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Article

Rock or Lock? Gamifying an online course management system for pronunciation instruction: Focus on English /r/ and /l/

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Abstract

This one-group quasi-experimental study aimed to determine the effectiveness of using a gamified course management system with points, badges (and consequently competition) to facilitate the development of English phonology in a foreign language context in Japan. To implement this idea, we focused on the acquisition of English segments /r/ and /l/ in production (as in /r/ock and /l/ ock respectively). During the study, participants were asked to engage in gamified pronunciation activities over a period of two weeks, using a popular learning site (*Moodle*). The data collection instruments included pre- and posttests to examine the development in production of /r/ and /l/ (using controlled aural elicitation tasks), a written follow-up questionnaire, and user logs to investigate users' perceptions of the pedagogy utilized. The results indicate that participants benefited from the proposed gamified system for L2 pronunciation instruction, as they improved their production of the target English /r/ and /l/ segments. In addition, responses from the interviews and user logs revealed that participants perceived using the site as enjoyable, anxiety-reducing, and pedagogically useful.

KEYWORDS: L2 PRONUNCIATION INSTRUCTION; GAMIFICATION; METAPHONOLOGICAL AWARENESS.

Over the past two decades, research in second or foreign language (L2) phonology, particularly within communicative frameworks (e.g., Celce-Murcia,

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Brinton, & Goodwin, 2010), has pushed pronunciation instruction and research forward. The move from achieving native-like pronunciation to a focus on more attainable goals such as the development of intelligibility and comprehensibility (e.g., Derwing & Munro, 2005) has enabled instructors to help learners work toward realistic goals, as opposed to laboring toward unrealistic objectives such as the achievement of native-like pronunciation (Levis, 2005). While many experiments attempt to understand the process of acquiring an L2 phonological system (e.g., Saito, 2013), there is a lack of research that investigates the development of *young* beginning learners' L2 pronunciation—without direct instruction from a teacher—in the foreign language setting (for examples with adult learners in a computer-assisted environment see Fouz-González, 2019; Mompean & Fouz-González, 2016; and Thomson, 2011). To this end, this paper investigates the effectiveness of using gamified pronunciation instruction on the development of L2 phonology.

In particular, this pilot study investigates how a gamified learning environment (occasionally referred to as "site") might contribute to the acquisition of foreign /r/ and /l/ by a group of Japanese junior high school English learners. The open source course management system, *Moodle*, was chosen because it is amenable to gamification via user-designed plugins (e.g., leader boards; Pastor-Pina, Satorre-Cuerda, Molina-Carmona, Gallego-Durán, & Llorens-Largo, 2015). As it will be detailed, a gamified *Moodle* site with pronunciation videos has the capacity to persuade learners to study about and practice pronouncing articulatorily difficult L2 segments. In this study, a gamified pronunciation site, titled "English Detective", rewarded students with points and badges as they worked through a series of detective themed pronunciation activities. A one-group pretest-posttest quasi-experimental design was employed to investigate the effectiveness of a gamified version of *Moodle* (specifically designed for this study, containing explicit pronunciation videos) on the acquisition of two English segments, /r/ and /l/, and associated metalinguistic knowledge.

Background

Second Language Pronunciation Instruction

As has been confirmed by researchers and practitioners, pronunciation instruction is still neglected in the L2 classroom (Celce-Murcia et al., 2010; Derwing & Munro, 2005). Currently, pronunciation research and pedagogy focus on intelligibility as the ultimate goal of pronunciation instruction (e.g., Jenkins, 2000), within an approach that recognizes the importance of both segmental and suprasegmental aspects of L2 phonology (Celce-Murcia et al., 2010; Jenkins, 2000). However, in foreign language contexts, access to the target language via exposure or interaction with other L2 speakers is often limited to

the classroom, where time and resources are limited (Collins & Muñoz, 2016). Accordingly, attention needs to be placed on how to teach pronunciation in a way that expands opportunities for learners to develop intelligible speech without exhausting the allotted time and resources.

One approach to pronunciation instruction is form-focused instruction, which is described as any effort a teacher makes to help learners build implicit or explicit knowledge about language form (Spada, 1997). Form-focused instruction consists of a sequence of teaching strategies that include noticing, building awareness, and then practicing the target feature (Lyster, 2007). The first step, noticing, is established when learners pay attention to and notice the accurate use of certain L2 features (DeKeyser, 2007). This is of importance to this study because the instructional pronunciation videos used in the treatment (see forthcoming discussion) are specifically designed to help learners cue in on the mouth to develop explicit knowledge about how to move their articulators to produce the target sounds: /r/ and /l/. The next step, awareness, occurs when students receive corrective feedback as a method of raising awareness during communicative activities. The third step, practice, occurs when they communicate or produce speech, which is the time when it is important for teachers to provide explicit corrective feedback for target features that are particularly difficult to notice (Spada & Lightbown, 2008).

