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# Refining Japanese Pronunciation through Digital Innovation: Tools and Strategies Based on Phonetic Theory

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## Abstract

This study aims to identify the level of awareness, usage, and perceptions of digital tools for Japanese pronunciation learning among teachers, students, and alumni in Indonesia, and to analyze the challenges associated with their integration in both classroom and self-directed learning. A mixed-methods approach was employed, combining quantitative surveys with qualitative interviews involving 122 participants from diverse educational backgrounds and Japanese learning experiences. The findings show that while 58.2% of respondents are aware of digital tools for Japanese learning, only a small portion are familiar with pronunciation-specific tools. Quizlet, NHK Pronunciation, and OJAD were the most frequently mentioned, yet around 40% reported no awareness of any pronunciation-focused applications. Major obstacles identified include limited access to devices or stable internet (26%), lack of teacher guidance (16%), and usability difficulties (12%). Despite infrequent use, 94% of respondents perceived digital pronunciation tools as helpful, particularly those that provide native speaker voice samples and pitch or intonation visualization. These insights highlight the importance of leveraging phonetic theory—particularly in relation to pitch-accent perception and auditory-visual feedback—to refine pronunciation instruction through technology. Overall, the study underscores the need for improved teacher training, stronger classroom integration, and the development of more accessible and user-friendly pronunciation tools tailored to Indonesian learners' needs.

**Keywords: Japanese pronunciation; Digital learning tools; Pitch-accent; Technology integration; Indonesian learners**

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# 1. Introduction

## 1.1 Background

The increasing availability of employment opportunities in Japan (Saponet, 2025) has further motivated young Indonesians to study Japanese more seriously. The steady rise in Japanese language learners in Indonesia reflects a strong and growing interest in the language (The Japan Foundation, 2018). Motivations vary widely: some learners target academic and career advancement in Japan, while others develop interest through exposure to Japanese popular culture and social media content. A recent survey by Dewanty et al. (2025) found that Japanese pop culture circulating on digital platforms plays a major role in encouraging learners to pursue formal Japanese language education.

While grammar and vocabulary acquisition are often prioritized in Japanese language classrooms, pronunciation plays an equally crucial role in achieving intelligibility and communicative success. Japanese employs distinctive phonetic features such as pitch-accent and vowel length, where differences in pitch patterns can change lexical meaning—for example, *hashi* meaning "bridge" versus *hashi* meaning "chopsticks" (Kubozono, 2015). Research on L2 intelligibility indicates that inaccurate pronunciation can result in miscommunication even when grammatical structures are correct and lexical choices are appropriate (Derwing & Munro, 2015). Therefore, mastering pronunciation is essential for ensuring meaning is conveyed accurately in spoken interaction. For learners who plan to study or work in Japan, accurate pronunciation becomes even more crucial. Communication in academic and professional environments relies heavily on oral clarity, where mispronunciation may hinder classroom participation, workplace performance, or social integration (Derwing & Munro, 2015). Thus, pronunciation competence is not only a linguistic skill but also a practical requirement for functioning effectively in real-world Japanese contexts.

Despite its importance, pronunciation remains one of the most challenging components for Japanese language learners. Difficulties arise from both segmental features—such as consonant and vowel articulation—and suprasegmental features like pitch accent, intonation, rhythm, and mora timing. Cross-linguistic phonological differences between Japanese and Indonesian languages can also lead to negative transfer, requiring more targeted pedagogical approaches (Fledge, 1995; Derwing & Munro, 2005; Kubozono, 2025; Saito, 2012). Previous instructional practices have often relied on imitation-based methods, leaving learners struggling to notice and correct their own pronunciation errors. With the advancement of digital technology, learners now have increased access to online resources that can potentially support pronunciation learning beyond the classroom. Digital tools, including speech analysis applications and pitch-accent visualizers, provide new opportunities for exposure to authentic phonetic input and individualized learning. However, it remains unclear to what extent learners and instructors are aware of and actively use these pronunciation-specific tools. Understanding this current state is essential to improve pedagogical integration and maximize the potential of digital resources in Japanese pronunciation instruction.

