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Research Article

Translanguaging Pedagogies in Digital Learning Environments: Fostering Multilingual Competence Among Generation Z Learners

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Abstract: This paper examines the implementation of translanguaging pedagogies within digital learning environments and their effectiveness in developing multilingual competence among Generation Z learners. Through a mixed-methods study involving 186 students and 14 educators across six higher education institutions, this research investigates how strategic integration of translanguaging practices in digital spaces supports linguistic flexibility, metalinguistic awareness, and cross-cultural competence. Findings reveal that digitally-mediated translanguaging approaches resulted in significant improvements in learners' willingness to communicate across languages ($p<.01$), metalinguistic awareness ($p<.001$), and cross-cultural communication efficacy ($p<.01$) compared to monolingual instructional approaches. The research further identifies five key digital translanguaging strategies that effectively leverage Generation Z's technological aptitude and multimodal literacy. This study contributes to the growing field of multilingual digital pedagogy by demonstrating how translanguaging can be systematically integrated into digital learning environments to foster linguistic repertoire expansion that aligns with the communicative needs of increasingly globalized contexts. The pedagogical framework presented offers practical guidance for educators seeking to implement translanguaging approaches in various digital learning modalities while accommodating Generation Z's learning preferences and multilingual development.

Keywords: translanguaging, digital learning, Generation Z, multilingual competence, language pedagogy, multimodal literacy

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1. Introduction

The linguistic landscape of higher education has undergone significant transformation in recent years, shaped by increasing globalization, digital connectivity, and evolving student demographics. Generation Z learners—typically defined as those born between 1997 and 2012—represent the first truly digital native cohort in educational settings (Seemiller & Grace, 2019). Having grown up in an era of ubiquitous internet access, social media, and mobile technology, these learners navigate digital environments with unprecedented fluency while simultaneously inhabiting increasingly multilingual spaces both online and offline (Prensky, 2021).

Traditional language education approaches, largely predicated on monolingual instructional models that compartmentalize languages, have proven increasingly misaligned with the fluid language practices of Generation Z learners who regularly engage in digital environments where language

boundaries are routinely traversed (Vogel et al., 2022). In response, translanguaging—an approach that recognizes and leverages learners' full linguistic repertoires as integrated communication systems—has emerged as a compelling pedagogical framework for multilingual education (García & Li Wei, 2014; García & Otheguy, 2020).

While translanguaging research has expanded substantially over the past decade, investigations of how translanguaging pedagogies function specifically within digital learning environments and how they align with the learning preferences and linguistic practices of Generation Z remain relatively limited (Choi & Ollerhead, 2023). This research gap is particularly significant given the accelerated shift toward digital learning modalities in post-pandemic educational landscapes (Wang & Crawford, 2023).

This study addresses this gap by examining the implementation and effectiveness of translanguaging approaches in digital learning environments for developing multilingual competence among Generation Z learners. Specifically, the research investigates:

1. How can translanguaging pedagogies be effectively implemented within different digital learning environments (synchronous, asynchronous, and blended) to support multilingual competence development?
2. What specific digital translanguaging strategies align with Generation Z's learning preferences and linguistic practices?
3. How do digitally-mediated translanguaging approaches affect learners' linguistic performance, metalinguistic awareness, and attitudes toward multilingualism compared to traditional monolingual approaches?
4. What challenges and opportunities arise when implementing translanguaging pedagogies in digital learning contexts?

The significance of this research lies in its contribution to evolving pedagogical practices that more effectively address the complex multilingual realities and digital literacy skills of contemporary learners. By examining the intersection of translanguaging theory, digital learning environments, and Generation Z characteristics, this study provides a foundation for developing more culturally and linguistically responsive pedagogical approaches that prepare learners for the communicative demands of globally connected contexts.

2. Literature Review

Translanguaging: Theoretical Foundations and Pedagogical Applications

Translanguaging emerges from a heteroglossic perspective that challenges monolingual ideologies and traditional conceptions of languages as bounded autonomous systems (García & Li Wei, 2014). Instead, translanguaging posits that bilinguals and multilinguals possess a unified linguistic repertoire from which they strategically select features based on communicative needs, rather than operating with separate linguistic systems (Otheguy et al., 2015). Originally introduced by Cen Williams (1994) to describe pedagogical practices in Welsh bilingual education, the concept has expanded to encompass both the spontaneous language practices of multilinguals and intentional pedagogical approaches that leverage these practices (Li Wei, 2018).

As a pedagogical framework, translanguaging has demonstrated effectiveness across various educational contexts. Research by Cenoz and Gorter (2020) documented how translanguaging pedagogies in

K-12 settings enhanced metalinguistic awareness by enabling explicit comparisons across linguistic features. Similarly, Mendoza and Parba (2019) found that university-level implementation of translanguaging approaches improved learner engagement and academic performance while validating students' diverse linguistic identities. A longitudinal study by Lin (2019) revealed that sustained translanguaging pedagogies contributed to more positive attitudes toward multilingualism and increased willingness to engage in cross-linguistic communication.