A study about the effect that form-focused instruction and corrective feedback have on Japanese learners' pronunciation of English /r/ was conducted by Saito and Lyster (2012). 65 Japanese university students learning debate skills in English were split into two groups: while one received form-focused instruction before communicative activities, the other received the same form-focused instruction in addition to corrective feedback (via recasts). The results revealed that learners who received corrective feedback in the form of pronunciation-focused recasts outperformed the group who only received form-focused instruction, though it showed only a slight improvement in this instructional setting, and only in familiar lexical contexts.

To explore this finding further, Saito (2013) conducted a study where learners in one experimental group received form-focused instruction (as discussed above), and the other experiment group received a combination of explicit phonetic information and form-focused instruction; the control group participated in meaning-oriented activities that did not focus on form. Explicit phonetic information differs from form-focused instruction because learners are specifically drawing their attention to segmental L2 speech instead of lexical units (Saito, 2013), which was hypothesized to magnify the effects of form-focused instruction and to help learners establish new phonetic categories. Saito's results indicate that learners who receive both explicit phonetic information and form-focused instruction can make improvements at pronouncing /r/ in

both familiar and unfamiliar lexical contexts, while learners who only receive form-focused instruction will likely fail to do so.

To deliver explicit phonetic information, Saito (2013) emphasizes providing over-exaggerated exemplars of the pronunciation of key features (e.g., lip rounding, slow speech) to help learners notice the differences between perceptually similar sounds such as /r/ and /l/. The author grounds this decision in research that examines how speech perception contributes to learners developing new phonetic categories to improve L2 pronunciation (e.g., perceptual assimilation model: Best & Tyler, 2007; speech learning model: Flege, 1995). Accordingly, instruction needs to focus on raising perceptual noticing of target sounds both lexically and phonetically in order to help learners create new phonetic categories so that they can differentiate similar sounds (Saito, 2013). In this study, digital technology was used to enhance the delivery of the explicit phonetic information, as students cued in on the instructor's mouth in videos specifically designed to provide explicit information before practicing pronunciation and trying minimal pair listening quizzes.

Computer-Assisted Pronunciation Instruction

Research in computer-assisted L2 learning indicates that it can be effective for providing opportunities to improve both knowledge of target sounds and the pronunciation of those features. In this scenario, learners have access to two channels of feedback—audio and visual (Hardison, 2004), which could enhance the delivery of explicit phonetic information. Tsubota, Dantsuji, and Kawahara (2004) explored the combination of audio and visual feedback in an experiment that focused on autonomous pronunciation practice in a multimodal system that provided university students with a detailed pronunciation report. Specifically, the system identified segmental errors such as /r/ and /l/ and provided written metalinguistic information about how to produce the target sound, which contributed to pronunciation gains.

In further evidence for digitally-based autonomous pronunciation practice, Mompean and Fouz-González (2016) conducted a study about the pedagogical use of Twitter, wherein participants received daily tweets that featured a target word and information on how to pronounce it. The results indicate that the learners autonomously improved their L2 pronunciation by the end of the treatment. Another recent example of how digital environments can be effective for pronunciation instruction is Fouz-González (2019), who provided learners with explicit information about L2 pronunciation in class before having them listen to a podcast with examples of the target feature. Students then practiced the features at home on their own before doing a group pronunciation activity in class. These aspects of CALL based pronunciation practice are important

because the use of technology in pronunciation instruction should enable learners to practice on their own without time constraints or the pressure associated with speaking in front of other students (Fouz-González, 2015).

One possible way of incorporating technology to deliver explicit phonetic information is through Fogg's (2002) captology approach, which is the use of computing technology to persuade individuals in ways humans cannot. One specific use, technology as a *medium*, is based on providing digital experiences that make anxiety-inducing activities more approachable. For example, the use of pronunciation videos that zoom in on the teacher's mouth could provide key metalinguistic information about how to produce the target sound. In a digital space, this can be done without the pressure associated with excessive requests by the instructor to repeat sounds, looking closely at the instructor's mouth, or making pronunciation mistakes in front of others. Such an approach could extend the work of Saito (2013), as the delivery of explicit phonetic information in instructional settings is typically only available in person. The use of digital tools to help students visualize how to pronounce L2 features in this manner contributes to the awareness of the target features (Lord, 2019). In sum, there is evidence that blending explicit pronunciation instruction with digital technology is a promising direction in research about L2 pronunciation instruction, but an equally important aspect of digital environments is that they afford learners opportunities to practice pronunciation in a comfortable setting of their choice.

