Improving Japanese Pronunciation: Implementation of a Pitch Accent Learning and Practice Program

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Abstract

Despite continued difficulty, very little has been done to ameliorate issues both novice and advanced learners face in their attempts to acquire correct Japanese pitch accent. The present study assessed the effects of an experimental pitch accent training regimen that used a Pitch Accent Learning and Practice (PALP) program. A treatment group of 20 participants who engaged in the training was compared to a control group of 8 participants who studied pitch accent using a traditional method. The current study further sought to clarify learner perceptions of the PALP program and training regimen. Participant accentuation was assessed using 3 pitch accent oral production tests of 20 items each. A mixed design analysis of variance was conducted to analyze the effect of the training on pitch accent ability. Results showed a significant main effect of group, as well as a significant time and group interaction effect. Specifically, these results revealed that treatment group participants significantly outperformed control group participants on the posttest and delayed posttest. Furthermore, results of a perceptions questionnaire indicate that the majority of participants felt the training materials were easy to use and helpful in learning Japanese pitch accent. Pedagogical implications and future suggestions are discussed.

1. Introduction

Students of Japanese face many difficulties in gaining control of standard Japanese pronunciation. Many novice students struggle to distinguish between and to master double-mora phonemes (i.e., long vowel sounds; Deguchi, 2011; Kawai & Hirose, 2000). Other learners have difficulty producing correct intonation in Japanese (Abe, 1957; Beckman & Pierrehumbert, 1986; Eda, 2004; Venditti & Swerts, 1996), and others struggle with parts of Japanese speech that they may not even know exist

(Venditti & Swerts, 1996), such as Japanese pitch accent (A & Hayashi, 2010; Cutler & Otake, 1999; Hirose, 2004; Nakamura et al., 2013). Nakamura et al. (2013) state that both novice and advanced learners of Japanese do not know that Japanese has pitch accent because it is "rarely taught in [the] classroom" (p. 2554). Because learners have many different problems with Japanese pitch accent, a deeper understanding of it and how it is taught may ameliorate the difficulty many learners of Japanese face.

The present study attempted to assess the effects of continual concentrated pitch accent training using materials that provide audio clips and visual depictions of pitch patterns, followed by pitch pattern recall testing. In the following Literature Review section, I provide an overview of Japanese pitch accent, review pedagogical issues and research on teaching materials, and address the research questions of the current study. In the next section, I give an explanation of the methodology used including a description of the PALP program. Finally, I discuss the results of the study and provide pedagogical implications and recommendations.

2. Literature Review

2.1 Japanese Pitch Accent

Japanese phonology takes advantage of pitch (high and low sounds). In Japanese, there are many minimal pairs or pairs of words with the same segments that are distinguished by pitch alone. Native Japanese speakers easily recognize the combination and order of pitch sounds that make up the differences in the meanings of words like *kaki* /kaki/ (LH) 'persimmon' and *kaki* /kaki/ (HL) 'oyster.' Because the assignment of pitch patterns to words in Japanese is arbitrary, non-native speakers of Japanese often have to ask a native speaker about the pitch pattern of certain words. In the past, some instructors of Japanese incorrectly taught that Japanese is a "flat language" with no pitch accent (J. P. Warnick, personal communication, 2014). Cutler and Otake (1999) found that native Japanese speakers were able to identify differences in meaning based on pitch accent a vast

majority of the time. Therefore, learners of Japanese who struggle to distinguish differences in pitch may face communication barriers.

Some scholars have posited that the difference in pitch is trivial, as in the case of *hashi* (which has three meanings "bridge," "edge," and "chopsticks," distinguished by pitch), because the context makes the meaning obvious. However, for words with related meanings, such as "sometime" and "the 5th of the month" (/itsuka/), context may be insufficient to allow the listener to fully understand the meaning without knowing the words' correct pitch patterns.

2.2 Issues in Teaching Japanese Pitch Accent

Even when contextualization helps express meaning, learners of Japanese are often mocked for their poor pronunciation (Derwing & Munro, 2005; Kawai & Hirose, 2000). This problem, Kawai and Hirose (2000) note, may arise from a lack of classroom time devoted to the teaching of Japanese pronunciation because "learners are eager to learn useful Japanese as quickly as possible" and teachers are "under pressure to prepare learners for Japanese language proficiency tests" (p. 131).