The theoretical underpinnings of translanguaging as pedagogy draw from sociocultural perspectives on learning (Conteh, 2018), positioning language development as fundamentally social and situated within cultural contexts. Vogel and García (2017) elaborate that translanguaging pedagogy operates through the strategic design of "translanguaging spaces" where learners' full linguistic repertoires are recognized and mobilized toward learning objectives. These spaces disrupt hierarchical relationships between named languages and create opportunities for more equitable educational experiences, particularly for linguistically minoritized students (García et al., 2017).

Recent scholarship has expanded translanguaging theory into the realm of multimodality. Kusters et al. (2017) argue for understanding translanguaging as a process that extends beyond verbal languages to include diverse semiotic resources and communicative modes. This expanded conceptualization becomes particularly relevant when examining translanguaging within digital environments that inherently support multimodal expression.

Digital Learning Environments and Multilingual Education

Digital learning environments encompass a spectrum of technology-mediated educational settings, from fully online asynchronous courses to blended approaches that combine digital tools with face-to-face instruction (Means et al., 2023). These environments offer unique affordances for language education through increased accessibility to authentic materials, opportunities for meaningful interaction with diverse linguistic communities, and tools for multimodal expression (Gee & Hayes, 2022).

Research on digital language pedagogy has documented how technology-enhanced learning environments can support language development through various mechanisms. Luo et al. (2021) demonstrated that digital annotation tools enhanced vocabulary acquisition and reading comprehension by allowing collaborative meaning-making across languages. Darvin and Norton (2020) examined how social media platforms enabled identity investment and authentic language use in ways that traditional classroom environments often failed to achieve. Similarly, Ware and Hellmich (2020) showed how video conferencing technologies facilitated intercultural communication skills through regular interaction with native speakers.

The relationship between digital environments and multilingual education specifically has garnered increasing attention. Palviainen et al. (2023) observed that online collaborative writing platforms naturally elicited translanguaging practices as participants navigated complex multilingual problem-solving. Wang and Zheng (2022) documented how language learning applications incorporating AI-driven translation tools simultaneously supported target language acquisition while validating learners' primary languages. A study by Androutsopoulos (2019) of multilingual digital communication found that online environments often serve as "translanguaging spaces" where linguistic fluidity is the norm rather than the exception.

Despite these promising findings, research by Oskoz and Elola (2022) cautions that many digital language learning environments continue to reinforce monolingual ideologies through rigid language separation and failure to acknowledge the multilingual realities of learners. This tension between the potential of digital environments to support translanguaging and their frequent implementation within monolingual pedagogical frameworks underscores the need for intentional design approaches that align technology affordances with translanguaging principles.

Generation Z Learners: Characteristics and Educational Implications

Generation Z represents the first demographic cohort to have no memory of a pre-internet world, resulting in distinctive characteristics with significant educational implications (Seemiller & Grace, 2019). Research on Generation Z learners has identified several key traits relevant to language education and digital learning.

First, Generation Z demonstrates strong digital nativity characterized by intuitive technology use, preference for digital information sources, and expectations for seamless technology integration in educational settings (Prensky, 2021). A comprehensive study by Martzoukou et al. (2021) found that 92% of Generation Z learners expected digital elements in their coursework and reported higher engagement with multimodal learning materials compared to traditional text-based resources.

Second, this generation exhibits distinctive communication preferences, including comfort with abbreviated language forms, extensive emoji use, preference for visual communication, and rapid code-switching across platforms and linguistic contexts (Turner, 2022). Research by Hampton and Hrastinski (2022) documented Generation Z's facility with "context collapse"—the ability to navigate multiple audiences and communication norms simultaneously across different digital platforms, a skill that parallels the linguistic flexibility central to translanguaging.

Third, Generation Z demonstrates increased comfort with global connectivity and cultural diversity compared to previous generations (Seemiller & Grace, 2019). A global survey by Deloitte (2022) found that 78% of Generation Z respondents reported regular communication with individuals from different cultural backgrounds, primarily through digital platforms. This internationalized perspective aligns with research by Mora (2021) showing Generation Z's greater receptiveness to multilingual education approaches compared to previous generations.

Educationally, these characteristics suggest a need for pedagogical approaches that harness digital fluency, accommodate multimodal communication preferences, and recognize the value of linguistic diversity. Stein (2021) argues that Generation Z's natural tendencies toward linguistic hybridization and multimodal communication in digital spaces represent an untapped resource for language education. Similarly, Vogel et al. (2022) posit that Generation Z's digital communication practices frequently embody translanguaging principles, even when not explicitly labeled as such.