Of interest to this study is the potential that explicit pronunciation instruction has to reduce language anxiety. L2 metaphonological awareness is a specific type of metalinguistic skill that focuses on L2 pronunciation (e.g., Celce-Murcia et al., 2010; Saito, 2013) and includes activities such as teaching students how to position their articulators to produce a specific segment. In the process, learners can take a more reflective and playful approach to pronouncing problematic L2 features (Szyszka, 2017). Szyszka stresses that this type of explicit pronunciation strategy enables the learner to take an approach that reduces anxiety by increasing ownership in developing skills that protect them from future embarrassment caused by pronunciation errors. This indicates that providing explicit phonetic information in a digital setting equipped with gamified elements could potentially help learners to practice pronunciation in a more comfortable way.

Gamified Learning Environments in L2 Acquisition

The notion of digital games serving as a space for learning is well documented (e.g., Bogost, 2011; Gee, 2007). Gamification, however, is different from video games because it utilizes video game *elements* (not games) to motivate users to engage in learning activities (Deterding, Dixon, Khaled, & Nacke, 2011). Gamification includes elements from games such as avatars, feedback, levels (and

consequently competition) under explicit and enforced rules, and teamwork (Reeves & Read, 2009). Hamari, Koivisto, and Sarsa (2014) explain that when motivational affordances such as points are earned, a psychological response is triggered, which, in turn, triggers a specific behavioral outcome such as pronunciation practice.

In L2 learning, Reinhardt (2019) proposes a framework to examine research and practice in digital games, which includes three distinct types: game-enhanced, game-based, and game-informed. The authors explain that game-enhanced materials include off the shelf games not designed for language learning, while game-based materials take advantage of game play for educational purposes. The third type, game-informed materials, includes elements of games that can be used to enhance L2 teaching and learning, which includes gamified approaches. Of importance to this study is that Reinhardt (2019) stresses that it is possible to utilize game-informed materials to investigate a research problem from the perspective of L2 pedagogy and/or the perspective of the learner. In line with this, the present study aims to inform L2 pronunciation research by emphasizing a comfortable and fun environment to develop explicit phonetic knowledge and practice pronunciation.

A popular example of gamification in language learning can be found in the app, *Duolingo*, which enables learners to earn points and badges as they work through levels on their own, completely free of a pedagogical context. To test the effectiveness of the app in a pedagogical setting, Rachels and Rockinson-Szapkiw (2018) investigated how *Duolingo* could be used to contribute to the acquisition of vocabulary and grammar in L2 Spanish. While one group of students completed lessons on the app, the other covered comparable materials in a classroom setting. The results indicated that there was no difference between the two groups in regard to gains, demonstrating that this type of technology is useful for L2 instruction. It is possible that the participants in both groups performed comparably because they both received grammar-translation style instruction. While this can be effective in some instances (e.g., for learning vocabulary and morphosyntax), we do not believe it would be as beneficial for pronunciation instruction.

For a more comprehensive and inclusive approach to L2 pedagogy, Reinhardt (2019) recommends the use of "smaller, limited games and educational apps that utilize *some game mechanics*" (p. 7) in order to create a more learning-oriented system. We believe that open source course management systems like *Moodle* can be adapted to fulfil this recommendation, as they are easily accessible to and commonly used by L2 teachers. Importantly, *Moodle* can be gamified to trigger responses via the following elements: progressive learning (e.g., via maps, levels); socialization (e.g., when students collaborate on missions, send messages); feedback (e.g., instant feedback, progress bars);

and rewards (e.g., coins, badges, leaderboards; Pastor-Pina et al., 2015). In this way, many typical elements of a *Moodle* page (e.g., conditions to access, chats), if combined with user-designed gamified-plugins to create leaderboards and reward systems, may contribute to pronunciation practice. Of further interest is that programming knowledge is not necessary to create such a system, which can instead be created through the customization of open source materials (Barcomb, Grimshaw, & Cardoso, 2017, 2019). This could enable more teachers to explore the use of gamified materials to enable students to practice pronunciation outside of class.

Research on the use of digital games in L2 pedagogy indicates that the role of the teacher and the location in which learners study can take on many different forms. For example, Sauro and Zourou (2019) explain that the "digital wilds" include online language learning environments that are completely independent of a pedagogical institution and can include activities such as using a second language to play a video game online with other users. In line with this, Sundqvist (2019) reports that Swedish secondary students who played English commercial games on their own online outperformed those who self-identified as infrequent users or non-gamers in recognizing and using L2 English vocabulary. Given that games and gamified learning environments, as discussed above, expand opportunities for language learning on-the-go, teachers may decide to incorporate such environments in pedagogical settings. In specific, *at-home teacher-initiated* materials (Sundqvist & Sylvén, 2016) are teacher-selected online language learning materials that students can use outside of class. An example of this can be seen in Newgarden and Zheng's (2016) study, in which the researchers replaced a semester-long ESL course with the commercial game *World of Warcraft*. Participants completed missions in the game with other classmates and the teacher once per week beyond the walls of an institution by using text-chats and video conferencing software to communicate with each other. Instead of adapting a commercial game to expand language learning opportunities beyond the walls of the language classroom, the current study examines a game-informed/gamified system that could be implemented as an online resource in an at-home teacher-initiated setting.