Most learners of Japanese cannot perform at a near-native speaking level (especially when it comes to pronunciation). And "most teachers receive no training in pronunciation teaching" (Kawai & Hirose, 2000, p. 132; Mizutani, 1993; Taniguchi, 1991) because word accent control comes naturally to native Japanese instructors, yet they are "not always good at labeling each mora as H/L in a given utterance" (Nakamura et al., 2013, p. 2554). The fact that the four Japanese writing systems (*kanji*, *hiragana*, *katakana*, and *rōmaji*) "do not require writers to mark the pitch attribute visually" additionally hinders learners' ability to correctly pronounce words in Japanese (Nakamura et al., 2013, p. 2554).

2.3 Japanese Pitch Accent Teaching Materials

In an effort to address the obvious lack in pitch accent teaching and learning materials, Nakamura et al. (2013) created what they claim is the first comprehensive online Japanese accent dictionary (OJAD), which can be used to

supplement teaching and learning Japanese accent. The system's focus is currently on providing accent and intonation patterns for words and phrases that appear in certain Japanese language learning textbooks. Furthermore, although Nakamura et al. (2013) claimed that the system is error free, there are still areas which can be improved. For example, the site is missing the audio files for many words. Many learners may find themselves pronouncing words incorrectly even after seeing the accent patterns because of this lack of audio files. The creators themselves pointed out that "direct visualization of the output of the accent sandhi module [alone] is not good pedagogically. The output of the module is often too complicated for learners to [understand]" (Nakamura et al., 2013, p. 2554). In their testing of this OJAD, Nakamura et al. (2013) found that learners did not become faster at identifying correct pitch patterns. Moreover, the participants' actual pitch accent ability was never discussed.

Another system to enhance learners' pitch accent abilities was created in 2004 by Keikichi Hirose. Hirose (2004) created a system that helped students find where and how they mispronounced words in Japanese by having them record their speech and then receive corrective audio feedback. Feedback was based on a comparison of the learner's recorded speech and an instructor's recorded speech. The system allowed learners to listen to their speech before and after the audio correction to get an idea of the difference between their production and the correct pitch accent. Visual feedback was also given along with the audio feedback. Hirose (2004) found that adding visuals to the feedback helped participants understand the correct pronunciation of sentences more quickly.

Hirose (2004) did not, however, find any difference between the system with and without visuals at the word (homonym) level. Thus, it is unclear if using the system would lead to retention of the learned pitch patterns and have similar results with more varied participants. Moreover, instructors using this system must first record the words and sentences that their students need to practice, which is burdensome for instructors. The present study aims to help fill these gaps. However,

these preliminary results suggest that after being taught and given feedback, learners may come to produce correct Japanese pitch accent.

2.4 Pitch Accent Training and Practice

Other attempts to improve learner pitch accent have been fruitful. A and Hayashi (2010) had 15 Mongolian and Chinese learners of Japanese use a learning technique called *shadowing*, where learners repeat a given text spoken by a native speaker. To test the usefulness of shadowing, research participants were divided into two groups by their level of Japanese proficiency. Participants shadowed a dialog ten times during three sessions over a seven-week period without seeing a script. A and Hayashi found that the speech rate and accuracy of participant pitch accent rose significantly after seven weeks in both groups, which suggests that learners, regardless of proficiency level, can increase their Japanese pitch accent accuracy over time through practice.

Hirano-Cook (2011) further investigated the effects of training on Japanese pitch accent abilities by training an experimental group of Japanese language learners to become more aware of Japanese pitch accent and increase their self-monitoring. After six 30-minute sessions, Hirano-Cook found that there was a significant difference between the means of the control and experiment groups. Furthermore, the statistical significance was also clinically meaningful.