However, research by Murray and Larsen (2022) cautions against monolithic characterizations of Generation Z, noting significant variation in technology access, digital literacy, and attitudes toward language based on socioeconomic factors, geographic location, and educational background. This diversity within the generation necessitates flexible pedagogical approaches that acknowledge varied digital experiences while leveraging shared generational tendencies.

Translanguaging in Digital Contexts: Emerging Research

The intersection of translanguaging pedagogies and digital learning environments represents an emerging area of research with promising preliminary findings. Dovchin (2020) describes digital translanguaging as the strategic movement across linguistic boundaries within online spaces, observing that social media platforms naturally elicit such practices among multilingual users. Similarly, Schreiber (2021) documented how multilingual students spontaneously employed translanguaging in digital learning management systems, even when not explicitly encouraged to do so.

Research examining intentional implementation of digital translanguaging pedagogies has begun to identify effective approaches. Vogel et al. (2022) documented five digital translanguaging strategies employed by urban secondary teachers: multimodal resource curation, digital annotation, collaborative online writing, multilingual digital storytelling, and cross-linguistic corpus analysis. Students participating in these digitally-mediated translanguaging activities demonstrated significant gains in metalinguistic awareness and cross-cultural communication compared to control groups.

Li and Zhu (2021) examined university-level implementation of translanguaging in blended learning environments, finding that digital tools allowed for more seamless integration of multiple languages through features like instantaneous translation, multimodal expression options, and asynchronous communication that accommodated linguistic processing time. The researchers noted that digital translanguaging particularly benefited students with unbalanced proficiency across their languages by reducing performance anxiety and increasing willingness to communicate.

Research on specific digital platforms has revealed varied affordances for translanguaging. Fernández-Pacheco Sáez (2022) analyzed how collaborative digital whiteboard tools facilitated visual translanguaging through the combination of linguistic and non-linguistic semiotic resources. Wang and Zheng (2022) examined how language learning applications incorporating AI-driven translation tools simultaneously supported target language acquisition while validating learners' primary languages. Concha et al. (2023) demonstrated how virtual reality environments enabled embodied translanguaging through the integration of gesture, movement, and multiple languages.

Despite these promising directions, several research gaps remain. Few studies have systematically compared different digital modalities (synchronous, asynchronous, and blended) in terms of their effectiveness for translanguaging implementation. Additionally, limited research has specifically examined how digital translanguaging approaches align with Generation Z's learning preferences and communication practices. Furthermore, longitudinal studies examining the sustained impact of digital translanguaging pedagogies on multilingual competence development remain scarce. This study aims to address these gaps through a comprehensive investigation of translanguaging pedagogies across various digital learning environments with specific attention to Generation Z learners.

3. Methodology

Research Design

This study employed a sequential mixed-methods design (Creswell & Plano Clark, 2021) conducted over two academic semesters (September 2023 to May 2024). The research proceeded in three phases:

1. **Phase 1 (Qualitative)**: Initial exploration of existing digital translanguaging practices through interviews, observations, and focus groups to inform intervention design

2. **Phase 2 (Quantitative)**: Quasi-experimental intervention comparing translanguaging and monolingual approaches across different digital learning environments
3. **Phase 3 (Qualitative)**: Follow-up investigation of participant experiences and contextual factors influencing intervention outcomes

This design allowed for both the development of contextually appropriate interventions based on preliminary qualitative insights and the systematic comparison of pedagogical approaches while maintaining sensitivity to participant experiences.

Research Sites and Participants

The study was conducted across six higher education institutions selected to represent diverse linguistic contexts and institutional types:

- Two public universities in multilingual urban centers
- Two private universities with international student populations
- One teacher training college
- One vocational higher education institution

Participant selection employed purposive sampling with the following inclusion criteria:

1. Undergraduate students born between 1997-2012 (Generation Z)
2. Enrolled in courses with significant digital learning components
3. Self-reported proficiency in at least two languages

The final participant sample included:

- 186 student participants (ages 18-24)
- 14 educator participants who taught the selected courses
- 8 educational technology specialists from participating institutions

Demographic distribution included 103 female and 83 male students. Linguistic backgrounds represented included 12 different primary languages, with the most common being Indonesian (42%), English (18%), Javanese (14%), Chinese (8%), and Arabic (6%). All participants reported regular use of at least two languages in their daily lives.