The Present Study

This study examined the pedagogical use of an online gamified pronunciation site to aid Japanese junior high school students in the production of /r/ and /l/ by enhancing their explicit understanding of these segments. This population was chosen because research indicates that the foreign language classroom in Japan provides limited opportunities for pronunciation practice (e.g., Machida, 2016). This scenario is further complicated by Japan's Ministry of Education's attempt to implement high-level linguistic activities, such as debates, into all

classrooms (MEXT, 2014). This pilot study aims to propose a way to alleviate these constraints by enabling students to study L2 pronunciation online.

The target segments /r/ and /l/ were chosen because Japanese learners have difficulty acquiring them in both perception (e.g., Lively, Logan, & Pisoni, 1993) and production (e.g., Larson-Hall, 2006). Japanese L1 learners also have difficulties differentiating /r/ and /l/ and instead perceive it as the Japanese tap, which is situated in a space between /l/, /r/, and /d/ (Hattori & Iverson, 2009). Finally, these two segments are of interest because they carry a high functional load, as defined by Brown (1988) and Celce-Murcia et al. (2010); that is, they are highly productive in English and serve to differentiate many highly frequent words in the language.

The following research questions were designed to address the goals of this mixed-methods study, which explored the use of a gamified online pronunciation environment to facilitate the development of /l/ and /r/ in a foreign language context in Japan. To determine the effectiveness of the proposed approach to teaching pronunciation, we have developed the following research question: What are the effects of the proposed gamified environment on the pronunciation of the /r/-/l/ distinction among Japanese learners of English? The question can be subdivided into three sub-components:

- Does the proposed gamified environment contribute to improved pronunciation of /r/ and /l/?
- Does the proposed gamified environment facilitate increased awareness of the /r/-/l/ distinction?
- What are users' perceptions of learning pronunciation in the proposed gamified environment?

Method

This one-group pretest posttest study took place in a gamified *Moodle* site and lasted for two weeks. It aimed to answer the first component of the overarching research question quantitatively with tests to determine if our proposal can improve learners' production of /r/ and /l/. After participants finished their final pronunciation test, they completed a posttest follow-up questionnaire that gathered qualitative data in the form of written responses to better understand the second and third components of the research question. The data include responses related to how participants perceived their explicit phonetic awareness was facilitated by pronunciation videos, how they perceived gamification (in general), and how they perceived the gamified site, including its ability to reduce anxiety and promote learning. The research design is illustrated in Figure 1.

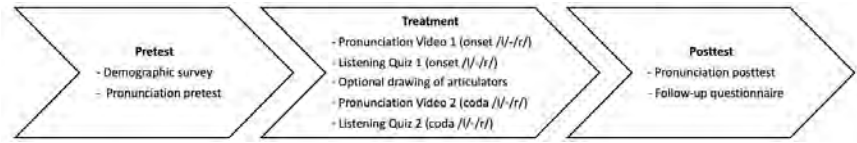

Figure 1. Research design.

Participants

The study included 11 Japanese junior high school students living in Japan (female: 7; male: 4) with a mean age of 13.7 (*SD*=1.7), all participating from home and interacting with the main researcher via a popular videoconferencing application; they were told that they would participate in a video game-like class to practice English using the video and audio functions of their iPads or laptop computers. Participants were recruited through learning centers, blogs, and online groups dedicated to learning English (i.e., they were not in an intact class). All 11 students who started the study completed it through the posttests, although participation was voluntary, and they were not compensated for their participation. The entire study was conducted online.

Instruments

To determine whether the proposed gamified environment contributed to improved pronunciation of /r/ and /l, students took a 38-item pronunciation pretest and posttest that included 28 target simple /r/ and /l/ words distributed in onset (word-initial; e.g., /r/ice, /l/ate) and coda positions (word-final; e.g., poo/r/, mai/l/). The remaining 10 items were distractors that contained neither /r/ nor /l/ (e.g., big). A breakdown of the items used in the study is shown in Figure 2.

The participants were asked to produce the target words in both isolation (e.g., /r/ain) and inserted at the beginning of short pause-initial sentences (e.g., /r/ain, I like that!). They completed a listen-and-repeat test that involved watching video recordings of either words or brief sentences before recording themselves saying the word or phrase that they heard. The pretests and posttests were both done at home via *Moodle*, which was designed to provide learners a comfortable place to do the assignments and reduce the observer's paradox (i.e., the participants' discomfort in being observed, which may affect their linguistic output; Labov, 1972). The accuracy of /r/ and /l/ pronunciation was assessed as accurate or inaccurate by one of the researchers (a native English speaker) and one assistant (a fluent English speaker of Japanese origin). When