## 1.2 About Pronunciation Acquisition

Pronunciation is a key element in mastering a foreign language. However, one of the main obstacles for learners is the influence of their mother tongue. Language acquisition research has long recognized that the phonological features of the first language (L1) can significantly affect pronunciation in the target language (L2). Lado's (1957) linguistic transfer

theory laid the foundation for this view, asserting that similarities between L1 and L2 facilitate learning, while differences often cause difficulties. Recent studies further emphasize that cross-linguistic influence remains a major factor in L2 pronunciation development, particularly in suprasegmental aspects such as intonation and rhythm (Best & Tyler, 2007; Ortega, 2014). Indonesia's multilingual context contributes additional challenges, as regional languages carry distinctive phonetic traits that may interfere with the acquisition of Japanese pronunciation (Shinohara & Subiyanto, 2023). Therefore, Indonesian learners must pay special attention to mastering the phonological characteristics unique to Japanese.

Meanwhile, digital technology has introduced a wide array of tools and applications across multiple platforms to support Japanese language learning. However, questions remain: Have teachers and students utilized these tools? How many are aware of their existence, and how many actually use them?

Mastery of Japanese pronunciation remains a major challenge in Japanese language education. Previous studies have shown that pronunciation is often perceived as one of the most difficult components for learners to acquire, particularly because the Japanese pitch-accent system differs significantly from many learners' native languages (Derwing & Munro, 2015). This challenge persists despite the availability of various instructional methods, as no single approach has been shown to consistently ensure successful pronunciation acquisition across different learner groups (Saito, 2012). At the same time, the development of digital technology has led to the widespread availability of tools, applications, and online platforms designed to support Japanese language learning. However, research indicates that many teachers and students are either unaware of these digital resources or have not integrated them fully into teaching and learning practices due to limited training, accessibility, or confidence in using technology (Kessler, 2016). These conditions raise important questions regarding the extent of actual utilization and awareness of digital pronunciation-learning tools among Japanese language instructors and learners. Considering these issues, this study examines the current utilization of digital tools in Japanese pronunciation learning and explores ways to enhance their effective implementation. The specific objectives of the research are presented in the subsequent section.

With the advancement of digital technology, various tools and applications have been developed to support language learning, particularly in pronunciation. Tools such as Speechling (Speechling, n.d.), NHK Pronunciation (NHK, n.d.), PRAAT Software (PRAAT, n.d.), and Speech Analyzer (SIL, n.d.) enable learners to visualize pitch contours, analyze acoustic features of their speech, and receive real-time feedback. These tools are grounded in phonetic theory and offer diagnostic feedback that traditional methods cannot easily provide (Levis & Pickering, 2004).

Ueyama (2020) highlighted the need for innovative approaches to Japanese pronunciation instruction in the digital age, particularly through the use of pitch-accent visualization and acoustic analysis. Recent developments, such as the software-assisted phonetic learning system proposed by Zhang et al.(2022), have demonstrated that visual feedback can significantly improve learners' prosodic awareness. These advancements align with the phonological principles outlined in Kubozono's (2025)work on Japanese phonetics, which provides a theoretical foundation for designing technology-enhanced pronunciation tools. While Akamatsu(1997) represents a more traditional approach, his emphasis on integrating theoretical phonetics with practical listening exercises helps explain the pedagogical

roots from which current digital methods have evolved. Silalahi et al. (2025) recommended the use of the JA Sensei application after conducting research on its effectiveness in enhancing Japanese language skills, particularly in vocabulary acquisition, kanji, and pronunciation. The study employed a quantitative analysis method by collecting data from users to assess their progress after using the application. The results indicated that JA Sensei is effective in improving reading, writing, speaking, and listening skills in Japanese, while also providing cultural insights that facilitate better communication with native speakers. In addition, a study by Fitrianingsih & Nurjaleka, (2023) explored the use of the social media platform TikTok in Japanese language learning, identifying the dominant types of content used for this purpose. The findings revealed that the most prevalent content focused on expressions and vocabulary, along with other types such as grammar, Japanese scripts, and Japanese culture.

However, most previous studies have focused on tool development or controlled classroom interventions, with limited attention to the actual awareness and usage of these tools by learners and teachers in real-world contexts, especially outside Japan. Empirical knowledge about user experiences, adoption barriers, and pedagogical integration remains scarce.

In Indonesia, Japanese language learning has grown significantly due to increasing employment and educational opportunities in Japan (Saponet, 2025; The Japan Foundation, 2018). However, pronunciation remains a persistent challenge for many learners, particularly due to the influence of diverse local languages and the distinctive pitch-accent system of Japanese (Shinohara & Subiyanto, 2023). Although various digital resources for Japanese learning are now accessible, their integration in Indonesian educational settings is still limited and not well documented. The extent to which teachers and learners utilize such tools—especially for pronunciation—has not been systematically examined in the Indonesian context.

