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Original Research

Orthographic Representation of Long Vowels in Gorontalo: A Sociolinguistic Perspective on Tradition and Technology

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Abstract: This study examines the orthographic representation of long vowels in Gorontalo, focusing on the sociolinguistic interplay between tradition and technology. Data were collected from 213 respondents across six administrative regions using a mixed-methods approach to explore preferences for single graphemes, digraphs, and diacritics in varied sociocultural and technological contexts. The findings reveal distinct patterns: rural communities primarily retain single graphemes, reflecting oral traditions that emphasize suprasegmental features like rhythm and intonation. In contrast, urban areas adopt digraphs for their practicality in digital communication, while diacritics are predominantly confined to formal educational settings with minimal use in everyday contexts. Technology significantly shapes orthographic preferences, with digital tools promoting modern practices in urban areas, while technological limitations in rural regions sustain traditional systems. Education emerges as a pivotal factor, offering opportunities to reconcile local traditions with contemporary demands through community-based curricula. This study contributes to global discourses on orthographic representation, sociolinguistic identity, and the integration of tradition with technological advancements. The Gorontalo case illustrates how orthographic practices act as cultural artifacts, mediating identity and communication amid rapid social and technological change.

Keywords: *Orthographic Representation, Long Vowels, Gorontalo, Sociolinguistics, Digital Communication*

Introduction

Orthographic systems play a central role in supporting literacy, written communication, and cultural preservation, particularly in the context of minority languages that are vulnerable to the pressures of modernization. As the visual representation of spoken language, orthography enables the relationship between graphemes and phonemes to be translated into consistent and meaningful written forms (Coulmas 2003; Crystal 2018). However, for minority languages such as Gorontalo, the challenge of developing a stable and relevant orthographic system remains a pressing issue. In particular, inconsistencies in orthographic representation, especially of long vowels, pose significant barriers to literacy and intergenerational comprehension.

Long vowels serve an essential phonemic function in Gorontalo, where their presence directly affects word meaning. For instance, the words *tu'o* (vomit) and *tuu'o* (hidden) illustrate how variations in vowel length produce substantial semantic differences. Nevertheless, variability in writing practices—ranging from the use of diacritics, digraphs, or omission of vowel-length markers—frequently generates ambiguity, hindering literacy, and reducing clarity in written communication (Ladefoged and Johnson 2014).

This issue is not unique to Gorontalo. Similar challenges are observed in other minority languages worldwide. For example, in Botswana, orthographic inconsistencies in Khoisan languages have impeded literacy development and weakened cultural recognition (Chebanne 2016). In Laos, community-based reforms of the Hmong language's orthography successfully established a culturally relevant and phonologically accurate writing system, significantly improving literacy (Dubost et al. 2019). Likewise, in Vietnam, orthographic reforms in the Cham language have demonstrated how accurate phonological representation can strengthen literacy while revitalizing cultural identity.

In Indonesia, orthographic inconsistencies extend beyond Gorontalo to other regional languages, including Sundanese, Bugis, and Minangkabau. Challenges in representing phonological elements, such as vowel length, create obstacles to literacy, particularly among younger generations who are more accustomed to the standardized orthography of Indonesian. For Gorontalo, this issue is exacerbated by the dominance of Indonesian as the national language, which has increasingly replaced many functions of Gorontalo in daily communication.

Sociocultural dynamics also play a crucial role in shaping orthographic preferences among Gorontalo communities. Research indicates that orthographic conflicts often reflect underlying power hierarchies and language ideologies within societies (Villa and Vosters 2015). The dominance of Indonesian has not only accelerated the marginalization of Gorontalo but also created a disconnect between traditional practices and modern needs. Conversely, community-based approaches have proven effective in addressing such challenges. For example, Dondelewski and Czopek (2022) highlighted how local community involvement in orthographic reforms can strengthen a sense of ownership over the language and enhance consistency in writing systems.

Although substantial research has explored orthography in minority languages, most studies primarily focus on phonological and morphological descriptions, neglecting in-depth examination of sociocultural and technological dimensions. Community-based approaches, successfully implemented in orthographic reforms for languages such as Maori in New Zealand and Khoisan in South Africa, have yet to be widely applied to Gorontalo (Chebanne 2016; Smith 2022). Additionally, while advancements in digital tools such as local keyboards and artificial intelligence (AI)–powered applications show significant potential to enhance orthographic consistency, their utilization remains minimal in the context of Gorontalo.

The Gorontalo language faces substantial challenges due to orthographic inconsistencies, particularly in the representation of long vowels. The ambiguity arising from varying writing practices poses significant barriers to literacy and written communication. Moreover, the absence of clear orthographic guidelines, limited technological support, and the dominance of Indonesian exacerbate these issues. A holistic approach is therefore required to bridge the gaps between linguistic needs, sociocultural dynamics, and technological solutions for Gorontalo's writing system.

This study aims to examine the variations in the practice of writing long vowels across different regions of Gorontalo, with a particular focus on the distribution of graphemes, diacritics, and digraphs. Additionally, it seeks to analyze the influence of sociocultural factors, such as local traditions and generational differences, on the orthographic preferences among Gorontalo communities. Another key objective is to evaluate the impact of digital tools, including localized keyboards and AI-based applications, in enhancing orthographic consistency and helping to preserve the Gorontalo language.

The study addresses three primary aspects. First, from a linguistic perspective, it examines variations in the practice of writing long vowels across Gorontalo. Second, it explores the sociocultural dimensions of orthographic preferences, considering traditional values, generational differences, and social contexts. Finally, from a technological standpoint, the study evaluates the potential of digital tools to support orthographic consistency and promote language preservation.