Yoshida and Fukada's (2014) study examined the effect of word repetition exercises on pitch accent acquisition. Instead of explicitly teaching the pitch accent of new vocabulary items, Yoshida and Fukada used an online system to have learners practice repeating the pronunciation of the vocabulary items they were assigned over certain chapters of their textbooks. Participants' pitch accent ability was tested prior to and following the implementation of the repetition exercises. Test scores indicated that the repetition exercises significantly increased learner accentuation ability.

The conclusions of Hirano-Cook (2011) and Yoshida and Fukada (2014) bolster the claims of A and Hayashi (2010), suggesting that training helps produce learners of Japanese with greater pitch accent perception and production skills.

2.5 The Current Study

The current study aims to compare the effects of two types of Japanese pitch accent instruction on pitch accent acquisition: (a) an experimental pitch accent training regimen including continual concentrated study with materials that provide audio clips and visual depictions of pitch patterns, followed by pitch pattern recall testing and (b) traditional instruction (using materials provided in textbooks, online, etc.). It also examines learner perceptions of the training regimen and answers the following research questions:

RQ1. Is there a relationship between type of Japanese pitch accent instruction and pitch accent accuracy?

H_0: $\mu_1 - \mu_2 = 0$ No difference; type of Japanese pitch accent instruction has no effect on pronunciation accuracy.

RQ2. How do learners perceive the utility of an experimental training regimen?

RQ3. To what degree are learners able to use an experimental training regimen for learning Japanese pitch accent?

3. Methodology

3.1 Participants

The participants in this study were 28 novice learners of Japanese as a Foreign Language (JFL) from a large midwestern university in the U.S. Twenty-seven participants' ages ranged from 18 to 22 (one participant was over 24). The participants' male-to-female ratio was 21:7. The first languages (L1) represented were Chinese (16) and English (12). Participants identified themselves in three racial groups: Asian (22; 18 specifically as Chinese), Black (2), and White (4).

There are a couple of limitations that this group of participants pose. Because of the relationship between sample size and statistical analyses, this small sample size will affect the analyses used in this study. However, the number of participants in the study reflects the total number of available students enrolled in first-semester Japanese courses at the university during the time that the study was conducted. Previous research also indicates that learners' L1 may influence how they acquire Japanese pitch accent (Peterson, 2018). I acknowledge that this also may be a potential confounding variable in the analyses.

The participants were enrolled in three sections of novice Japanese online courses. At the time of the study, all participants were expected to be able to read and write basic Japanese using the *hiragana* and *katakana* syllabaries.

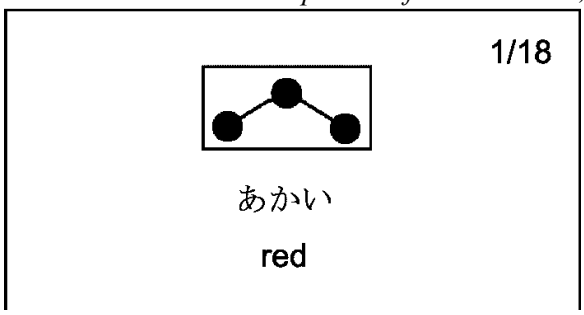
Participants were separated into two groups: a treatment group, which was made up of two intact sections, and a control group, taken from a single intact section. The treatment and control groups had 20 and 8 participants, respectively. The treatment group followed a specific regimen in their study of Japanese pitch accent and vocabulary items. This included using a Pitch Accent Learning and Practice (PALP) program (described in section 3.2). The control group used a traditional method for studying Japanese pitch accent and vocabulary items. Thus, the control group was only provided with the materials in the Nakama 1 textbook (Y. A. Hatasa et al., 2014) and other common online tools for novice-level Japanese instruction and were not assigned any specific amount of time to study pitch accent.

3.2 Instruments

Dr. Kazumi Hatasa (Purdue University) has designed and programed the Pitch Accent Learning and Practice (PALP) program, a new technological system for the teaching and learning of Japanese pitch accent (K. Hatasa, 2017). The system is based on recent research that suggests that students who are shown visual depictions of pitch accent alongside the written word have more accurate pronunciation than those without visual aids (Miyamoto, 2014).