This article seeks to fill that gap by investigating the awareness and usage of digital tools for Japanese pronunciation learning among teachers and students. Unlike previous studies that emphasize experimental outcomes or tool design, this research focuses on real-world user experiences and pedagogical implementation. The study offers a novel contribution by examining how digital pronunciation-learning tools are recognized, applied, and perceived by both teachers and learners in Indonesia, ultimately providing user-informed recommendations rooted in phonetic theory.

### 1.3 Pronunciation Acquisition and Digital Learning Tools

Pronunciation is a key component of foreign language mastery, yet it remains one of the most challenging aspects for learners. The influence of learners' mother tongues significantly affects target language pronunciation accuracy, as described in Lado's (1957) theory of linguistic transfer and further supported by research on cross-linguistic influence in suprasegmental acquisition (Best & Tyler, 2007; Ortega, 2014). For Indonesian learners, multilingual linguistic backgrounds pose additional challenges due to diverse phonological systems that differ from Japanese pitch-accent patterns (Shinohara & Subiyanto, 2023).

Advancements in digital technology have introduced a variety of tools designed to support Japanese language learning, including pronunciation-specific applications such as Speechling, NHK Pronunciation Library, PRAAT, and Speech Analyzer. These tools provide speech analysis, pitch-accent visualization, and auditory feedback grounded in phonetic theory (Levis & Pickering, 2004). Experimental and software-assisted studies (Ueyama, 2020; Zhang

& Liu, 2022) have demonstrated that visual and auditory feedback can effectively improve learners' prosodic awareness.

However, despite the accessibility of such resources, mastery of Japanese pronunciation continues to be limited in educational contexts. Many learners and teachers still rely on imitation-based methods and face challenges such as insufficient training, lack of guidance, and usability concerns (Kessler, 2016). These issues suggest that the existence of technology alone does not guarantee adoption or effectiveness. In Indonesia, the demand for Japanese language education continues to grow, yet pronunciation difficulties remain prominent among learners due to distinct phonological differences from their native languages (Shinohara & Subiyanto, 2023). Although digital pronunciation tools are increasingly available, their awareness, usage frequency, and pedagogical integration within Indonesian instructional contexts remain unclear and under-researched. Most existing studies focus on tool design or controlled interventions, while empirical investigations into real-world usage and user experience are still scarce, particularly outside Japan.

To address this gap, the present study investigates the actual implementation of digital tools for Japanese pronunciation learning among teachers and learners in Indonesia. It evaluates how these tools are recognized, used, and perceived, while also identifying associated challenges and opportunities to improve pedagogical integration. Findings are expected to provide practical recommendations grounded in phonetic theory and informed by real classroom and learning experiences.

Concerning the issues discussed above, this study addresses four main research questions. First, it examines the extent to which Japanese language teachers and learners are aware of digital tools specifically designed for pronunciation learning. Second, it investigates how these digital tools are used in both classroom instruction and independent learning contexts. Third, the study explores the challenges faced by teachers and learners when integrating digital tools into pronunciation learning. Finally, it analyzes teachers' and learners' perceptions regarding the usefulness and accessibility of digital pronunciation tools.

In line with the research questions outlined above, this study aims to investigate the extent of awareness and usage of digital tools for Japanese pronunciation learning among teachers and learners, to examine how these tools are utilized in both classroom instruction and independent learning contexts, and to identify the challenges encountered in integrating digital pronunciation tools into learning practices. In addition, the study seeks to explore teachers' and learners' perceptions regarding the usefulness and accessibility of these digital tools. By drawing on insights from phonetic theory and user experiences, this study aims to offer practical recommendations to help bridge the gap between the potential of digital technology and its actual implementation in Japanese pronunciation pedagogy.

### 1.4 Theoretical Framework

This study is grounded in phonetics and Computer-Assisted Language Learning (CALL) theories, with the following foundations:

Phonetics Theory – According to (Akamatsu, 1997) and (Kubozono, 2025), pronunciation instruction includes segmental (consonants and vowels) and suprasegmental (intonation, rhythm, pitch accent) components. Given the complexity of Japanese pitch accent, instruction must incorporate acoustic-phonetic approaches.