Methodology

Research Approach

This study employs a descriptive–exploratory approach with mixed methods, integrating quantitative and qualitative data to provide a comprehensive understanding of the distribution of long vowel orthography in Gorontalo, as well as the sociocultural influences and the impact of technology and education on orthographic consistency. This approach was chosen, as it offers deeper insights than relying on a single method alone (Creswell and Creswell 2017; Tashakkori and Teddlie 2010). The descriptive–exploratory design was used to examine existing orthographic patterns, while the mixed-methods approach provided flexibility in combining statistical and thematic analyses (Yin 2018; Flick 2018).

Research Location and Participants

The research was conducted across six administrative regions in Gorontalo Province: Gorontalo City, Gorontalo Regency, Bone Bolango Regency, Boalemo Regency, Pohuwato Regency, and North Gorontalo Regency. These regions were selected to capture the social, cultural, and geographical diversity relevant to the distribution of orthographic practices. The

participants comprised 213 individuals selected through purposive sampling, a method suitable for qualitative research as it allows the selection of participants with in-depth knowledge of the study topic (Lawrence Neuman 2014; Etikan et al. 2016). Participants included students, teachers, indigenous community members, and digital technology users to capture the dynamics of orthography across domains such as formal education, digital communication, and local cultural traditions (Israel and Hay 2006).

Data Collection Procedures

Data were collected through surveys, semi-structured interviews, and focus group discussions (FGDs). Triangulation of data was employed to enhance the validity and reliability of the research findings by combining multiple methods and data sources (Denzin 2017).

1. Survey: The survey utilized structured questionnaires to document the distribution of long vowel orthographic practices, including diacritics, digraphs, and single graphemes. The survey provided quantitative data to capture general preferences across the six research locations (Bryman 2016; Field 2024).
2. Semi-Structured Interviews: Semi-structured interviews were designed to delve deeper into the sociocultural factors influencing orthographic preferences in Gorontalo. They allowed participants to elaborate on their preferences and the role of technology and education in shaping their orthographic practices (Guest et al. 2011).
3. Focus Group Discussions: Focus Group Discussions (FGDs) were conducted to discuss the opportunities and challenges in implementing a dual-system orthographic model. These discussions involved representatives from local communities, teachers, and language practitioners to identify needs and expectations for orthographic reform (Chebanne 2016; Smith 2022).

Research Instruments

This study employed three types of instruments:

1. Questionnaires: Used to measure the distribution of orthographic usage and participants' perceptions of orthographic consistency within their respective regions (Bryman 2016; Creswell and Poth 2016).
2. Interview Guides: Developed to explore social and technological dimensions of orthographic preferences (Lawrence Neuman 2014; Braun and Clarke 2006).
3. FGD Guidelines: Designed to analyze collective perspectives on the development and application of a dual-system orthographic model (Israel and Hay 2006; Creswell and Poth 2016).

Data Processing and Analysis Procedures

The data collected in this study were analyzed using both quantitative and qualitative approaches to ensure a comprehensive understanding of orthographic preferences across different research locations. The following methods were employed:

1. Quantitative Analysis: Data from the surveys were analyzed using descriptive statistics to identify the distribution of diacritics, digraphs, and single graphemes across the six research locations. This analysis provided a detailed understanding of orthographic preferences in various social contexts (Field 2024; Tashakkori and Teddlie 2010).
2. Qualitative Analysis: Data from interviews and FGDs were analyzed thematically to identify patterns, themes, and relationships relevant to the orthographic preferences of Gorontalo communities. This method is effective for exploring the sociocultural dimensions within the research context (Braun and Clarke 2006; Guest et al. 2011).

Ethical Considerations

This study adhered to research ethics guidelines by ensuring that all participants were fully informed about the research objectives, methods, and their rights as participants. Participation was voluntary, with written informed consent obtained from all participants. Data confidentiality was strictly maintained throughout the research process and subsequent publication (Israel and Hay 2006; Babbie 2020).

Data Reliability and Validity

To ensure data reliability and validity, a pilot test of the questionnaire was conducted with ten respondents before the main survey. Additionally, methodological triangulation was employed to compare findings from the survey, interviews, and FGDs, enhancing the credibility and trustworthiness of the research results (Denzin 2017; Lincoln and Guba 1985).

Results

Distribution of Long Vowel Orthographic Practices

With modernization, social media and digital communication have transformed how communities choose orthographic patterns, particularly in urban areas where efficiency emerges as a dominant factor (Baron 2010; Tagg and Seargeant 2021). However, tradition continues to play a significant role in rural areas, reflecting how communication patterns are preserved as a form of cultural identity (Finnegan 2012; Pauwels 2016).

The orthographic choices of Gorontalo communities highlight the interplay between cultural traditions, social dynamics, and technological influences. In this context, urban areas such as Gorontalo City exhibit progressive adoption of technology, with digraphs dominating orthographic practices. Conversely, rural areas like North Gorontalo and

Boalemo tend to retain single graphemes, aligning with oral traditions rich in suprasegmental elements such as intonation and rhythm (Harrison and Anderson 2008; Leith 2016).

These findings are visualized through grouped bar charts and heatmaps, offering comprehensive insights into the distribution of orthographic practices, driving factors, and respondent characteristics across the six regions of Gorontalo (see Figure 1).