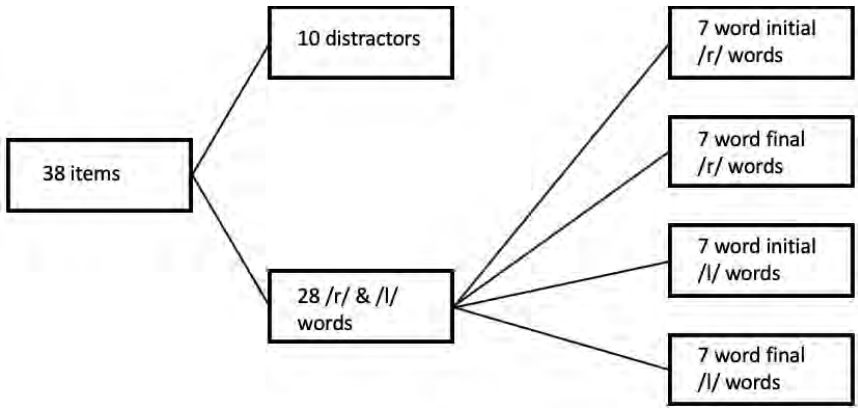

Figure 2. Pronunciation materials.

the raters disagreed on an item (which rarely happened), a third researcher was asked to make a determination. If students produced /l/ instead of /r/, or instead produced the Japanese tap (i.e., /ɾ/), then the item was deemed to be inaccurate. There were 28 /r/ and /l/ items (14 of each) on the pre- and posttest.

Qualitative data were collected to understand how learners perceived the pronunciation videos affected their awareness of the target features, and how the proposed gamified environment (including its anxiety-reducing benefits) contributed to learning. These data were collected in the form of an eight-item written follow-up questionnaire that asked open-ended questions in Japanese: (1) What was the strength of the site to learn English? (2) What do you like about this site? (3) What was the weakness of this site to learn English? (4) What would you change about this site? (5) After learning with the site, do you feel that you are more comfortable speaking English in front of your class? (6) Do you feel that you learned English from the site? (7) Would you like this site if it was part of your school curriculum? And (8) How do you feel about learning English from videos? These eight questions required open-ended responses about how the participants perceived learning pronunciation on the site and what they liked or did not like about the pedagogical experience. The questionnaire was completed online and was located in a link found in *English Detective*. The written responses (completed in Japanese but translated into English for analysis) were coded according to the themes that informed the qualitative analysis: the development of an explicit phonetic understanding of target features in a digital context, and participants' perceptions of the gamified site, including its ability to reduce anxiety and promote learning.

English Detective: A gamified Moodle site

English Detective is a gamified *Moodle* site that was built specifically for this study. To encourage learners to practice L2 pronunciation in an environment less likely to trigger anxiety, activities were completed in the form of gamified missions. Participants received experience points for each mission they attempted, which automatically went to a leaderboard and subsequently opened the next mission. This was done through a leaderboard plugin in *Moodle, Level Up!*, which housed many of the gamified elements in this treatment. The leaderboard, which can be seen with other elements in Figure 3, was orchestrated to provide experience points in the form of coins for each activity, show each participant's avatar, display the total number of coins, update badges, and inform the students of the number of coins necessary for the next badge.

As a strategy to compete, participants were instructed to review materials in order to receive additional coins and, thus, higher ranking badges. For every 20 coins, participants earned a new badge, ranging from *Rookie Agent* to *Super Agent*. To deemphasize failure, the coins and leaderboard represented "experience points", which means the coins reflected attempts, not mastery. Because the target feature was a hard-to-acquire segment and therefore beyond the learner's immediate control, the goal was to deemphasize failure and instead reward learners for their effort and continued practice (e.g., Bell, 2018). Each student used the site for approximately one hour by the end of the study. To prevent participants from receiving coins for constantly doing the same mission, a filter required 20 minutes to pass before earning points for the same activity.

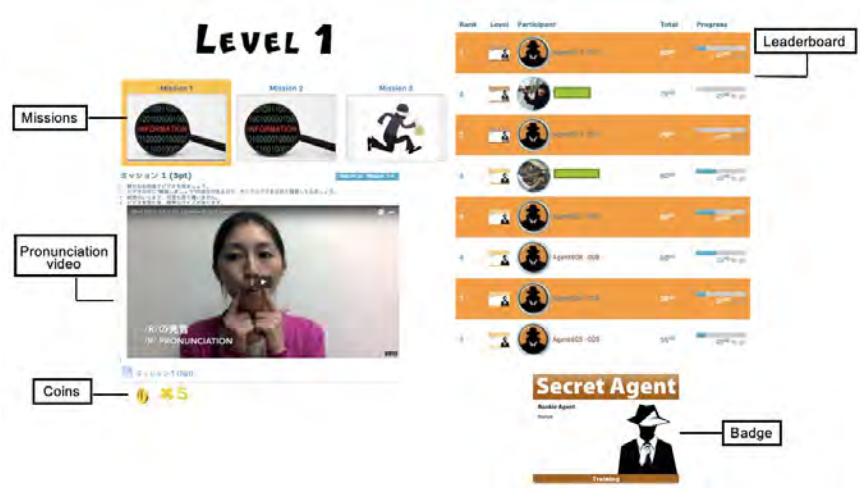

Figure 3. Overview of the gamified pronunciation site.