Speech Perception and Feedback – Levis & Pickering (2004) posits that effective pronunciation learning requires accurate input models, learner production, and timely feedback. Tools that enable visualization of pitch and rhythm help reduce the gap between perception and production.

CALL and Visualization Tools. Zhang & Liu (2022) argue that digital tools providing visual feedback (such as pitch contours and spectrograms) enhance metalinguistic awareness and self-correction abilities. This aligns with the concept of "affordances" in CALL (Chapelle, 2003)

Technology Acceptance Model (TAM). Davis (1989) suggests that technology adoption is influenced by perceived usefulness and ease of use. This model supports the explanation of user attitudes affecting actual use of digital tools among teachers and students.

## 2. Methods

This study adopts a mixed-methods approach by combining quantitative surveys and qualitative interviews. Questionnaires measure awareness, usage frequency, and perceived effectiveness of digital pronunciation tools. Semi-structured interviews explore users' in-depth experiences and obstacles. Additionally, digital tools are classified based on phonetic features and pedagogical applicability. Participants in this study totaled 122 people, consisting of Japanese language teachers 17 persons and learners 82 persons (beginner to intermediate levels) , from universities, High schools, language institutions, and alumni 23 persons in Indonesia. The selection of respondents in this study was based on purposive sampling, taking into consideration the participants' speech accessibility, willingness to respond, and relevance to the research objectives. This approach ensures that the selected participants possess sufficient linguistic and experiential background to provide meaningful data related to the use of digital tools in Japanese pronunciation learning (Etikan, 2016)

Surveys distributed online via Google Forms. Interviews conducted virtually through video conferencing platforms. Quantitative data analyzed descriptively to identify usage trends. And qualitative data coded thematically to uncover common themes related to user experience and perception.

## 3. Results and Discussion

### 3.1 Result

The results of the data collection provide valuable insights into the current state of awareness and usage of digital tools in learning Japanese pronunciation. A total of 122 participants responded, comprising 17 teachers/lecturers, 82 students, and 23 alumni. Most respondents (60.5%) had 1–3 years of learning experience, while only one individual reported more than six years. Proficiency levels were primarily intermediate (57%), followed by beginner (23%) and advanced (19.8%).

(1) In terms of **general awareness**, 58.2% of respondents reported being aware of digital tools for Japanese learning. However, a significant portion either had no knowledge (7.4%) or were unsure (4.9%), indicating that information dissemination regarding these tools remains limited.

(2) Regarding **specific tools**, Duolingo (49%) emerged as the most recognized, followed by Mazii (41%), Kanji Study (37%), and Jisho (36%) (Table 1). These tools are primarily vocabulary or grammar-oriented, revealing a gap in awareness or usage of tools specifically designed for pronunciation.

(3) When narrowing the focus to **pronunciation tools** (Tabel 2), awareness significantly dropped. Only 33% mentioned Quizlet, 21% cited NHK Pronunciation Library, and smaller proportions mentioned OJAD (Online Japanese Accent Dictionary) (13,9%), Praat (4,9%), Speech Analyzer (4%), and Speechling (4%). Notably, 33% of participants were unaware of any digital tools for pronunciation at all. This gap indicates a lack of exposure or integration of pronunciation-specific tools in language programs.

Table 1. The Tools/Applications respondents aware

| Digital Tools/Apps | Fq | % | Digital Tools/Apps | Fq | % |
|---|---|---|---|---|---|
| Duolingo | 60 | 49% | YouTube | 2 | 1,6% |
| Mazii | 50 | 41% | Bunpo | 1 | 0,8% |
| Kanji Study | 45 | 37% | Chat GPT | 1 | 0,8% |
| Jisho | 44 | 36% | Game based learning | 1 | 0,8% |
| Irodori | 43 | 35% | hellotalk (kaiwa) | 1 | 0,8% |
| Quiziz | 34 | 28% | Hiragana Memory Hint | 1 | 0,8% |
| Todaii Japanese | 29 | 24% | Kanji Memori Hint | 1 | 0,8% |
| Hiragana/Katakana | 21 | 17% | Kanji quizer | 1 | 0,8% |
| Anki | 19 | 16% | Katakana Memori Hint | 1 | 0,8% |
| Obenkyou | 19 | 16% | Kotoba | 1 | 0,8% |
| Others | 17 | 14% | Listening Postcast/kaiwa | 1 | 0,8% |
| Canva | 15 | 12% | Listening Task 25 Minna 1 | 1 | 0,8% |
| Tokoboto | 13 | 11% | Listening Task 25 Minna 2 | 1 | 0,8% |
| Mira: Listening Postcast/Kaiwa | 12 | 10% | Minna no Nihongo aplikasi | 1 | 0,8% |
| Hey Japan | 10 | 8% | Nihongo kira-kira | 1 | 0,8% |
| Shirabe Jisho | 8 | 7% | OJAD | 1 | 0,8% |
| JA sensei | 6 | 5% | Poro | 1 | 0,8% |
| Furuutsu basuketto | 5 | 4% | Power point, kartu huruf, kartu kanji, kartu kosakata | 1 | 0,8% |
| Migi JLPT | 2 | 2% | | | |