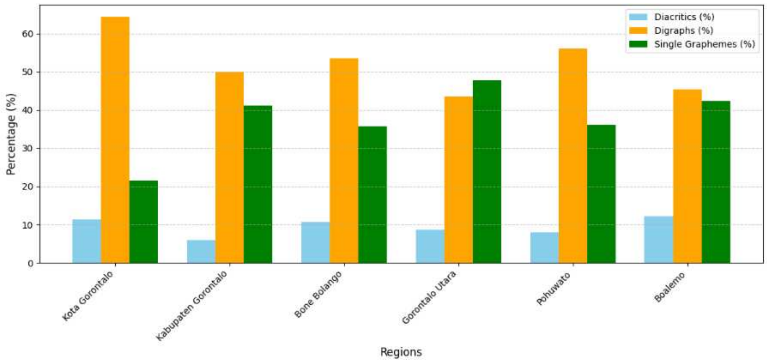

Figure 1: Distribution of Orthographic Practices Across Regions

The grouped bar chart illustrates the distribution of diacritics, digraphs, and single graphemes across six regions in Gorontalo. Gorontalo City demonstrates a dominance of digraphs (64.29%), reflecting the urban community's emphasis on efficiency in digital communication. Digraphs are preferred for their ability to expedite communication without compromising meaning, aligning with the findings of Herring et al. (2013), who noted that digital language prioritizes speed and practicality.

In contrast, rural regions like North Gorontalo exhibit a dominance of single graphemes (47.83%), closely tied to oral traditions. As explained by Ong and Hartley (2013), oral traditions rely heavily on suprasegmental features such as intonation and stress, with written forms functioning merely as complements to spoken language.

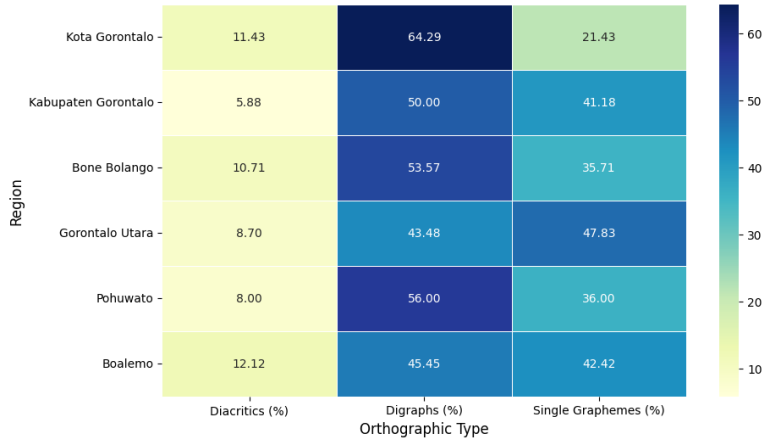

Figure 2: The Heatmap of Orthographic Practice by Region

The heatmap in Figure 2 emphasizes the orthographic variations across different regions. Darker shades in Gorontalo City highlight the dominance of digraphs, while North Gorontalo exhibits a high intensity of single grapheme usage. Regions such as Bone Bolango and Pohuwato display a more balanced distribution between digraphs and single graphemes, reflecting transitional areas that strive to integrate modernity with local traditions. This analysis aligns with Fishman's (2001) theory, which asserts that language patterns reflect the interaction between sociocultural dynamics and technological changes.

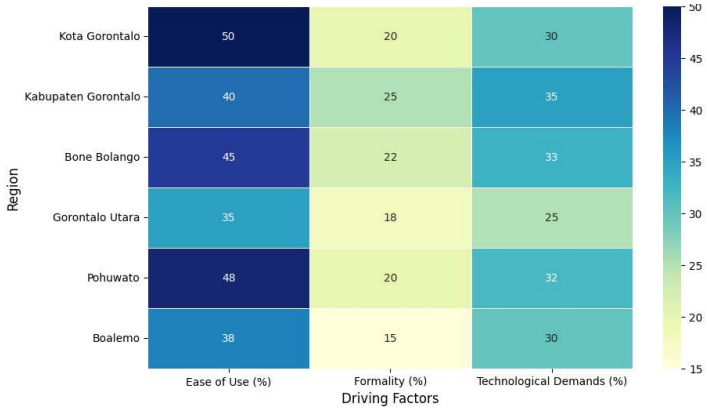

Figure 3: Heatmap of Driving Factors for Orthographic Preferences

The heatmap in Figure 3 illustrates the primary reasons behind orthographic choices across different regions. Gorontalo City stands out with "ease of use" as the dominant factor (50%), aligning with the demand for fast communication in digital spaces (Baron 2010; Tagg and Seargeant 2021). In contrast, the "more formal" factor is more prominent in semi-urban areas such as Gorontalo Regency (25%), reflecting the need to adapt orthographic practices to educational or official documentation contexts. Rural areas like North Gorontalo indicate that the "technological demand" factor has less influence compared to urban regions, consistent with limited access to technology in these areas.