The PALP program is computer-based and consists of two main modules: presentation and practice.[1] During the presentation module, learners are introduced to new vocabulary items (see Figure 1). The vocabulary items are written in Japanese with the English translation and include a visual depiction of the vocabulary item's pitch pattern and an audio clip of the vocabulary item.

Figure 1
Word Introduced with Depiction of Pitch Pattern, English Translation, and Model Audio



Following the initial presentation, a new screen appears with identical information, but with multiple options for the pitch pattern (see Figure 2). Learners choose which pitch pattern is correct for the target vocabulary item. The audio is not replayed on this screen until the learner selects which pitch pattern they believe correctly correlates with the target vocabulary item. If the learner answers correctly, the audio plays and the next vocabulary item is shown. If they answer incorrectly, they select other options until they choose the correct pitch pattern and the vocabulary item is added to the end of the vocabulary item list to be reviewed again (see Figure 3).

Figure 2
Learner Selects the Pitch Pattern that Correlates with the Target Vocabulary Item

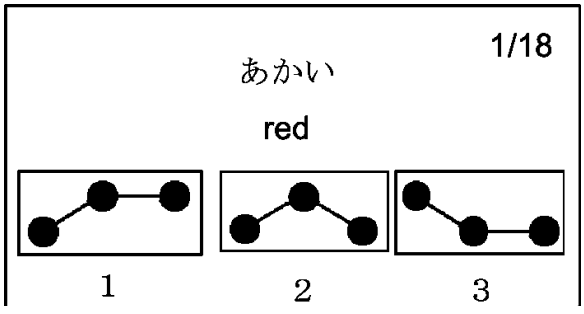
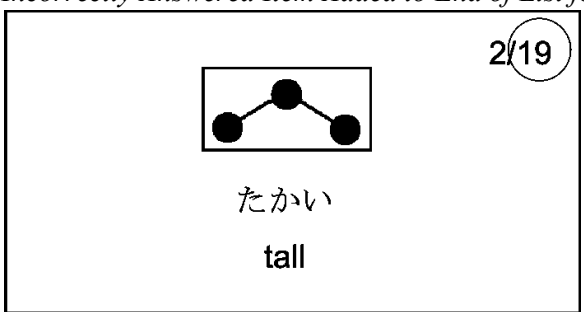
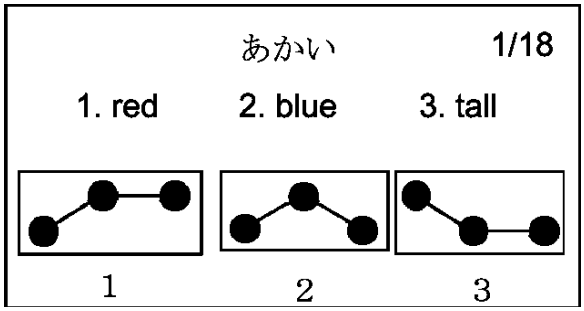


Figure 3
Incorrectly Answered Item Added to End of List for Further Review



The practice module is used to check the learners' knowledge of the accent patterns and the meaning of the target vocabulary item through a multiple-choice question similar to what occurs on the second screen shown during the presentation module (see Figure 2). The audio is only played after the learner has selected an answer (see Figure 4), and vocabulary items that are answered incorrectly are added to the end of the list to be practiced again. All vocabulary items included in the three 20-item tests were presented and practiced during this training as well as in Speak Everywhere (see Fukada, 2013).

Figure 4
Practice Module



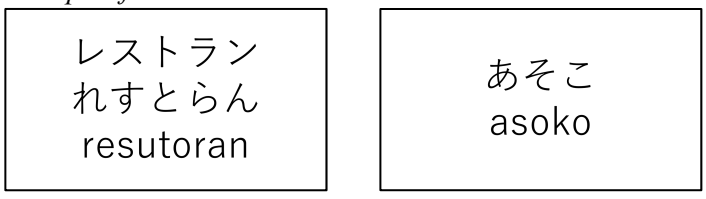
3.3 Procedures and Treatments

Participants in the treatment group were introduced to the PALP program at the beginning of the course and taught how to use the program outside of class. Treatment group participants used the program to practice pronunciation throughout the semester. They and the control group also used Speak Everywhere

to practice pronouncing the vocabulary words. Participants in the treatment group received course credit for completing each chapter's vocabulary item practice using the PALP program. At the end of each module, participants sent a screenshot of the final page of the program to their instructor to receive credit. The PALP program introduced vocabulary items that all novice students learn in Chapters 3–5 of the Nakama 1 textbook (Y. A. Hatasa et al., 2014).