Table 2. Tools/Application for Pronunciation Practice

| Tools/Apps | Frequency | Persentage |
|---|---|---|
| No one | 49 | 40,2% |
| Quizlet | 40 | 32,8% |
| NHK Pronunciation | 26 | 21,3% |
| OJAD | 17 | 13,9% |
| Praat | 6 | 4,9% |
| Speech Analyzer | 5 | 4,1% |
| Speechling | 5 | 4,1% |

(4) In exploring the source of **information**, most respondents discovered tools independently online (50%), while only 24.6% learned through formal education contexts. This trend suggests an absence of structured institutional support or curriculum design that incorporates digital tools for pronunciation.

(5) Regarding **usage frequency**, only 4.9% reported frequent use, and 14.8% used them often. The majority either used them occasionally (29.5%) or rarely (16.4%), with a small segment never using them. This low level of sustained engagement indicates either a lack of motivation, awareness, or perhaps usability issues.

(6) For **learning context**, 73% of respondents reported using digital tools for grammar, 19% for vocabulary, and only 8% for pronunciation in self-study settings. In classroom settings, the trend was similar—76% for grammar, 18% for vocabulary, and only 6% for pronunciation. This strongly indicates that pronunciation is still underemphasized in both independent and classroom learning despite being a crucial aspect of communication.

(7) In terms of **tools used for pronunciation**, Quizlet remains the most used (33%), followed by NHK Pronunciation (21%) and OJAD (14%). Others like Praat, Speech Analyzer, and Speechling were known but rarely used. This reveals a narrow adoption window, suggesting a need for greater training and promotion.

(8) Participants also identified several **barriers to usage**, such as limited access to devices or internet (26%), lack of teacher guidance (16%), and interface difficulty (12%). These challenges are consistent with previous findings (Ueyama , 2020; Zhang & Liu, 2022), which point to technological, pedagogical, and motivational hurdles.

(9) Despite these barriers, 49% of respondents found the tools to be very helpful in improving pronunciation, and 45% found them reasonably helpful. Only 5% felt the tools were not useful. This generally positive perception highlights an untapped potential for greater integration.

(10) As for features considered most effective, native speaker voice samples (44%) were the most valued, followed by pitch visualization (39%), offline accessibility (36%), and automatic feedback (26%). These preferences align with findings from phonetic visualization studies (Zhang & Liu, 2022) and support theories emphasizing auditory and visual feedback in phonetic learning (Kubozono, 2025)

(11) Finally, regarding **the importance of pronunciation**, 42% considered it important, and 25% deemed it very important. This perception contrasts with its limited application, again highlighting a mismatch between acknowledged importance and actual practice.

(12) **Analysis by Respondent**

Teachers exhibit the highest level of awareness regarding digital pronunciation tools (82.3%), likely due to their exposure to pedagogical resources and professional development. Students show moderate awareness (54.3%), while alumni demonstrate the lowest awareness (47.8%), attributed to reduced engagement in structured learning environments. These differences suggest that awareness is strongly influenced by instructional roles and ongoing access to language learning networks.

Further analysis based on respondent category revealed meaningful differences in patterns of awareness, usage, and perception of digital pronunciation tools. Teachers demonstrated the highest awareness levels of available tools, yet their actual usage was lower compared to students, likely due to limited instructional time and established teaching routines. Students showed higher usage frequency because they remain actively engaged in classroom learning and self-study, although their awareness of pronunciation-specific tools was relatively limited. Meanwhile, alumni reported reduced usage, reflecting a shift in priorities once formal Japanese study is completed.

These variations indicate that learning context strongly influences technology adoption: teachers are informed but underutilize tools in pedagogy; students are active users but lack exposure to specialized tools; and alumni disengage after their academic needs decline. Thus, the overall findings across (1) - (11) should be interpreted in relation to the differing motivations, responsibilities, and accessibility among the respondent groups.