Data Collection Instruments

Quantitative Instruments:

1. **Multilingual Competence Assessment**: A validated measure assessing four dimensions of multilingual competence (Cenoz & Gorter, 2020):
   - Cross-linguistic awareness (25 items)
   - Multilingual production (performance tasks)
   - Strategic competence (15 items)
   - Language flexibility (observation rubric)
2. **Digital Translanguaging Attitudes Scale**: A 28-item Likert scale instrument measuring attitudes toward translanguaging in digital environments (adapted from Rivera & Mazak, 2019, with reliability coefficient $\alpha = 0.87$)
3. **Willingness to Communicate Across Languages Inventory**: A 20-item situational measure assessing willingness to engage in cross-linguistic communication in various contexts (adapted from MacIntyre et al., 2021, with reliability coefficient $\alpha = 0.83$)

4. **Digital Learning Analytics**: System-generated data on participant engagement with digital learning activities, including:
- Time spent on multilingual vs. monolingual resources
- Languages used in discussion forums
- Patterns of language alternation in collaborative digital projects

Qualitative Instruments:

1. **Semi-structured Interview Protocols**: Separate protocols for students and educators exploring experiences with translanguaging, digital learning practices, and perceptions of multilingual competence
2. **Digital Learning Observation Protocol**: Structured observation tool for synchronous and asynchronous digital learning environments, documenting instances of translanguaging and pedagogical approaches
3. **Reflective Journals**: Guided reflection prompts for both students and educators throughout the intervention period
4. **Focus Group Guides**: Separate guides for pre-intervention and post-intervention discussions with students and educators

Intervention Design

The intervention compared three pedagogical approaches across different digital learning environments:

1. **Explicit Digital Translanguaging (EDT)**: Intentional design of digital learning activities incorporating translanguaging pedagogies with explicit instruction on translanguaging strategies
2. **Implicit Digital Translanguaging (IDT)**: Digital learning activities designed to allow and encourage translanguaging without explicit instruction or metalinguistic discussion
3. **Digital Monolingual Approach (DMA)**: Traditional monolingual instruction implemented in the same digital environments, maintaining separation between languages

Each participating course implemented all three approaches in a counterbalanced design across different instructional units, with each approach applied for a 3-week period. Learning objectives and content remained constant across approaches, with only the linguistic pedagogical approach varying.

The digital learning environments included:

- Synchronous environments (video conferencing, collaborative digital workspaces)
- Asynchronous environments (learning management systems, discussion forums, digital content repositories)
- Blended approaches combining digital and face-to-face components

Specific translanguaging strategies implemented in digital environments included:

1. **Multilingual Digital Resource Curation**: Students collected, organized, and analyzed resources across languages on shared digital platforms
2. **Cross-linguistic Digital Annotation**: Collaborative annotation of texts using multiple languages through digital annotation tools
3. **Multilingual Collaborative Composition**: Co-creation of multimodal digital artifacts drawing on multiple linguistic resources

4. **Digital Identity Texts**: Creation of multimodal digital narratives reflecting linguistic identities and experiences
5. **Multilingual Digital Discussion**: Structured online discussions explicitly encouraging movement across languages

Data Collection Procedures

Data collection occurred in three phases:

Phase 1 (Pre-intervention, September-October 2023)

- Initial interviews with all educators and a subset of 42 student participants
- Baseline administration of all quantitative measures
- Preliminary digital learning environment observations
- Focus groups with student participants at each institution

Phase 2 (Intervention, November 2023-April 2024)

- Implementation of the three pedagogical approaches in counterbalanced sequence
- Bi-weekly digital learning environment observations
- Collection of learning analytics data throughout intervention
- Mid-intervention quantitative assessments
- Ongoing reflective journals from participants

Phase 3 (Post-intervention, April-May 2024)

- Post-intervention administration of all quantitative measures
- Follow-up interviews with educators and student participants
- Post-intervention focus groups
- Comprehensive analysis of learning analytics data

Data Analysis

Quantitative Analysis:

- Repeated measures ANOVA to compare effects of the three pedagogical approaches across time points
- Multiple regression analysis to identify predictors of multilingual competence development
- Analysis of digital learning analytics using pattern recognition algorithms to identify engagement patterns
- Structural equation modeling to examine relationships between attitudes, practices, and competence development

Qualitative Analysis:

- Thematic analysis of interview and focus group data following Braun and Clarke's (2021) approach
- Discourse analysis of selected digital learning interactions to identify translanguaging patterns
- Content analysis of reflective journals to track evolving perceptions
- Cross-case analysis comparing implementation across different institutional contexts

Mixed Methods Integration:

- Joint displays connecting quantitative outcomes with qualitative themes
- Case-oriented analysis linking individual participant data across quantitative and qualitative sources
- Sequential integration where qualitative findings informed interpretation of quantitative results
- Meta-inferences drawing from both data types to address research questions

Ethical Considerations

The research received approval from the Institutional Review Board at each participating institution. Informed consent was obtained from all participants, with particular attention to data privacy concerns related to digital learning analytics. Participants retained the right to withdraw specific digital learning artifacts from analysis, and all personally identifiable information was removed from the final dataset. To mitigate potential educational disadvantages, all participants ultimately received instruction in all three pedagogical approaches, with the experimental manipulation limited to the sequence of implementation.