To test the efficacy of the pitch accent training, participants were recorded reading aloud 20 of the vocabulary items they had practiced in Chapters 3–5 of their textbook.[2] Participants completed these recordings in person at the researcher's office as part of their pretest, posttest, and delayed posttest (three assessments).[3] Because using the same set of test items may introduce a testing threat to internal validity (Fraenkel et al., 2011), new items (with the same pitch patterns across tests) were used on each test. The vocabulary items on the assessments were presented to the participants as shown in Figure 5. Students completed the pretest at the beginning of the semester, prior to any instruction of vocabulary words. Participants completed the posttest following completion of Chapter 5 in Nakama 1. The treatment group completed the delayed posttest two weeks later and the control group completed the delayed posttest one week after the posttest.

Figure 5
Examples from Assessments



Following the delayed posttest, a questionnaire (delivered via a Qualtrics survey) was used to investigate the degree to which treatment group participants were able to use the PALP program and to examine the participants' perceptions of the utility of the training regimen.

3.4 Analysis

Following testing (pretest, posttest, and delayed posttest), two pitch accent trained raters (a native speaker and a near-native speaker holding a Superior level certification on the ACTFL Japanese OPI) graded the recordings according to pitch accent accuracy. Each word was awarded one point if the participant pronounced the word with the correct pitch pattern. Each rater graded the recording with no knowledge of the other rater's assigned point values. When the two raters' scores did not match, a third pitch accent trained rater (native speaker) graded the recorded word. The word was then rated correct or incorrect based on which two of the raters' scores matched. The third rater was not made aware of the two main raters' assigned point values nor from which group the recordings came. I then ran descriptive and inferential statistics on the collected data and conducted a non-directional two independent samples *t*-test on the pretest data to determine if both groups began the study with the same relative pitch accent ability. I then ran a mixed design analysis of variance (ANOVA) to answer Research Question 1. For the statistical analysis, α was set at .05. However, after adjusting for the two hypothesis tests (Bonferroni correction), statistical significance was determined by an α of .025. The dependent variable for these analyses were the participants' pitch accent assessment scores (0 to 20). Finally, to answer Research Questions 2 and 3, I analyzed the frequency data of answers on the questionnaire.

4. Results and Discussion

4.1 Proportion of Agreement Between Test Raters

Table 1 below summarizes the proportion of overall agreement (p_o) between the two main raters of the three pitch accent tests. For the scores that the two main raters did not agree, a third rater graded the recording, producing 100% rating agreement on each item from at least two raters across all three tests.

Table 1
Proportion of Overall Agreement Between Two Raters

	Group	Pretest	Posttest	Delayed Posttest
p_o	Treatment	.71	.82	.82
	Control	.76	.83	.86

4.2 Pretest

To determine the relative accentuation ability of both groups at the onset of the study, I conducted a non-directional two independent samples *t*-test using the pretest data. Three assumptions of the *t*-test were maintained: (a) normality, (b) independence, and (c) equal variances.

4.2.1 *Pretest Inferential Data*

Results of the two independent samples *t*-test for the pretest scores show that the difference between the treatment group (M = 8.60 points) and the control group (M = 9.13 points) was not statistically significant, $t(26) = -.331$, $p > .025$. Because these results indicate that both groups began at the same accentuation ability at the outset of the study, I determined that further investigation could be conducted.

4.3 RQ1

I addressed RQ1 by analyzing the data collected from the assessment recordings, as described previously. I analyzed the data using descriptive analyses as well as by conducting a mixed design ANOVA. In conducting the mixed design ANOVA, three assumptions were completely maintained: (a) independence, (b) homogeneity of covariance matrices, and (c) sphericity of the covariance matrix. The assumption of normality was all but fully sustained, due to limited skewness of the treatment group posttest score distribution, allowing for continued analysis. The assumption of homogeneity of variance was also all but fully met, due to a low level of unequal variance in delayed posttest scores.

