Pertanika Proceedings 2 (1): 127 - 131 (2026)

PERTANIKA JOURNALS

PERTANIKA PROCEEDINGS

Journal homepage: http://www.pertanika.upm.edu.my/

Investigation of Alphabet Pronunciation among Japanese Elementary School Children Using Ultrasound Analysis

Akio Abe[1]*, Noriko Yamane[2], and Xiaofeng Tan[2]

[1]*Oomoto Elementary School, Elementary School Teacher, 700-0925 Okayama, Japan*
[2]*Hiroshima University, Graduate School of Humanities and Social Sciences, 739-8521 Hiroshima, Japan*

ABSTRACT

The 2017 revisions to Japan's curriculum introduced early English education in elementary schools. However, phonetic research on Japanese children's English pronunciation is limited. Research findings have indicated low pronunciation accuracy for R, V, Z, P, and L. Reportedly, age and learning experience impact the acquisition of L and R. This study uses ultrasound images to examine the pronunciation of R and L by Japanese children, aiming to improve teaching methods by understanding the pronunciation challenges and individual differences.

Keywords: Elementary school children, Japanese speakers of English, ultrasound analysis, pronunciation

INTRODUCTION

In Japan's public education system, there is a trend of introducing English education at earlier stages (MEXT, 2017), similar to other countries where English as a Foreign Language (EFL) is taught. One of the expectations of lowering the age is that younger learners, considering their developmental stage, are more perceptive to phonetic aspects. However, within the context of second language acquisition, the actual state of English pronunciation among children in an EFL environment remains unclear. This study aims to investigate the English pronunciation of Japanese elementary school children using ultrasound to clarify their articulation of English sounds.

LITERATURE

In Japanese public schools, English education was expanded in 2020. Currently,

ARTICLE INFO

Article history:
Received: 30 December 2025
Published: 06 March 2026

DOI: https://doi.org/10.47836/pp.2.1.021

E-mail addresses:
Akio Abe (akireiwa2019@gmail.com)
Noriko Yamane (yamanen@hiroshima-u.ac.jp)
Xiaofeng Tan (d210781@hiroshima-u.ac.jp)
* Corresponding author

e-ISSN: 3083-9475

from the 3rd grade, there is a 45-minute foreign language activity class once a week, and from the 5th grade, foreign language is taught as a subject twice a week. Although initially introduced as part of international understanding, there is now an increasing expectation for the acquisition of knowledge and skills. As a new subject, ongoing efforts are being made to refine teaching methods, evaluation techniques, and teacher education, all of which consider the developmental stages of children (MEXT, 2017).

Despite expectations for the improvement of phonetic skills in elementary school English education, little has been discussed on the assessment of students' pronunciation skills (Abe, 2018). Joto et al. (2024) recorded and acoustically analysed the pronunciation of English alphabet names by 3rd graders and conducted an intelligibility survey with native English speakers. They found that the pronunciation of the letters R, V, Z, P, and L was difficult for native English speakers to understand. It remains unclear to what extent their pronunciation skills of these sounds differs across grade levels. Even under such conditions, Abe (2024) reported that elementary school children enjoyed explicit pronunciation instruction and perceived it as useful.

The acquisition process and difficulties may vary by grade level. Abe (2018) addresses developmental differences in public elementary schools. Focusing on the English sounds L and R, which do not exist in Japanese, Abe conducted pronunciation instruction using picture books and cards with 2nd and 6th graders. The study found that while students from both grades showed improvement in pronunciation abilities, 2nd graders exhibited greater individual differences, suggesting variations in learning experience or developmental stage compared to 6th graders, who had already established knowledge of the alphabet.

There are a few acoustic and perception studies assessing Japanese pupils' English pronunciation. One of the key points of articulating these challenging sounds is the mastery of tongue-tip movement. The investigation of pronunciation using ultrasound, which allows a more visual and detailed capture of the actual state of children's tongue movements, aims to answer a simple question: "What does their pronunciation look like?"

METHOD

Participants

Our study focused on 4th graders (10 years old) and 6th graders (12 years old) attending Japanese public elementary schools (a total 66 students). These ages represent students who have completed two years of foreign language activities and four years of foreign language learning, making them ideal for evaluating the outcomes of elementary English education. Participation was voluntary. The study was approved by the research ethics committee at Hiroshima University, and consent was obtained from the school principal.

Data

Participants were seated individually in a broadcasting room. A collaborator operated the ultrasound machine (Articulate Instruments, 2012) to record the session, while another collaborator placed the ultrasound probe under the student's chin to observe their tongue movements. The students then pronounced the stimuli sounds (らあら, raa araa, laa alaa) three times.

Analysis

Chi-square Test

We visually categorised participants into two groups: those whose tongue shape for the English /r/ differs from the Japanese /r/ and those whose tongue shape does not differ. We counted the number of participants who produced a correct English /r/ and performed a chi-square test to statistically demonstrate differences in pronunciation between grade levels.