In summary, the findings indicate a clear gap between recognition of pronunciation's importance and actual use of supporting tools. Increased training, integration into curricula, and enhanced user support systems are essential to promote the adoption of digital tools for pronunciation learning. This study confirms and builds upon previous research while highlighting novel issues of access and pedagogical integration.

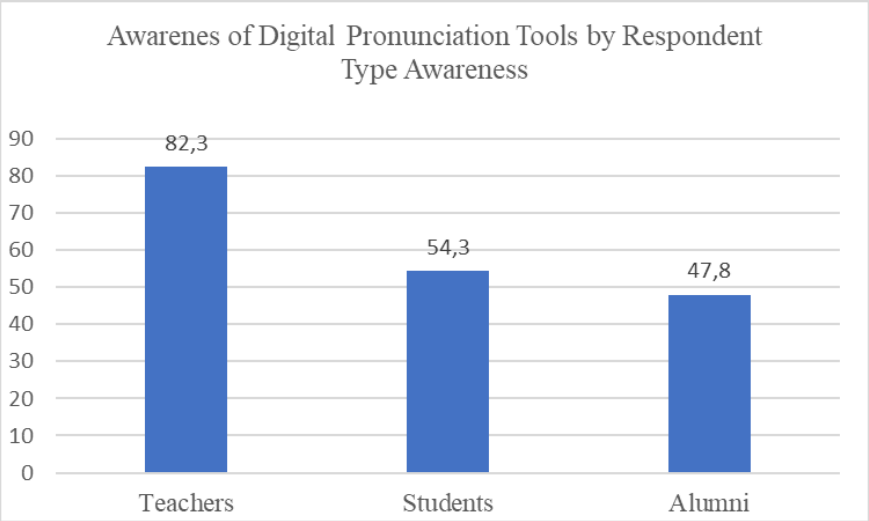


Figure 1. Awareness of Digital Pronunciation Tools by Respondent Type

## 3.2 Discussion

This section discusses the findings in light of the research questions and relevant theoretical frameworks.

### 3.2.1 Awareness and Understanding of Digital Pronunciation Tools

The findings indicate that 58.2% of respondents are aware of digital tools for learning Japanese, but only a small portion are aware of pronunciation-specific tools. This has direct implications for pronunciation acquisition from the perspective of Krashen's Input Hypothesis (1992), which states that learners can only acquire language features they are sufficiently exposed to through comprehensible input. Limited awareness of pronunciation-focused tools restricts access to rich phonetic input—such as native pitch patterns, accent cues, and intonation found in tools like NHK Pronunciation or Speechling. Therefore, low awareness does not only reflect a technological gap but also creates an input gap, reducing opportunities for learners to internalize authentic pronunciation models necessary for developing accurate Japanese phonology.

This interpretation is supported by the current findings: despite the availability of digital tools, only 4.9% of respondents reported frequent usage for pronunciation learning, and a significant number expressed difficulties related to accessibility, teacher guidance, and interface design (as shown in Section 3.1 No.(8)).

Additionally, learners mainly use digital tools for grammar (73%) and vocabulary (19%) rather than pronunciation (8%), suggesting that they may not view pronunciation-focused tools as equally essential or beneficial. These behavioral patterns imply that low awareness is accompanied by insufficient perceived usefulness and ease of use, consistent with the Technology Acceptance Model (Davis, 1989).

### 3.2.2 Usage Patterns of Pronunciation Tools

Despite widespread use of popular digital tools like Duolingo and Mazii, pronunciation-focused tools are used much less frequently. This can be explained by Cognitive Load Theory (Sweller, 1988), which states that tools that introduce extraneous cognitive load—such as complex interfaces or unclear functionality—are more likely to be avoided, especially by learners without specific training.

In addition, Long's Interaction Hypothesis (Long, 1996) highlights the importance of interaction and feedback in language learning. Since many of the tools used by respondents do not offer interactive features or corrective feedback, their impact on pronunciation development may be limited.