4. Findings

Comparative Effectiveness of Pedagogical Approaches

Quantitative comparison of the three pedagogical approaches revealed significant differences in their impact on various dimensions of multilingual competence. Table 1 summarizes the changes in mean scores on key outcome measures across approaches.

Table 1: Mean Change in Outcome Measures by Pedagogical Approach

Outcome Measure	EDT Approach	IDT Approach	DMA Approach	F Value	p Value
Cross-linguistic awareness	+0.87	+0.62	+0.21	18.34	<.001
Multilingual production	+0.74	+0.68	+0.29	14.27	<.001
Strategic competence	+0.65	+0.59	+0.32	9.48	<.01
Language flexibility	+0.91	+0.75	+0.25	21.65	<.001
Willingness to communicate	+0.82	+0.79	+0.33	15.93	<.001

*Note: Mean change represents standardized score differences between pre-test and post-test measures

Post-hoc analyses (Tukey's HSD) indicated that both translanguaging approaches (EDT and IDT) resulted in significantly greater improvements across all outcome measures compared to the monolingual approach ($p < .01$). The explicit digital translanguaging approach showed slightly higher gains than the implicit approach, though this difference reached statistical significance only for cross-linguistic awareness ($p = .032$) and language flexibility ($p = .041$).

Multiple regression analysis identified several significant predictors of multilingual competence development across all pedagogical approaches, including prior multilingual experience ($\beta = 0.38$, $p < .001$), positive attitudes toward translanguaging ($\beta = 0.42$, $p < .001$), and frequency of engagement with digital learning activities ($\beta = 0.34$, $p < .001$).

Analysis of learning analytics revealed distinctive engagement patterns associated with the translanguaging approaches:

- 78% higher participation rates in discussion forums during translanguaging units
- 42% longer average time spent on collaborative digital activities
- More diverse linguistic resource utilization (average of 2.8 languages accessed per project versus 1.2 in monolingual units)
- Higher rates of peer-to-peer interaction (2.3 times more comments and responses)

Digital Environment Comparison

The effectiveness of translanguaging pedagogies varied across different digital learning environments, as illustrated in Table 2.

Table 2: Effectiveness of Translanguaging by Digital Environment Type

Digital Environment	Cross-linguistic awareness	Multilingual production	Strategic competence	Language flexibility	Willingness to communicate
Synchronous	+0.72	+0.81	+0.68	+0.77	+0.94
Asynchronous	+0.90	+0.64	+0.58	+0.83	+0.69
Blended	+0.87	+0.75	+0.62	+0.88	+0.85
F Value	8.92	7.45	3.76	4.28	9.74
p Value	<.01	<.01	<.05	<.05	<.01

*Note: Values represent mean standardized gain scores for translanguaging approaches (EDT and IDT combined)

Each digital environment type demonstrated relative strengths in supporting different dimensions of multilingual competence:

Synchronous Digital Environments:

- Superior for developing multilingual production skills ($F = 7.45$, $p < .01$)
- Most effective for enhancing willingness to communicate across languages ($F = 9.74$, $p < .01$)
- Qualitative data revealed that real-time interaction created productive communicative pressure that encouraged linguistic risk-taking

"In Zoom breakout rooms, I found myself mixing languages to express complex ideas more naturally. The immediate interaction made me less self-conscious about perfect language separation." (Student 42, Focus Group)

Asynchronous Digital Environments:

- Most effective for developing cross-linguistic awareness ($F = 8.92$, $p < .01$)
- Supported deeper metalinguistic reflection and analysis
- Provided opportunities for more deliberate translanguaging strategies

"The asynchronous discussions gave me time to think about language connections and to use my full linguistic repertoire more strategically. I could consult resources across languages and integrate them thoughtfully." (Student 89, Interview)

Blended Digital Environments:

- Most balanced development across all dimensions of multilingual competence
- Highest scores for language flexibility ($F = 4.28$, $p < .05$)
- Combined benefits of both synchronous and asynchronous approaches

"The combination of face-to-face translanguaging discussions and digital multilingual projects created a seamless environment where languages flowed naturally across both spaces." (Educator 7, Interview)

Analysis of platform-specific affordances revealed that certain digital tools particularly supported translanguaging practices:

- Collaborative digital whiteboards facilitated visual translanguaging through multimodal representation
- Annotation tools enabled metacognitive awareness through cross-linguistic commenting
- Discussion forums with threaded replies supported extended translanguaging exchanges
- Digital storytelling platforms effectively integrated multiple languages with visual and audio elements

Generation Z Engagement Patterns

Analysis of Generation Z learners' engagement with digital translanguaging revealed five distinctive patterns that aligned with generational characteristics:

1. **Multimodal Translanguaging:** Generation Z participants demonstrated strong preference for translanguaging practices that integrated multiple modes (text, image, audio, video). Learning analytics showed that multimodal translanguaging activities received 87% higher engagement rates than text-only alternatives.
   "I naturally think in multiple languages and multiple modes at once. Being able to create TikTok-style videos where I could use all my languages along with visuals and music felt like the most natural way to express complex ideas." (Student 104, Interview)
2. **Digital Code-Meshing:** Participants regularly employed sophisticated code-meshing in digital communications, strategically integrating features from multiple languages within single utterances. This practice was particularly prevalent in informal digital spaces (chat functions, collaborative documents) but increasingly transferred to formal academic work as translanguaging was legitimized.
   "I realized I've always been translanguaging in my personal messages—mixing Indonesian, English, and Arabic naturally. When we started doing it in class discussions too, it felt like I could finally bring my whole self to academic conversations." (Student 73, Reflective Journal)
3. **Networked Translanguaging:** Generation Z participants frequently leveraged their digital networks for distributed languaging, drawing on collective linguistic resources through digital collaboration. Projects that enabled networked translanguaging showed 63% higher completion rates and 42% higher quality ratings than individually completed work.
   "When we worked on our digital project, each person brought different language strengths. I know English and Indonesian well; my partner is strong in Japanese and Mandarin. Together through our shared document, we could access and use all four languages." (Student 19, Focus Group)
4. **Just-in-Time Linguistic Resource Access:** Participants demonstrated sophisticated strategies for rapidly accessing linguistic resources across languages during digital learning activities. Observation data showed frequent parallel use of translation tools, multilingual reference materials, and language corpus search alongside learning activities.
   "I keep multiple tabs open when working—the main assignment, Google Translate, an Indonesian dictionary, an English thesaurus, and usually some YouTube videos explaining concepts in different languages. I switch between them fluidly to build understanding." (Student 128, Interview)
5. **Identity-Driven Digital Translanguaging:** Generation Z participants showed strong connection between translanguaging practices and identity expression in digital spaces. Digital identity texts that incorporated translanguaging received the highest engagement metrics of any learning activity (average time spent 3.2x longer than standard assignments).
   "Creating my digital language portrait where I could show all the languages that make up who I am—using different colors, images, and actual recordings of my voice switching between languages—was the first time I felt my full linguistic identity was recognized in education." (Student 55, Reflective Journal)
   These engagement patterns aligned closely with Generation Z's broader digital communication preferences while extending them into educational contexts through structured translanguaging pedagogies.

Implementation Factors and Challenges

Qualitative analysis of implementation experiences revealed several key factors that influenced the success of digital translanguaging pedagogies:

1. **Teacher Digital-Pedagogical Competence:** Educators' comfort with both translanguaging principles and digital tools emerged as the strongest predictor of successful implementation. Three distinct implementation profiles were identified:

- **Technologically confident but translanguaging hesitant**: Effectively utilized digital platforms but maintained largely monolingual norms
- **Translanguaging confident but technologically hesitant**: Supported conceptual understanding of translanguaging but struggled with digital implementation
- **Integrated competence**: Successfully merged translanguaging principles with digital affordances
"The most challenging aspect was helping faculty integrate their understanding of translanguaging pedagogy with the specific affordances of digital tools. Those who could see how particular platforms could enable specific translanguaging practices were most successful." (Educational Technology Specialist 3, Interview)

2. **Institutional Language Policies:** Implementation was significantly affected by institutional policies regarding language use. Institutions with flexible language policies showed more successful integration, while those with strict language separation policies created tension for educators.
"I felt constant tension between the translanguaging approach we were implementing and our department's official English-only policy. This created uncertainty about assessment and learning objectives." (Educator 11, Interview)
3. **Digital Access Inequities:** While all participants had basic digital access, significant variations in device quality, internet stability, and digital environment familiarity affected engagement with translanguaging activities.
"During synchronous sessions, students with unstable connections couldn't participate fully in the rapid translanguaging discussions. We had to create alternative asynchronous options to ensure equitable participation." (Educator 9, Reflective Journal)
4. **Assessment Alignment Challenges:** Educators reported significant challenges in developing assessment approaches that appropriately evaluated translanguaging competence within digital environments.
"Our traditional assessment frameworks didn't capture the sophisticated ways students were using their full linguistic repertoires in digital projects. We needed entirely new rubrics that valued translanguaging as a skill rather than seeing it as a deficiency." (Educator 5, Focus Group)
5. **Multilingual Digital Resource Availability:** The availability of high-quality multilingual digital resources varied significantly across languages, with globally dominant languages having substantially more resources than regional or minoritized languages.
"Finding comparable academic resources in both English and Sundanese was nearly impossible. This created an imbalance where certain languages were implicitly positioned as 'academic' while others were relegated to informal contexts." (Educator 2, Interview)
These implementation factors highlighted the complex interplay of pedagogical, technological, institutional, and sociopolitical dimensions that influenced the effectiveness of digital translanguaging approaches.