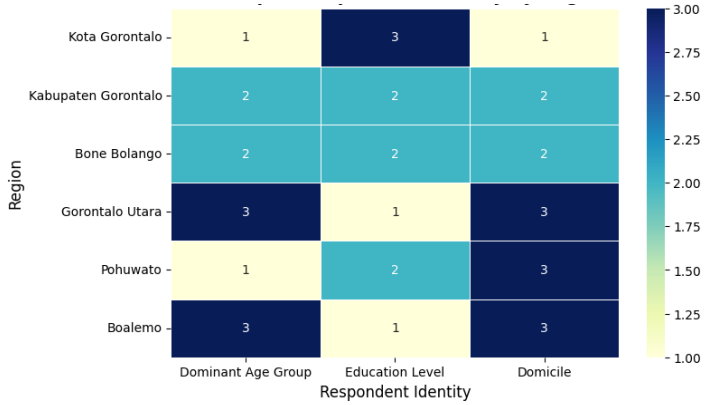

Figure 4: Heatmap of Respondent Identity by Region

The heatmap in Figure 4 provides insights into the social characteristics underlying orthographic preferences. Gorontalo City, dominated by a younger generation with higher education levels and urban residence, tends to favor digraphs as a symbol of modernity. Conversely, rural areas such as Boalemo and North Gorontalo, characterized by older generations with lower education levels and rural residence, prefer single graphemes to preserve traditional patterns. These findings align with Pauwels' (2016) theory, which posits that language and orthographic choices often reflect cultural identity.

The visualization illustrates that Gorontalo's orthographic preferences are shaped by the interaction between tradition, modernization, and social dynamics. Urban areas, such as Gorontalo City, exhibit high adoption of digraphs, driven by efficiency needs and the influence of digital technology. In contrast, rural areas like North Gorontalo maintain single graphemes as part of oral traditions, reflecting a strong cultural identity.

These findings highlight the importance of understanding the social and cultural context when analyzing language patterns. As noted by Crystal (2018) and Harrison and Anderson (2008), modernization does not entirely replace tradition but creates a hybridization of communication patterns. The results have significant implications for educational policies and cultural preservation, particularly in maintaining a balance between technology and tradition amid dynamic social changes.

The Relationship Between Social Context and Orthographic Preferences

The orthographic preferences of Gorontalo communities reflect the complex sociocultural dynamics deeply embedded in their social context. Orthographic patterns, such as digraphs, single graphemes, and diacritics, not only fulfill practical needs for communication but also illustrate how communities negotiate between modernity and tradition. On one hand, urban areas and social media promote more flexible and efficient orthographic patterns, such as digraphs, to facilitate rapid, technology-based communication. On the other hand, oral traditions and rural regions preserve more traditional patterns, such as single graphemes, which are closely tied to verbal practices and local cultural values (Crystal 2018; Finnegan 2012).

Previous studies indicate that modernization often drives shifts in communication patterns, particularly in the context of urbanization and the penetration of digital media (Labov 2006; Herring et al. 2013). However, in communities rooted in oral traditions, suprasegmental elements such as intonation, rhythm, and stress remain dominant factors in maintaining simple yet meaningful communication patterns (Duranti 1997; Ladefoged and Johnson 2014).

This study aims to uncover how differing social contexts influence the orthographic preferences of Gorontalo communities. The following data visualizations provide a detailed depiction of the distribution of orthographic preferences across various social contexts, including social media, urban and rural areas, and oral traditions.

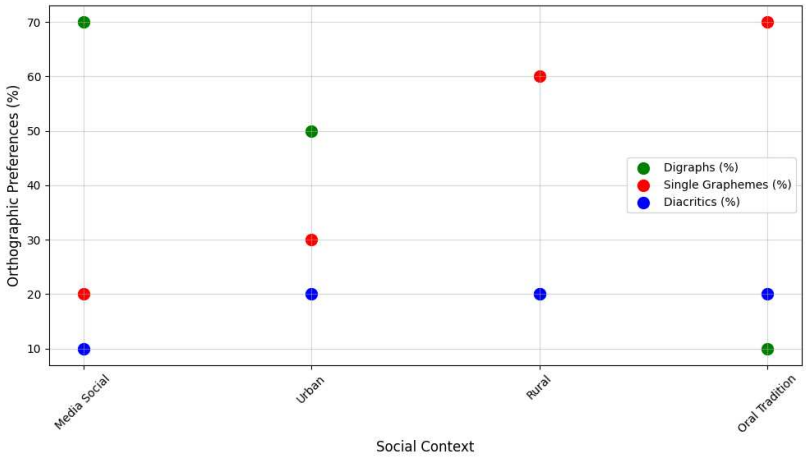

Figure 5: Scatter Plot: Relationship Between Social Context and Orthographic Preferences

The distribution of orthographic preferences, as depicted in Figure 5, reveals a clear relationship between social context and the written communication patterns of Gorontalo communities. Within oral traditions, single graphemes dominate with a proportion of 70%, reflecting the importance of suprasegmental elements in preserving message integrity and meaning, particularly in religious texts, folklore, and traditional rituals (Finnegan 2012; Yule 2022). Writing in this context functions as a complement to verbal communication rather than as a replacement or primary medium. Digraphs account for only 10% due to their limited relevance in culturally rooted communication, while diacritics (20%) play a significant role in emphasizing meaning in formal or religious texts.

In rural areas, which remain heavily reliant on oral traditions, a similar pattern is observed, with single graphemes still dominant at 60%. Suprasegmental elements such as intonation and stress continue to influence societal perceptions of writing as a tool that complements verbal communication. Folklore and religious texts, often employing rich verbal communication, make single graphemes more relevant than other patterns. Conversely, digraphs (20%) and diacritics (20%) play more limited roles as they are less aligned with the needs of conservative rural communities (Ong and Hartley 2013; Crystal 2018).