4.3.1 *Inferential Data*

Table 2 summarizes the mean assessment scores out of 20 possible points. Tables 3–6 summarize the results of the mixed design ANOVA for the test scores. These results show that there was a significant main effect of time at the .05 level, $F(2, 48) = 17.58$, $p < .025$, with a large effect size, $\eta_p^2 = .42$. Tests of within-subjects contrasts revealed that posttest scores were significantly higher than pretest scores, $F(1, 24) = 28.31$, $p < .025$, with a large effect size, $\eta_p^2 = .54$. Delayed posttest scores were also significantly higher than pretest scores, $F(1, 24) = 9.81$, $p < .025$, with a large effect size, $\eta_p^2 = .29$. This shows that participants performed significantly better on the posttest and delayed posttest compared to the pretest.

Table 2
Mean Assessment Scores by Group

Group	Pretest	Posttest	Delayed Posttest
Treatment	8.60	15.50	12.85
Control	9.13	10.88	9.88

Table 3
Results of Mixed Design ANOVA – Tests of Within-Subjects Effects

Source	df	*F*	*p*	η_p^2
Time	2	17.580	.000*	.423
Time * Group	2	7.895	.001*	.248
Error (Time)	48			

*. $p < .05$

Table 4
Results of Mixed Design ANOVA – Tests of Within-Subjects Contrasts

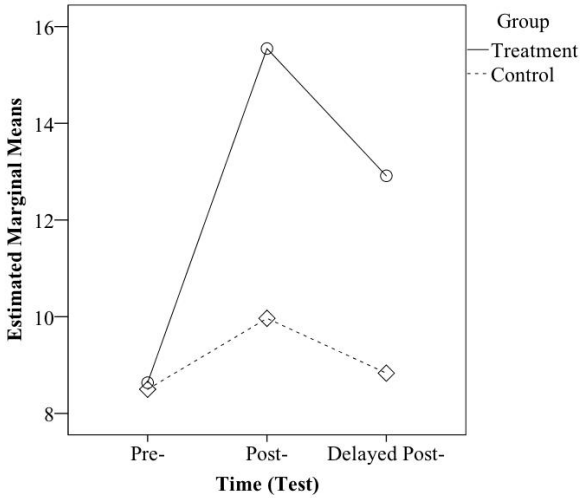
Source	Time (Test)	df	*F*	*p*	η_p^2
Time	Pre- vs. Post-	1	28.310	.000*	.541
	Pre- vs. Delayed Post-	1	9.812	.005*	.290
Time * Group	Pre- vs. Post-	1	11.953	.002*	.332
	Pre- vs. Delayed Post-	1	7.180	.013*	.230
Error (Time)	Pre- vs. Post-	24			
	Pre- vs. Delayed Post-	24			

*. $p < .05$

These results also show a significant interaction effect between the time when participants took each test and the group of the participants, $F(2, 48) = 7.90$, $p < .025$, with a medium effect size, $\eta_p^2 = .25$. This indicates that posttest and

delayed posttest scores in the treatment and control groups were significantly different. To break down this interaction, tests of within-subjects contrasts were performed, comparing each test to the pretest across treatment and control group participants. These tests revealed a significant interaction when comparing treatment and control group scores on posttest scores compared to pretest scores, $F(1, 24) = 11.95$, $p < .025$. This was found to have a large effect size, $\eta_p^2 = .33$. Furthermore, when comparing treatment and control group scores to delayed posttest scores compared to pretest scores, a significant interaction was found, $F(1, 24) = 7.18$, $p < .025$. This produced a medium effect size, $\eta_p^2 = .23$. Figure 6 also shows the time and group interaction.