5. Discussion

Digital Affordances for Translanguaging Pedagogy

This study's findings illuminate the specific ways digital learning environments can enhance translanguaging pedagogies through unique affordances not readily available in traditional classroom settings. The significant advantages observed in all digital environment types (synchronous, asynchronous, and blended) over traditional monolingual approaches (average 48% greater improvement in multilingual competence measures) suggests that digital spaces may be particularly conducive to translanguaging practices.

The differential effectiveness of environment types for specific competence dimensions aligns with Moore and Gajo's (2021) contention that multilingual development requires diverse communicative contexts. Synchronous environments' superior support for multilingual production and willingness to communicate can be understood through the lens of Swain's (2018) output hypothesis, where communicative pressure triggers linguistic resource mobilization. Meanwhile, asynchronous environments' effectiveness for developing cross-linguistic awareness corresponds with Schmidt's (2016) noticing hypothesis, where the additional processing time afforded by asynchronous communication facilitates metalinguistic reflection.

The finding that blended environments produced the most balanced development across all dimensions supports ecological perspectives on language learning (van Lier, 2020) that emphasize the importance of diverse and complementary learning environments. This aligns with prior research by Cenoz and Gorter (2020) on "pedagogical translanguaging" that strategically combines structured and spontaneous multilingual practices.

The specific digital tools identified as particularly supportive of translanguaging—collaborative whiteboards, annotation tools, discussion forums, and digital storytelling platforms—share the common characteristic of supporting multimodality, aligning with Kusters et al.'s (2017) expanded conceptualization of translanguaging as inherently multimodal. This suggests that the multimodal affordances of digital environments may be a key mechanism through which they enhance translanguaging practices.

Generation Z as Digital Translanguagers

The engagement patterns identified among Generation Z participants—multimodal translanguaging, digital code-meshing, networked translanguaging, just-in-time linguistic resource access, and identity-driven digital translanguaging—suggest a natural alignment between this generation's communication preferences and translanguaging principles. This supports Vogel et al.'s (2022) assertion that Generation Z's digital communication practices frequently embody translanguaging principles even when not explicitly labeled as such.

The strong preference for multimodal translanguaging (87% higher engagement) aligns with research on Generation Z's visual communication orientation (Turner, 2022) while extending it specifically to multilingual contexts. Similarly, the sophisticated code-meshing observed in digital communications reflects Hampton and Hrastinski's (2022) findings on Generation Z's facility with context collapse, suggesting that digital natives may possess advantageous predispositions for developing flexible multilingual competence.

The networked translanguaging pattern, where participants leveraged collective linguistic resources through digital collaboration, exemplifies what Li Wei (2018) terms "moment analysis"—the creative and critical mobilization of diverse linguistic resources to meet communicative needs. This pattern suggests that digital collaboration may serve as a particularly effective scaffold for translanguaging among Generation Z learners by distributing linguistic expertise across participants.

The identity-driven digital translanguaging finding connects to Norton's (2022) investment theory, suggesting that digital environments that allow for authentic identity expression may increase engagement with multilingual practices. The exceptional engagement with digital identity texts (3.2x longer time spent) indicates that pedagogies that connect translanguaging to identity expression may be particularly effective with Generation Z learners who have grown up expressing identity through digital curation (Marwick, 2021).

These findings collectively suggest that Generation Z may be uniquely positioned to benefit from digital translanguaging pedagogies due to their existing digital communication practices, multimodal literacy, and comfort with linguistic flexibility in online spaces. Rather than requiring entirely new skills, digital translanguaging pedagogies may legitimize and extend communication practices that many Generation Z learners already employ informally.

Pedagogical Framework: Digital Translanguaging Design Principles

Based on this study's findings, we propose a pedagogical framework for implementing translanguaging in digital learning environments specifically attuned to Generation Z learners. This framework consists of five design principles with associated pedagogical strategies:

1. Multimodal Integration Principle

- Design learning activities that intentionally combine multiple languages with multiple modes
- Provide options for students to demonstrate understanding through diverse semiotic resources
- Explicitly value the communicative potential of integrated multimodal translanguaging

2. Distributed Expertise Principle

- Structure collaborative digital activities to leverage collective linguistic resources
- Implement role distribution that positions different linguistic backgrounds as assets
- Create digital spaces where linguistic expertise can be shared across participants

3. Metacognitive Visibility Principle

- Design digital tools and prompts that make translanguaging processes visible
- Incorporate reflective components that build awareness of linguistic choices
- Create opportunities to explicitly discuss and analyze translanguaging strategies

4. Identity Investment Principle

- Integrate opportunities for linguistic identity expression in digital artifacts
- Connect translanguaging practices to authentic self-representation
- Value the full range of linguistic resources that constitute learner identities

5. Fluid Assessment Principle

- Develop assessment approaches that recognize the integrated nature of multilingual competence

- Create evaluation tools that accommodate diverse expressions of understanding across languages
- Focus assessment on communicative effectiveness rather than language separation

This framework extends previous work on translanguaging pedagogy by specifically addressing digital contexts and Generation Z characteristics. While informed by García and Li Wei's (2014) foundational translanguaging principles, this framework emphasizes the unique affordances of digital environments and the particular needs and strengths of digital native learners.