In urban areas, modernization begins to shape more complex and balanced communication patterns. Digraphs dominate at 50%, reflecting the need for efficiency in written communication, particularly in digital technology contexts (Herring et al. 2013; Fishman 2001). However, single graphemes (30%) and diacritics (20%) remain relevant, particularly in formal domains such as education and official documents. Urbanization introduces a pluralistic interaction between tradition and modernity, where traditional elements are preserved even as the influence of technology grows (Labov 2006).

In the context of social media, digraphs have the highest usage proportion at 70%, consistent with the platform's emphasis on efficiency and speed in communication. Single

graphemes are used at 20%, while diacritics account for 10%, reflecting a shift in orthographic preferences entirely focused on the practical needs of technology-based communication. Social media, as an informal communication space, demonstrates that the suprasegmental elements dominant in oral traditions hold little relevance in digital contexts (Duranti 1997; Crystal 2018).

These findings confirm significant differences in orthographic preferences based on the social contexts of Gorontalo. Oral traditions and rural areas maintain single graphemes as the dominant pattern, supported by the strong role of suprasegmental elements in sustaining local cultural continuity. Conversely, urban areas and social media show a preference for digraphs, reflecting the influence of modernization and technology in shaping more flexible and efficient communication patterns.

This study supports the view that tradition and modernity can coexist when a balance is maintained between preserving cultural identity and adapting to social change (Fishman 2001; Yule 2022). Although modernity continues to progress, these findings demonstrate that oral traditions remain a vital foundation for Gorontalo communities in navigating complex social dynamics. Orthographic choices not only reflect practical needs but also serve as symbols of cultural adaptation, preserving traditional roots amidst the tides of technological and global changes.

The Relationship Between Education and Orthographic Preferences

The orthographic preferences of Gorontalo communities are closely tied to education levels, reflecting not only practical needs in acquiring written language but also the sociocultural dynamics that shape communication patterns. Orthographic forms such as digraphs, single graphemes, and diacritics are utilized differently across educational stages, illustrating a shift between the need for efficiency, local traditions, and formal precision. Education serves not only as a means of language acquisition but also as a medium that bridges local traditions and modernization, as evidenced by the evolving orthographic preferences across different educational levels (Crystal 2018; Yule 2022).

At early educational stages, such as primary school, writing practices focus more on simple comprehension for practical communication. In contrast, at higher levels of education, the need for more formal and complex orthographic forms begins to emerge. This pattern demonstrates that education not only imparts technical writing skills but also shapes how students understand culture and tradition through written language (Finnegan 2012; Ong and Hartley 2013). To visually capture these dynamics, the following scatter plot illustrates the distribution of orthographic preferences across educational levels in Gorontalo.

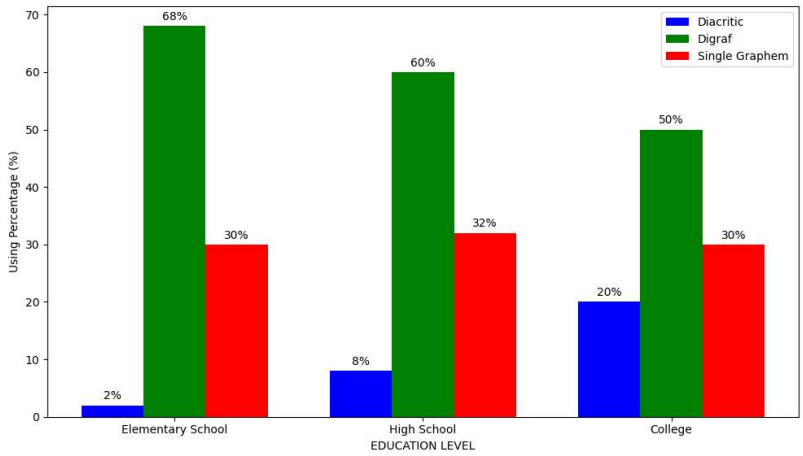

Figure 6: The Comparison Among Education Level and Orthographic Preferences in Gorontalo

The data visualization in Figure 6 reveals the distribution of orthographic preferences, illustrating the relationship between educational levels and the use of digraphs, single graphemes, and diacritics. At the primary school level, digraphs dominate with 68%, while single graphemes account for 30%, and diacritics only 2%. The dominance of digraphs reflects an early education approach emphasizing simplicity and efficiency in the learning process. Digraphs are more accessible to primary school students due to their straightforward nature, supporting foundational literacy skills in reading and writing. Meanwhile, the minimal use of diacritics indicates that linguistic formality is not a primary focus at this stage (Crystal 2018; Ladefoged and Johnson 2014).

At the secondary school level, while digraphs remain dominant at 60%, there is an increase in the use of single graphemes to 32% and diacritics to 8%. This pattern suggests that secondary education begins to introduce students to more complex and formal orthographic usage. The rising use of single graphemes may reflect the influence of local traditions, as this pattern is often associated with simplicity and cultural proximity, particularly in religious texts and traditional literature (Finnegan 2012; Ong and Hartley 2013). Conversely, the increased use of diacritics at this level indicates growing exposure to linguistic precision, especially in academic contexts or documents requiring formal expression.

At the higher education level, there is a significant shift in orthographic preferences. Digraphs decline to 50%, while single graphemes remain stable at 30%, and diacritics rise to 20%. This shift suggests that higher education emphasizes precision and formality in written communication. Diacritics become more relevant at this stage, particularly in academic or professional contexts where accuracy and detail are paramount. Meanwhile, digraphs, though still dominant, begin to decline as they do not always align with the demands of more formal communication. The stability of single grapheme usage across educational levels reflects the enduring influence of tradition, even as modernization continues to exert its impact (Labov 2006; Duranti 1997).