Mission 1 consisted of videos that provided learners with explicit instruction and multiple opportunities to practice the pronunciation of /**r**/ and /l/ in *onset* position. In line with Saito (2013), the videos provided metalinguistic cues to visually draw the learner's attention to the relevant articulators (e.g., the positioning of the tongue tip against the alveolar ridge to produce /l/). To relax, students were instructed to massage their faces to prepare themselves to make foreign sounds. To deliver information about how to produce these sounds, an L1 speaker of Japanese with experience teaching EFL served as the teacher in the videos and delivered relevant metalinguistic information about the features before pronouncing a few words; a native English speaker also provided examples of how to pronounce each sound. In the /l/-related videos, students were instructed to touch their tongue to the alveolar ridge (i.e., "the hard bump on the roof of the mouth"), while for /r/ production, the videos focused on lip rounding and preventing the tongue from touching the alveolar ridge, according to Celce-Murcia et al.'s (2010) recommendations.

As a pedagogical strategy, participants were instructed that, if they saw the teacher's tongue in the video, that meant /l/ was produced. For the pronunciation of /r/, learners were instructed to focus on lip rounding and to avoid touching their tongue to the alveolar ridge. Per Fogg's (2002) recommendations, the video instructed learners to rewind and pause the video to practice pronouncing the words and to study the instructor's articulators for each segment. The activity was designed to provide access to a form of explicit phonetic information not available in classroom instruction. Students were also instructed to pause the video to review wordlists with the target feature before pressing play to listen to the instructor's pronunciation. An optional activity in Mission 1 gave participants the opportunity to use tablets to draw a picture of what a person's mouth looks like when pronouncing /l/ or /r/ (see Figure 4).

Mission 2 followed the same format as Mission 1, except that it focused on the production of /l/ and /r/ in *coda* position (e.g., poo/r/, mai/l/).

Mission 3 gave learners an opportunity to practice the skills learned in the first two missions by completing a minimal-pair listening quiz. The rationale for including a listening quiz comes from findings that suggest that these tasks can improve oral production (Bradlow, Pisoni, Akahane-Yamada, & Tohkura, 1997) and may even reduce anxiety by giving learners an opportunity to focus on target sounds without the pressures associated with language production (Celce-Murcia et al., 2010). Perception activities also serve as an opportunity for learners to exercise their explicit phonetic understanding of the target features, which can contribute to pronunciation gains (Saito, 2013). Six questions quizzed learners on their ability to

differentiate minimal pairs (e.g., "lip" and "rip"). Half of the questions showed a video of the researcher pronouncing the word so that participants could visually notice the target feature, and the other half were audio only. After viewing and/or listening to each item, participants selected /r/ or /l/ based on which sound they heard.

Analysis of Results

The data from the pronunciation tests were analyzed using descriptive statistics. Initially, a composite score for /l/-/r/ pronunciation was calculated in order to determine the effectiveness of the treatment on the pronunciation of perceptually similar segments. To better understand the effect of the treatment on each individual segment, a separate set of analyses was conducted.

The short-answer follow-up questionnaire data were analyzed with the help of one research assistant, according to the coding methods proposed by Saldaña (2009): the participants' responses were first categorized based on learners' reported experiences, that is, their perception of learning pronunciation in a gamified site with respect to its strengths and weaknesses as a pedagogical tool. These were then broken into subcomponents according to the themes that informed the analysis: the effects of the proposed site on (1) developing an explicit phonetic understanding of /r/-/l/, (2) reducing anxiety, and (3) promoting learning. In vivo coding was chosen as the coding method to represent participants' intended meanings (i.e., sections of data were assigned a label such as "developing explicit phonetic awareness"). These data were extracted verbatim from the data set and inserted into columns in a spreadsheet to create themes, categories, and sub-categories for the qualitative analysis.

Results

Quantitative

All participants began and completed the study through the posttests and, by the end, completed all proposed activities at least once and spent a mean total of 63.23 minutes in the gamified site, SD= 24.82, 95% CI [46.72, 80.22]. To first determine the effectiveness of the gamified environment on the production of /r/ and /l/ as a composite score, a Wilcoxon Signed-Rank test was used to measure the accuracy of their pronunciations. The key assumption for the test, the distributional assumption, was not violated, as assessed by a histogram with a superimposed normal curve on the distribution of scores. The results in Table 1 indicate that there was a statistically significant increase in /r/ and /l/ accuracy (Mdn = 8) on the posttest (Mdn = 19) when compared to the pretest (Mdn = 11), z = 2.97, p = .003.

