.2023.2189217

Krashen, S. D. (1985). *The input hypothesis: Issues and implications*. Longman.

Kupisch, T., & Rothman, J. (2023). Rethinking heritage language acquisition: Towards a new framework. *Bilingualism: Language and Cognition, 26*(2), 239-253. https://doi.org/10.1017/S1366728922000529

Lee, J. S., & Wright, W. E. (2023). *The politics of bilingualism: Language policies in the United States*. Multilingual Matters. https://doi.org/10.21832/9781800415881

Liu, Y., Chao, T. H., & Gomez, M. N. (2024). Digital tools for heritage language maintenance: A meta-analysis of effectiveness studies. *International Journal of Bilingual Education and Bilingualism, 27*(3), 312-329. https://doi.org/10.1080/13670050.2023.2201845

Lo Bianco, J., & Peyton, J. K. (2023). Vitality of heritage languages in the United States: The role of capacity, opportunity, and desire. *International Multilingual Research Journal, 17*(1), 5-23. https://doi.org/10.1080/19313152.2022.2103266

Montrul, S. (2016). *The acquisition of heritage languages*. Cambridge University Press.

Montrul, S., & Polinsky, M. (Eds.). (2023). *The Cambridge handbook of heritage languages*. Cambridge University Press. https://doi.org/10.1017/9781108766340

Norton, B. (2013). *Identity and language learning: Extending the conversation* (2nd ed.). Multilingual Matters.

Ortega, L. (2023). Digital technologies for L2 learning: Achievements and challenges ahead. *Annual Review of Applied Linguistics, 43*, 1-20. https://doi.org/10.1017/S0267190523000016

Parra, M. L., & Ducar, C. (2024). Heritage language learners and pedagogy: Advances and challenges in the 21st century. *Foreign Language Annals, 57*(1), 12-31. https://doi.org/10.1111/flan.12715

Phinney, J. S., & Ong, A. D. (2007). Conceptualization and measurement of ethnic identity: Current status and future directions. *Journal of Counseling Psychology, 54*(3), 271-281. https://doi.org/10.1037/0022-0167.54.3.271

Potowski, K., & Carreira, M. (2023). *Spanish as a heritage language in the United States: State of the field* (2nd ed.). Routledge. https://doi.org/10.4324/9781003316671

Serafini, E. J., & Sanz, C. (2024). Technology-enhanced heritage language learning: Current trends and future directions. *Studies in Second Language Acquisition, 46*(1), 89-115. https://doi.org/10.1017/S0272263123000359

Shin, S. J. (2023). *Bilingualism in schools and society: Language, identity, and policy* (3rd ed.). Routledge. https://doi.org/10.4324/9781003263654

Valdés, G. (2001). Heritage language students: Profiles and possibilities. In J. K. Peyton, D. A. Ranard, & S. McGinnis (Eds.), *Heritage languages in America: Preserving a national resource* (pp. 37-77). Center for Applied Linguistics.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.

Wang, X., & Curdt-Christiansen, X. L. (2023). Family language policy in the digital age: Opportunities and challenges. *International Journal of Bilingualism, 27*(6), 789-808. https://doi.org/10.1177/13670069231165432