Orthographic preferences in Gorontalo reflect a complex interplay between educational levels, local traditions, and modernization. At the primary education level, the dominance of digraphs represents the need to simplify early learning, while at secondary and higher education levels, the demand for formality and precision increases, as evidenced by the growing use of diacritics. The consistent use of single graphemes across all educational stages underscores the importance of tradition in shaping the cultural identity of Gorontalo communities.

These findings support the view that education plays a vital role as a bridge between tradition and modernity. Education not only shapes students' technical writing abilities but also influences their perceptions of tradition and formality in written communication. In the context of Gorontalo society, education functions not only as a tool for modernization but also as a medium for preserving local cultural values, ensuring that shifts in communication patterns do not erase key elements of the community's identity (Crystal 2018; Yule 2022; Finnegan 2012; Herring et al. 2013).

Technological Implications for Orthographic Choices

The adoption of technology in Gorontalo communities demonstrates significant variations based on geographical location and social context. These patterns reflect the dynamics between modernity and tradition, where modern technologies such as social media and digital devices are more widely accepted in urban areas, while simpler technologies remain relevant in rural regions. These variations are not only influenced by generational preferences but are also shaped by technology accessibility, social needs, and levels of urbanization (Crystal 2018; Fishman 2001).

Key orthographic tools, such as keyboards, keypads, and touchscreens on digital devices, play a crucial role in shaping orthographic practices in Gorontalo. In the context of digital technology, these features influence the efficiency and ease of using various orthographic methods. This suggests that technological infrastructure is a critical factor in shaping how communities adapt to specific orthographic systems.

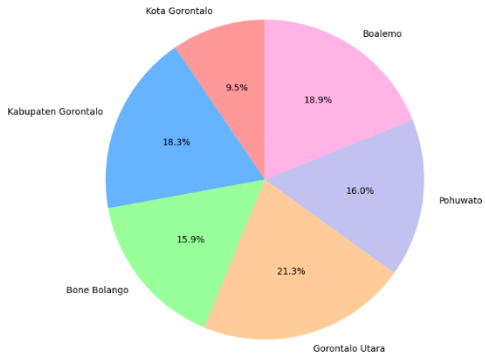

Figure 7: Proportion of Respondents Who Mentioned Technology as a Barrier

The pie chart in Figure 7 illustrates variations in perceptions of technology across six regions in Gorontalo. Rural areas, such as North Gorontalo (21.3%) and Boalemo (18.9%), have the highest percentage of respondents perceiving technology as a barrier. This indicates that limited technological infrastructure, low digital literacy, and inadequate training in using digital devices are significant challenges in these regions (Ong and Hartley 2013; Finnegan 2012). These barriers make it more difficult for rural communities to adopt modern technologies, resulting in a continued preference for simpler orthographic methods, such as single graphemes.

In contrast, Gorontalo City has the lowest percentage of respondents (9.5%) viewing technology as a hindrance. Higher rates of technology adaptation in urban areas are supported by better access to digital devices, higher levels of education, and greater exposure to social media. This pattern aligns with the findings of Herring et al. (2013), which demonstrate that adequate technological infrastructure fosters efficiency and flexibility in digital communication.

The variation in perceptions of technology across Gorontalo reflects the strong relationship between technological accessibility, infrastructure conditions, and sociocultural dynamics. In rural areas, technological barriers are more pronounced, sustaining traditional orthographic methods. Conversely, in urban areas like Gorontalo City, higher technological adaptation enables the use of more efficient methods, such as digraphs, in digital communication.

This analysis underscores the importance of improving technological access and digital literacy in rural areas to bridge the technological divide between regions. Moreover, these findings support the perspectives of Crystal (2018) and Pauwels (2016), who argue that technological modernization does not necessarily replace tradition but instead creates adaptive patterns influenced by local sociocultural contexts.

These results are consistent with global patterns, where urban regions tend to adopt technology more quickly due to advanced infrastructure and better access to education (Labov 2006). Conversely, rural areas, such as North Gorontalo and Boalemo, are often slower to integrate technology due to structural barriers, including high costs and limited resources (Duranti 1997; Fishman 2001).

The accompanying scatter plot visualizes the relationship between technological exposure and orthographic preferences, mapping the interaction of location and generational indicators. This scatter plot provides a quantitative perspective on how specific combinations of variables influence orthographic adaptation across different contexts.

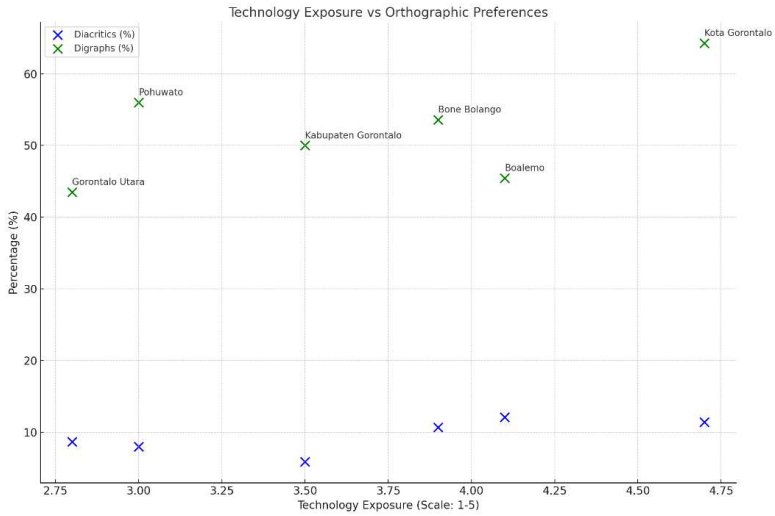

Figure 8: Relationship Between Technological Exposure and Orthographic Preferences