Ultrasound Analysis

Using ultrasound recordings, we qualitatively analysed the tongue shapes in greater detail. For both 4th and 6th graders, we examined whether the tongue tip and/or tongue root differed between the English /r/ and Japanese /r/. With the use of an automatic built-in tracing function in the ultrasound machine, we visualised the contours of the tongue shapes with a red line, making a visual assessment of the English /r/ sounds possible.

RESULTS

Chi-square Test Results

A chi-square test of independence was performed to examine the relation between grade level and the ability to produce correct /r/ (Table 1). The relation between these variables was significant, X2 (1, N = 66) = 4.857, p = .0028. The 6th graders were more likely than the 4th graders to produce correct /r/. Additionally, an effect size was calculated using Cramer's V, which was found to be 0.27. While this effect size is statistically significant, it is moderate in magnitude.

Table 1
The contingency tables for the chi-square test

	Evaluation		
Grade	**No**	**Yes**	**Total**
4	12 (57.14%)	9 (42.85%)	21 (100%)
6	13 (28.89%)	32 (71.11%)	45 (100%)
Total	25 (37.88%)	41 (62.12%)	66 (100%)

The Result of Ultrasound

The ultrasound images below reveal 4th and 6th grade students who did and did not show differences between the pronunciation of the English /r/ and Japanese /r/ sounds (Figure 1). The master group exhibits the characteristic of retroflexion, specifically the tip-up of the tongue.

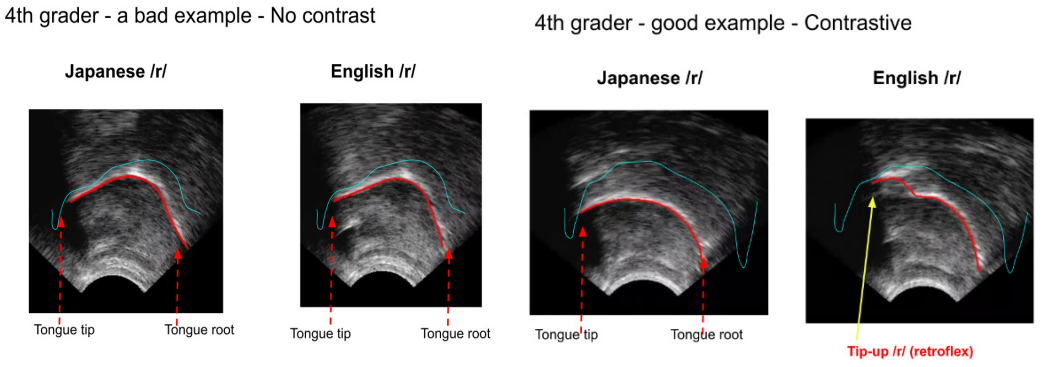

Figure 1. The ultrasound image of two 4th graders

DISCUSSION

The correct pronunciation rate increased from 41% among 4th graders to 71% among 6th graders. This data suggests a difference in learning experience or developmental stage, aligning with the findings of Abe (2018). The 6th graders likely benefited from their established knowledge of the alphabet when learning new sounds.

This indicates that Japanese elementary school English education is effectively facilitating the acquisition of English phonemes that do not exist in Japanese. Our study was conducted at a single school with one teacher, with 5 minutes of phonics practice once a week for 4th graders and twice a week for 6th graders. Thus, it would be interesting to see how the results vary with different schools, teachers, duration, and frequency of pronunciation practice.

Limitations of this study include the following points. As a single-school case study in which one teacher taught English to all students, caution is required when generalising the results. Furthermore, due to constraints on image accuracy, ultrasound findings could only be presented as case examples. There remains scope for collecting more data in future studies.

ACKNOWLEDGEMENT

The authors would like to thank the participating students and school staff for their cooperation in this study.

REFERENCES

Abe, A. (2018). The effectiveness of giving oral corrective feedback in L2 pronunciation development to elementary school pupils. *JASTEC Journal, 37*, 87-102.

Abe, A. (2024). The possibility of pronunciation instruction for elementary school students: Based on survey results on usefulness and enjoyment for children. *The Journal of the Practical English Phonetics, 5*, 39-57. https://doi.org/10.57512/jpepsj.5.0_39

Articulate Instruments. (2012). *Articulate assistant advanced user guide: Version 2.14.* Articulate Instruments.

Joto, A., Nishio, Y., Toi, K., & Abe, A. (2024, July 14-15). *English pronunciation instruction manual for elementary school foreign language activities: Based on digital teaching materials and analysis of teacher and student voices.* [Paper presentation]. 24th Annual Conference of the Japan Association of Elementary English Education, Japan.

MEXT. (2017). *The Course of Study for Elementary Schools (2017 Revision): Foreign language activities and foreign language education edition*. Ministry of Education, Culture, Sports, Science and Technology.