Figure 6
Time and Group Interaction



Furthermore, results shown in Table 5–6 further indicate a significant main effect of group, $F(1, 24) = 7.00$, $p < .025$, with a medium effect size, $\eta_p^2 = .23$. Ignoring all other variables, this effect suggests a significant difference between treatment and control group pitch accent performance. Pairwise comparisons revealed that treatment group participants scored significantly higher than control group participants. This indicates that participants who studied and practiced Japanese pitch accent using the experimental training regimen performed significantly better than those who studied using traditional methods.

Table 5
Results of Mixed Design ANOVA – Tests of Between-Subjects Effects

Source	df	*F*	*p*	η_p^2
Group	1	6.999	.014*	.226
Error	24			

*. $p < .05$

Table 6
Results of Mixed Design ANOVA – Pairwise Comparisons

					95% CI for Difference†	
Compared Groups	Mean Difference (T−C)	Std. Error	*p*	η_p^2	Lower Bound	Upper Bound
Treatment −Control	3.265	1.234	.014*	.226	.718	5.813

*. $p < .05$
† Adjustment for Multiple Comparisons: Bonferroni

As supported by the interaction plot (see Figure 6), the effect size suggests that treatment and control group participants' scores were very similar for the pretest, but treatment group participants scored significantly higher than control group participants on both the posttest and delayed posttest. As both groups studied Japanese over multiple months it is expected that both treatment and control group participants' scores would increase at least a little bit from pretest to posttest. However, the data show that this increase was far more pronounced in the treatment group. These results suggest that use of the experimental training regimen significantly improved treatment group participants' pitch accent accuracy over time. Given these results, we reject the null hypothesis, thus suggesting that there is a relationship between type of Japanese pitch accent instruction and pronunciation accuracy.

As the amount of time participants in either group spent studying pitch accent was not assessed, it is possible that the difference between the groups was to some extent indicative of differing amounts of time on task. The sample size of groups for this analysis was also small. These limitations are acknowledged. However, comparisons of scores show that the treatment group improved 61%

more than the control group did from pretest to posttest, and 41% more from pretest to delayed posttest. Thus, the sample size is adequate to show that there is a large and clinically meaningful difference in pitch accent gains between the groups.

Results of this study are similar to those found by A and Hayashi (2010), Hirano-Cook (2011), and Hirose (2004). These studies also found that after implementing different pitch accent learning methods, such as shadowing and training sessions, participants' pitch accent abilities improved significantly. The current study further bolsters the implications and results of these studies.

4.4 RQ2–3

To address RQ2–3, I analyzed data collected from the questionnaire, which included open-ended, multiple-choice, and Likert scale questions.

4.4.1 *Survey Question 1*

To what degree did you find using the PALP program (the new Pitch Accent Learning and Practice program) helpful in learning Japanese pitch accent? Table 7 summarizes the frequency data regarding this question. All but two participants indicated that the PALP program was helpful.

Table 7
Perceptions Survey Results – Frequency of Answers to Question 1

	Very Helpful	Helpful	Unhelpful	Very Unhelpful
Question 1	3	15	2	0

When asked to explain how the PALP program helped their learning, 14 participants mentioned that the pitch accent visualizations helped them focus on and better understand patterns and improve their pronunciation. Five participants said the program helped them learn the new vocabulary words. For the two who felt that the program was unhelpful, one mentioned that it seemed like busywork and the other found the pitch accent visualizations difficult to grasp.

4.4.2 *Survey Question 2*

Do you think your pitch accent pronunciation has improved because you used the PALP program? To this question, 16 participants answered "Yes," and four participants answered "No," indicating that following the use of the PALP program, most participants felt a sense of accomplishment. Despite feeling otherwise, all four participants who answered "No" to this question actually showed improvement in their posttest scores. When compared to their average pretest score (M = 9.5), these four participants improved 79% on the posttest (M = 17) and 63% on the delayed posttest (M = 15.5).

When asked to further explain in what way they felt their pitch accent had improved, one participant stated that she felt more professional, three participants said they were able to speak more fluently, three participants mentioned being more aware of pitch accent, and one participant stated that "[Pitch accent pronunciation] comes more easily to me. When I read new words, I often guess right on the accent pattern."