The scatter plot in Figure 8 provides a detailed perspective on the relevance of technology across different regions. The data reveal that areas with high technological exposure, such as Gorontalo City, show a strong preference for modern technology, as indicated by the dominance of digraphs (60%) as the primary orthographic pattern. This reflects the urban youth's demand for efficiency in technology-based communication (Herring et al. 2013). In contrast, regions such as North Gorontalo and Pohuwato, with lower technological exposure, are more inclined to maintain single graphemes as their main orthographic pattern, highlighting an attachment to tradition and limited access to technology.

The scatter plot also illustrates the relationship between generational relevance and social context. The range of relevance values (*Y*-axis) indicates that lower values (0–1) are predominantly found in rural areas, where technology is perceived as less relevant for younger generations. For instance, simpler technologies referred to as "rural technologies" dominate in regions like Pohuwato and North Gorontalo. Conversely, higher relevance values (3–5) are observed in urban areas such as Gorontalo City and Gorontalo Regency, where indicators like "social media" and "practicality" align more closely with the needs of the younger generation (Crystal 2018; Duranti 1997).

Additionally, the scatter plot highlights transitional regions such as Bone Bolango. This area demonstrates high relevance to mobile technologies ($Y = 3–4$), reflecting an adaptation phase where traditional elements persist, but modern technology adoption is increasing. Boalemo, on the other hand, shows the highest relevance ($Y = 5$) for the "practicality" indicator, indicating a strong demand for efficiency among the younger generation (Ong and Hartley 2013).

These visualizations complement one another in explaining the relationship between technological exposure, orthographic preferences, and perceptions of technological barriers

in Gorontalo. The pie chart reveals that regions with high perceptions of technological barriers tend to have low technological exposure and maintain traditional patterns, as seen in North Gorontalo and Boalemo. In contrast, the scatter plot indicates that regions with high technological exposure, such as Gorontalo City, favor modern patterns like digraphs.

This data confirm that technological exposure acts as a catalyst in shaping orthographic preferences, but the success of technology adoption heavily depends on social factors such as infrastructure, digital literacy, and local cultural values (Herring et al. 2013; Fishman 2001). While modernization drives technological adoption in urban areas, tradition continues to play a significant role in rural regions, particularly in sustaining patterns such as single graphemes.

These findings highlight how technology adoption in Gorontalo is influenced by the interplay of technological exposure, generational relevance, and social context. Urban areas like Gorontalo City exhibit more progressive technology adoption, with a strong preference for modern orthographic patterns like digraphs. Conversely, rural areas like North Gorontalo and Boalemo tend to preserve traditional patterns, reflecting cultural resistance to rapid technological modernization.

By combining quantitative and qualitative perspectives, this analysis provides deep insights into the technological divide between urban and rural areas. This approach not only maps the data distribution but also uncovers the social contexts underpinning these patterns. These findings offer a foundation for policy development aimed at reducing technological disparities, considering local needs and the potential for transitioning to modern technologies across Gorontalo's regions.

Discussion

Sociocultural Dimensions: Orthography as a Marker of Identity

The orthographic choices of Gorontalo communities reveal a close relationship between cultural practices and identity formation. Rural areas like North Gorontalo exhibit a dominance of single graphemes, reflecting oral traditions that prioritize suprasegmental elements such as intonation and stress over complex visual representations in writing. This underscores the role of orthography as a tool for preserving local cultural heritage, where writing serves as a supplementary rather than primary medium for communication (Finnegan 2012; Ong and Hartley 2013).

The use of single graphemes aligns with findings by Chebanne (2016) on Khoisan communities in Botswana, where simplified orthography helps sustain cultural identity amid marginalization. In Gorontalo, this choice similarly reflects resistance to modern pressures, as highlighted by Villa and Vosters (2015), who argue that orthography often becomes an ideological battleground for preserving local values against global dominance.

In contrast, urban areas like Gorontalo City exhibit a preference for digraphs, symbolizing efficiency and adaptation to modernity. As noted in Hillewaert's (2015) study

on social media, the use of digraphs reflects not only communicative functionality but also social identity, showcasing connectivity with digital technology. Globally, this shift illustrates urban communities' efforts to negotiate a modern identity while maintaining respect for cultural roots.

Technology and Orthographic Transformation

Technology serves as a major catalyst for changing orthographic patterns in urban Gorontalo. The preference for digraphs in digital environments reflects how tools like keyboards and touchscreens promoted efficient communication. Herring et al. (2013) highlights that digitalization often influences societies to prioritize methods of communication that are faster and easier to comprehend.

However, technology also reveals adoption disparities in rural areas. Higher perceptions of technological barriers in North Gorontalo and Boalemo reflect uneven access to technology. This factor reinforces the dominance of simple single graphemes, which better align with technological limitations in these regions (Mlambo and Matfunjwa 2024). Here, technology becomes not only a tool for transformation but also a symbol of social and geographical inequalities.

Nevertheless, the potential of technology to support cultural preservation cannot be overlooked. Weber et al.'s (2023) study on Blackfoot Words demonstrates how digital platforms can archive local languages and support community literacy. A similar approach could be applied in Gorontalo, leveraging technology to document oral traditions and strengthen single grapheme practices as part of local cultural preservation.