### 3.2.3 Learning Contexts and Challenges

Most digital tools are used for self-study rather than in classroom settings. As shown in the results (see Section 3.1 No.(6)), only 6% of respondents reported using digital tools for pronunciation in class, compared to 8% in self-study, and 16% stated that lack of teacher guidance prevents them from using these tools effectively (Section 3.1 No. (8)). These findings indicate that pronunciation learning through technology occurs largely without structured

support. According to Vygotsky's Sociocultural Theory (Alkhudiry, 2022; Pappas, 2025), language development—particularly higher-level skills such as pronunciation—benefits from instructional scaffolding and interaction with more knowledgeable individuals. Therefore, limited classroom integration suggests that learners are missing opportunities for guided pronunciation practice, which may reduce learning effectiveness despite the availability of digital tools.

Challenges reported by respondents—such as limited access to internet or devices, lack of teacher guidance, and unfamiliar user interfaces—further support the TAM framework. If learners perceive digital pronunciation tools as difficult to use or not integrated into regular learning activities, their use will remain limited.

### 3.2.4 Perceived Usefulness of Digital Pronunciation Tools

Even though actual usage is low, 94% of respondents perceive pronunciation tools as helpful (49% very helpful and 45% helpful). This indicates that learners hold positive attitudes toward technology-supported pronunciation learning. According to Krashen's Affective Filter Hypothesis (Iris-Wilbanks, 2013), positive emotional responses such as motivation and confidence can lower the affective filter, allowing learners to be more receptive to pronunciation input when these tools are used. Therefore, the strong positive perception observed in the findings suggests a favorable affective condition, although it has not yet translated into frequent usage due to external barriers such as limited access and guidance.

Moreover, the respondents' preference for pronunciation tools with multimodal features supports Paivio's Dual Coding Theory (Paivio, 1986). As shown in the findings (Section 3.1 No.(10)), 44% of participants selected native speaker audio samples as the most helpful feature, while 39% highlighted pitch visualization as beneficial. These results indicate that learners value tools that provide both auditory and visual representations of pronunciation. According to Dual Coding Theory, such multimodal input enhances cognitive processing by activating both verbal (sound) and non-verbal (visual) channels, improving retention and recall of phonological patterns. Therefore, tools like OJAD and NHK Pronunciation, which integrate audio with visual pitch cues, align well with learners' preferences and learning needs for acquiring Japanese pitch-accent.

### 3.2.5 Instructional Integration Strategies

The findings suggest a need for more structured classroom integration of digital pronunciation tools. This recommendation is consistent with Swain's Output Hypothesis (Swain, 1995), which asserts that learners develop language skills through producing language and receiving feedback. Tools like Speech Analyzer and Speechling, which offer feedback on pronunciation, are particularly valuable for this purpose.

In line with the principles of Computer-Assisted Language Learning (CALL) (Rahmadini & Zpalanzani, 2018), digital tools should integrate authentic native-speaker pronunciation and real pitch patterns, offer interactive features with responsive feedback, and be contextualized to align with learners' proficiency levels and classroom needs.

Teachers need training and support to effectively implement these tools in class, and more learner-friendly interfaces are needed to reduce extraneous cognitive load.

## 4. Conclusion

This study investigated the awareness, usage patterns, challenges, and perceived effectiveness of digital tools in Japanese pronunciation learning among Indonesian teachers and learners.

Regarding the first research question, the findings indicate that while a majority of respondents are aware of general digital tools for Japanese learning, their awareness of pronunciation-specific tools remains limited. Many participants were unfamiliar with dedicated pronunciation resources such as NHK Pronunciation Library, OJAD, and Speech Analyzer, revealing a considerable knowledge gap in this area.

Concerning the second research question, the study found that the frequency of digital tool usage for pronunciation practice is relatively low. Most learners and teachers use such tools only occasionally, and primarily in self-directed learning rather than classroom settings. This limited use suggests that pronunciation practice through digital platforms has not yet been fully integrated into structured pedagogical practice.

In addressing the third research question, respondents reported several challenges in implementing digital pronunciation tools, including limited internet access, lack of teacher guidance, complex user interfaces, and insufficient training. These barriers reflect the need for greater institutional support and teacher capacity-building in digital pedagogy.

For the fourth research question, the results reveal that specific tool features are strongly valued by users. As shown in the findings, 49% of participants found digital pronunciation tools very helpful and 45% found them helpful (Section 3.1 No.(9)). Additionally, native speaker voice samples were chosen by 44% of respondents as the most useful feature, followed by pitch visualization (39%) and interactive or automatic feedback (26%) (Section 3.1 No.(10)). These data indicate that learners appreciate multimodal resources that connect perception and production, supporting the importance of combining auditory and visual feedback in pronunciation learning environments.

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