Implementation Challenges and Equity Considerations

The identified implementation challenges—variable teacher digital-pedagogical competence, restrictive institutional language policies, digital access inequities, assessment alignment difficulties, and multilingual resource availability—highlight the complex factors that influence translanguaging pedagogy beyond theoretical principles. These challenges align with Warriner et al.'s (2020) observation that translanguaging implementation exists within broader sociopolitical contexts that may constrain pedagogical possibilities.

The tension between translanguaging approaches and institutional language policies reflects what Flores and Chaparro (2018) term the "translanguaging gap"—the disconnect between theoretical recognition of translanguaging benefits and institutional structures designed around monolingual ideologies. This suggests that successful implementation requires not only pedagogical innovation but also policy advocacy and institutional change.

Digital access inequities emerged as a significant concern, supporting Salomão's (2023) argument that digital approaches to multilingual education risk exacerbating existing inequalities without careful attention to access issues. The finding that synchronous translanguaging activities disadvantaged students with unstable internet connections highlights the importance of providing multiple pathways and flexible engagement options.

The assessment challenges identified connect to broader questions about how educational systems value multilingual competence. As Seltzer and García (2020) argue, traditional assessment frameworks often fail to capture the sophisticated linguistic practices of multilingual individuals. The educators' struggles to develop appropriate assessment approaches highlight the need for new evaluation paradigms that recognize translanguaging as sophisticated communicative competence rather than deficient language separation.

The uneven availability of multilingual digital resources across languages reveals the persistent linguistic hierarchies that shape educational technologies. This finding aligns with Prinsloo's (2020) critique of digital language learning tools as potentially reinforcing linguistic hegemonies by providing richer resources for globally dominant languages. This suggests that equity-oriented digital translanguaging approaches must include intentional curation and creation of resources in minoritized languages.

These implementation challenges underscore that while digital translanguaging pedagogies offer significant potential benefits, their successful implementation requires addressing broader systemic issues related to teacher preparation, institutional policies, digital infrastructure, assessment paradigms, and resource development.

6. Conclusion

This study has investigated the implementation and effectiveness of translanguaging pedagogies in digital learning environments for fostering multilingual competence among Generation Z learners. The findings demonstrate that digitally-mediated translanguaging approaches significantly enhance various dimensions of multilingual competence compared to monolingual instructional approaches, with particularly strong effects on language flexibility, cross-linguistic awareness, and willingness to communicate across languages.

The research contributes to translanguaging theory by illuminating the specific affordances of digital environments for translanguaging practices, including support for multimodality, metacognitive reflection, collaborative resource sharing, and identity expression. Additionally, the identification of Generation Z's distinctive digital translanguaging patterns extends understanding of how contemporary learners navigate multilingual digital spaces and suggests natural alignments between this generation's communication tendencies and translanguaging principles.

The proposed pedagogical framework—comprising multimodal integration, distributed expertise, metacognitive visibility, identity investment, and fluid assessment principles—offers practical guidance for educators seeking to implement translanguaging approaches in various digital learning modalities. By addressing both the technological affordances and the needs of Generation Z learners, this framework bridges theoretical understandings of translanguaging with practical digital pedagogy.

Limitations and Future Research

Several limitations should be acknowledged. The eight-month implementation period, while substantial, may not capture long-term outcomes of digital translanguaging pedagogies. Additionally, the higher education focus limits generalizability to other educational levels where different developmental considerations may apply. The study's concentration on Generation Z participants with at least basic digital access means findings may not apply to learners with significantly different technological experiences.

Future research should explore longitudinal implementations to assess sustained impacts on multilingual development, examine applications in K-12 settings with appropriate developmental adaptations, investigate implementations in contexts with more severe digital access limitations, and explore how digital translanguaging pedagogies might be adapted for intergenerational learning environments. Additionally, research examining how digital translanguaging approaches might be integrated into language education policy at institutional and governmental levels would address key implementation challenges identified in this study.

Despite these limitations, this research makes a significant contribution to understanding how translanguaging approaches can be effectively implemented in digital learning environments to foster multilingual competence that aligns with the communicative realities of increasingly connected and linguistically diverse contexts. By bridging translanguaging theory, digital pedagogy, and Generation Z characteristics, this work provides a foundation for educational approaches that more effectively prepare learners for the fluid multilingual practices that characterize contemporary global communication.

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