Education as a Bridge Between Tradition and Modernity

Education serves as a crucial arena for bridging the gap between tradition and modernity. The use of diacritics in formal institutions reflects efforts to maintain formality in written communication. However, data indicate that diacritics are used less frequently than digraphs or single graphemes, suggesting their limited functionality outside educational contexts.

This case parallels Dubost et al.'s (2019) findings on the Hmong community in Laos, where successful orthographic reforms involved local community engagement to create culturally relevant and functional systems. In Gorontalo, integrating local elements into the educational curriculum could enhance the relevance of formal orthography, such as diacritics, while addressing the needs of rural communities that prioritize single graphemes.

Additionally, research by Majorano et al. (2021) highlights that orthographic consistency plays a vital role in supporting literacy. Education can be a strategic tool for improving literacy in Gorontalo through community-based approaches that merge local traditions with modern technology. For example, educational programs that promote digraph use in urban areas and single graphemes in rural areas could bridge these gaps effectively.

Global Reflection: Social, Technological, and Policy Implications

The findings from Gorontalo illustrate how orthography functions as both a tool for cultural preservation and a symbol of modernity, aligning with global trends. Chebanne's (2016) study on African communities shows that simplified orthography can serve as a means of preserving tradition amid marginalization, while Hillewaert (2015) highlights the role of modern orthography in constructing identity within digital spaces.

In the context of Gorontalo, technology has the potential to simultaneously support cultural preservation and enhance communication efficiency. As suggested by Mlambo and Matfunjwa (2024) and Weber et al. (2023), digitalization can be an inclusive tool for improving literacy in rural areas without compromising traditional values. However, literacy policies must be designed to address technological disparities and ensure that local needs remain a priority.

Community involvement in orthographic development also emerges as a key factor for success, as demonstrated by Dondelewski and Czopek (2022). Similar initiatives in Gorontalo could include community-based programs to support the use of single graphemes and digraphs, reflecting local needs while reinforcing cultural identity.

Conclusion

The orthographic choices in Gorontalo reflect the dynamic interplay between cultural traditions and modernity, influenced significantly by sociocultural, technological, and educational factors. Rural areas tend to retain single graphemes as a reflection of oral traditions that emphasize suprasegmental elements and collective cultural identity. Conversely, urban areas demonstrate a dominance of digraphs, highlighting adaptation to digital technology and the demand for communication efficiency.

Education plays a pivotal role in bridging this divide, with significant potential to integrate traditional elements and modern needs through community-based curricula. Technology, while a driver of orthographic transformation in urban areas, continues to face significant challenges in rural regions due to infrastructure limitations and low digital literacy.

Globally, these findings align with similar phenomena in other regions, such as Africa and Southeast Asia, where orthography serves as both a tool for cultural preservation and a symbol of modernity. The results contribute to broader discussions on the relationship between orthography, identity, and social change, emphasizing the importance of community-based approaches in literacy development and orthographic policymaking.

Recommendations

Addressing the findings of this study requires strategic interventions that balance tradition, modernity, and local needs. One critical step is the enhancement of digital literacy in rural areas, where limited technological infrastructure and low digital literacy levels persist.

Community-based digital literacy programs tailored to local contexts can serve as a bridge, incorporating region-specific orthographic practices to empower rural communities in adapting to modern communication demands. Alongside this, educational curricula should reflect a dual approach: integrating single graphemes as symbols of cultural identity for rural regions, while promoting digraphs in urban areas to align with technological efficiency and global communication trends.

Further, the development of digital tools holds immense potential in supporting both tradition and modernization. Local governments and cultural organizations could collaborate to create applications or platforms that document oral traditions and reinforce single grapheme practices. Such tools not only preserve cultural identity but also foster literacy and modern communication skills. Community engagement is essential in these efforts; by involving local stakeholders in the design and standardization of orthographic systems, policies and tools can remain culturally relevant and practical. Lastly, continued research into the intersection of technology, literacy, and cultural preservation is crucial. Future studies should evaluate the long-term effects of technology-driven literacy policies, especially in rural areas, and investigate the sustainability of integrating traditional orthographic practices into modern technological contexts.

Limitations

Despite its contributions, this study has several limitations that should be acknowledged. The research's limited sample size and geographic coverage may constrain the generalizability of its findings to all regions of Gorontalo. Expanding the sample to include a broader demographic would provide more representative insights into orthographic preferences and practices. Furthermore, the study's focus on Gorontalo limits the applicability of its conclusions to other regions in Indonesia, underscoring the need for comparative studies across diverse linguistic and cultural contexts.

Another limitation is the absence of longitudinal data. This research provides a snapshot of orthographic preferences but does not examine how these preferences evolve over time in response to technological, educational, or sociocultural changes. Longitudinal studies could offer valuable insights into the sustainability of shifts in orthographic practices. Additionally, the lack of experimental approaches restricts the study's ability to measure the direct impact of interventions such as digital literacy training or community-based orthographic policies. Incorporating experimental designs in future research would help assess the effectiveness of specific strategies in transforming orthographic preferences.

Finally, while this study highlights the influence of technology on orthographic practices, it does not explore the role of specific technological tools, such as mobile applications or educational software, in shaping these practices. Addressing this gap in future research could provide a more nuanced understanding of the interplay between technology and orthography in Gorontalo and other similar contexts.

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Informed Consent

The authors have obtained informed consent from all participants.

Conflict of Interest

The authors declare that there is no conflict of interest.

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