4.4.3 *Survey Question 3*

To what degree were you able to use the PALP program for learning Japanese pitch accent? Table 8 summarizes the frequency data for this question. All but one participant indicated that the PALP program was at least somewhat easy to use and mentioned that the interface was simple enough to understand and navigate through. Unfortunately, the participant who answered that the program was not at all easy to use stated that he "can't really specify what feature" made the program difficult to use.

Table 8
Perceptions Survey Results – Frequency of Answers to Question 3

	Easily	Somewhat Easily	Not Very Easily	Not At All
Question 3	8	11	0	1

4.4.4 *Survey Question 4*

Would you like to use the PALP program again in the future? To this question, 16 participants answered "Yes," and four participants answered "No." This indicates that most participants felt that the program was successful and easy enough to use that future use would benefit them further.

Five participants stated that they would like to continue using the program specifically because it helped them improve their pronunciation. One participant mentioned that was a good way to study and said that the audio files accompanying the program were particularly helpful. Two participants stated that they don't want to use the program in the future because the program doesn't run on computers with Mac OS, and the other two said that the program wasn't helpful enough to warrant future use.

According to data from the questionnaire, the majority of participants found that the training was helpful in learning Japanese pitch accent. Moreover, many participants felt the training helped them visualize Japanese pitch patterns better, which helped improve their pitch accent accuracy. Most participants also felt that following training, their pitch accent had improved. These results indicate that, in general, participants' perceptions of the pitch accent training aligned with the reality that their pronunciation had improved. Results also suggest that using the PALP program in the training was simple, and the majority of participants noted that they would like to use the program in the future.

4.5 Pedagogical Implications and Recommendations

Results of this study suggest that learners who engage in continual, concentrated pitch accent training and practice using materials that provide audio clips and visual depictions of pitch patterns can acquire correct pitch accent. Furthermore, results suggest that learners who are provided with and use materials similar to the PALP program will significantly outperform learners who only use traditional methods and materials. Given these results, I would recommend further implementation of

pitch accent learning and practice systems that provide both aural and visual cues along with pitch pattern recall assessment.

4.6 Limitations and Future Suggestions

The nature of the online courses used in this study reduced my ability to procure a large number of participants or conduct complete random sampling. The difference in L1s of participants was also a potential confounding variable in the study. Furthermore, this study tested participants' ability to produce correct pitch accent at the word level. I hope to follow up on this study by further investigating the effect of the pitch accent training on learner pitch accent at the sentence level with a larger number of participants.

Replication studies, including data from additional online courses, will further offset the previously mentioned limitations and strengthen the implications of this study. Moreover, studies using a training regimen similar to that implemented in the current study within a traditional course (conducted face-to-face) would also indicate the effect of concentrated pitch accent training for in-class learners.

5. Conclusion

The present study has found that the pitch accent of learners who used the experimental training regimen improved significantly. Also, these participants significantly outperformed those who studied using traditional methods. This suggests that a relationship exists between type of Japanese pitch accent instruction and pronunciation accuracy, which supports the findings of previous studies.

Additionally, it was found that participants felt the training materials were easy to use. Moreover, participants reported that the training regimen was helpful in their learning, indicating an alignment of participant perceptions and reality.

Although results suggest significant differences between the treatment and control groups, further replication studies in different contexts using similar methods are needed to further strengthen these findings. However, given the results

of this study, it is hoped that instructors of Japanese will begin implementing, to a larger extent, training that assists learners in continual, concentrated practice of Japanese pitch accent.

Notes

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1. Participants in both groups practiced pronouncing vocabulary items on a separate web application called Speak Everywhere (see Fukada, 2013). Speak Everywhere, created at Purdue University by Dr. Atsushi Fukada, is often used in speaking practice and speaking tests outside the classroom.
2. Due to space limitations, the test items and questionnaire used in this study could not be included here. All data collection instruments used in the present study can be freely downloaded on the IRIS Database: https://www.iris-database.org/iris/app/home/detail?id=york:939223.
3. Due to the nature of online courses, four participants in the control group were unable to meet in person for the pretest only, and they completed the pretest recordings during online, one-on-one synchronous meetings.

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