Table 1
Composite /r/ and /l/ Results (z-scores)

	Pretest	Post		
Outcome	Mdn	Mdn	n	z
/r/ & /l/ items	11.00	19.00	11	2.97*

* p < .05. Mdn = Median

To better understand the effect of the treatment on the pronunciation of /r/ and /l/, each segment was analyzed separately by conducting a pair of related-samples Wilcoxon signed-rank tests (Table 2). The key assumption for the test, the distributional assumption, was not violated, as assessed by a histogram with a superimposed normal curve on both /r/ and /l/ distributions.

Table 2
Individual /r/ and /l/ Results (z-scores)

	Pretest	Post		
Outcome	Mdn	Mdn	n	z
/l/ items	5.00	10.00	11	2.94*
/r/ items	6.00	10.00	11	2.81*

* p < .05. Mdn = Median

Regarding the pronunciation of /l/, a Wilcoxon signed-rank test determined that there was a statistically significant median increase in the number of correct /l/ items from the pretest (*Mdn* = 5 correct /l/ items) to the posttest (*Mdn* = 10 correct /l/ items), $z = 2.94$, $p < .05$. Similar to the composite score, a Wilcoxon signed-rank test for /r/ pronunciation determined that there was a statistically significant median increase in the number of correct /r/ items from the pretest (*Mdn* = 6 correct /r/ items) to the posttest (*Mdn* = 10 correct /r/ items), $z = 2.81$, $p < .05$. Altogether, these findings indicate that the participants benefited from the gamified *Moodle* site, as learners appear to have equally improved in their production of English /r/ and /l/.

Qualitative

To answer the second and third subcomponents of the research question, which examined (1) whether the proposed learning environment led to an increase in phonetic awareness of the /r/-/l/- distinction and (2) the participants'

perceptions of the gamified learning environment, participants completed a posttest written questionnaire consisting of eight open-ended questions, as described earlier.

The analysis of the participants' responses suggests they developed explicit knowledge of /r/ and /l/ by: (1) noticing segments that do not exist in their L1 (e.g., "I could learn about sounds that do not exist in Japanese"); (2) learning how to manipulate their articulators (e.g., "I can pronounce sounds correctly by focusing on my tongue, mouth, and lips"); (3) differentiating contrasting sounds (e.g., "I feel that I learned the /r/ and /l/ difference"); and (4) developing explicit phonetic knowledge in *both* perception and production (e.g., "I can hear and practice correct pronunciation").

To further understand the development of explicit phonetic awareness from a qualitative perspective, the drawing activity provides key insights. Of the seven students who completed the activity, all focused on ensuring their drawing showed the tongue tip touching the alveolar ridge for /l/ and a low and drawn back tongue for /r/. Figure 4 illustrates an example of a typical drawing produced by the participants, indicating their awareness of the tongue positioning for /l/.

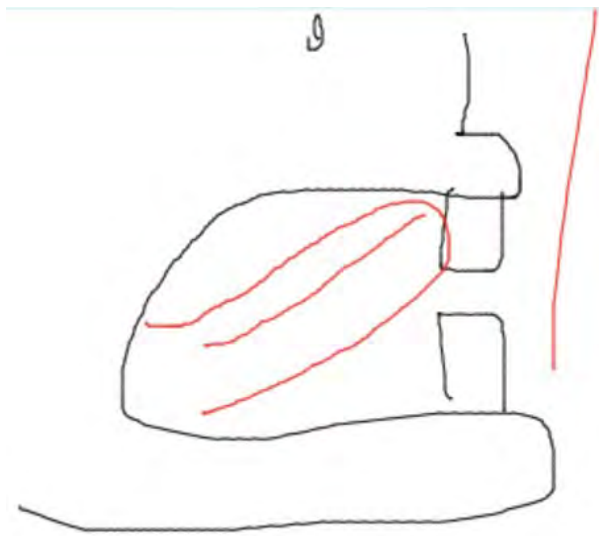

Figure 4. An example of a student's depiction of one's articulators when producing /l/.

An interview question about how participants perceived learning from videos yielded responses that were directly related to the affordances of persuasive technology (Fogg, 2002), which indicates that this strategy may have

been effective for delivering explicit phonetic information. For instance, six learners stated that they were comfortable with closely analyzing the teacher's mouth in the video to build explicit knowledge about the target L2 pronunciation (e.g., "I can see the shape of the mouth"; "videos allowed me to watch the movement of the tongue and mouth"). Furthermore, six responses indicated that, in line with the affordances of persuasive technology, learners paused and replayed the videos to study each feature (e.g., "I can hear native speaker sounds as many times as I want and still be able to repeat to practice"). An analysis of the log data supports that students viewed the videos several times: those related to /l/-/r/ in onset position were watched 70 times, and those involving the coda were viewed 59 times.

Based on the assertion that metalinguistic approaches to pronunciation instruction can reduce anxiety (Szyszka, 2017), and that pronunciation anxiety in the L2 classroom is negatively correlated with WTC (Baran-Łucarz, 2014), one of the interview questions asked the students: "After learning with the site, do you feel that you are more comfortable speaking English in front of your class?" Seven participants responded that they felt more relaxed about speaking English in front of their classmates (e.g., "I am more relaxed because I understand the pronunciation a little more"; "I am more relaxed because I can pronounce a little better"). Interestingly, these quotes provide some preliminary evidence that participants experienced at least some sense of relaxation as a result of having a better understanding of L2 pronunciation.

Overall, participants reported that they enjoyed the site, particularly because it involved the assignment of coins and intrinsic competition (n=3), or watching videos to gain points to compete (n=7). In response to the question about the perceived weaknesses, five of the responses were related to the interface being in English. The other most common issue reported was that the videos did not always load properly (n=3).

Discussion and Concluding Remarks

The goal of this study was to examine the pedagogical effectiveness of a gamified online site with pronunciation videos to aid the development of the L2 segments /r/ and /l/ and related explicit phonetic awareness by a group of Japanese EFL learners. Our findings provide quantitative evidence that the proposed pedagogical approach contributed to the development of English /l/ and /r/ over the treatment period. This finding conforms with Saito (2013), who reported pronunciation improvements in /r/-/l/ production when participants received a combination of form-focused instruction and explicit phonetic information. The results also conform with Saito (2013) with regard to explicit phonetic

information aiding the production of /l/ and /r/, as the instructional videos provided an explicit (often exaggerated) pronunciation of the target features.

In addition to the quantitative evidence offered, the qualitative data suggest that some students developed explicit phonetic awareness, likely aided by the pronunciation videos; consequently, they felt less anxious after completing the experiment, thus confirming Fogg's (2002) assumption that using technology as a *medium* can make anxiety-inducing activities more approachable—developing explicit phonetic information and practicing pronunciation in the case of this study. Furthermore, unlike the classroom learners in Baran-Łucarz (2014) who experienced pronunciation anxiety, it appears that the digital environment in this study enabled some participants to practice pronunciation in a more comfortable way.

Practicing pronunciation while being rewarded with experience points in a gamified environment may have also contributed to helping learners detect progress and persevere at learning about and pronouncing the target segments, as evidenced by the fact that all participants completed the assigned quizzes at least once and watched the pronunciation videos for a total of 129 times. This finding is consistent with Hitosugi, Schmidt, and Hayashi (2014), who reported instances of deep cognitive development by participants learning L2 vocabulary in a game-based system that also afforded them chances to replay "learning missions" as frequently as necessary.

Despite the promise that this study shows in regard to facilitating the acquisition of L2 phonology, there are a number of limitations that should be acknowledged. The first relates to the lack of a control group, which prevents us from drawing specific conclusions regarding the optimistic results obtained. Two other methodological limitations are the short duration of the experiment (participants spent roughly one hour in the course), and the absence of delayed posttests, which would allow us to determine if the observed improvements affected learners' long-term phonological inventory. Furthermore, the study employed a written questionnaire to examine metalinguistic knowledge. Although this instrument provided invaluable information about the participants' awareness to the articulation of /r/-/l/, a more refined qualitative approach is necessary. In future studies, the development of qualitative instruments should be guided by the literature on explicit phonetic awareness and pronunciation anxiety to appropriately probe into responses related to the development of explicit knowledge of the target features. Finally, the analysis of the qualitative data was directed by the research questions, which means that the themes were pre-determined and did not emerge as part of the data analysis. Future versions of the study require more refined qualitative measures such as interviews and focus group discussions.

In terms of phonological gains, measuring the mere accuracy of /r/ or /l/ production in all prosodic contexts does not provide a full picture of its acquisition. Whether participants improved more on onsets or codas is valuable information because, as based on the syllable structure of L1 Japanese, which only allows CV (coda-less) sequences, it is likely that word-final consonants will prove to be more difficult and, therefore, possibly more anxiety inducing than onsets. Finally, for reliability in pronunciation rating, future versions of this study will need multiple raters and the subsequent calculation of interrater reliability.

Although pilot studies do not guarantee the success of a future experiment, they are a critical first step toward understanding which aspects of a treatment to include in future iterations; this study does make a compelling case to include many of its features in a follow-up study, especially with the inclusion of a control group and more comprehensive methods that can shed light on the effectiveness of digital gamification in the acquisition of hard-to-acquire L2 phonological features. This study is a first step toward determining that L2 pronunciation techniques within a gamified setting is not only feasible in terms of design and implementation, but also potentially facilitative of L2 pronunciation.

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