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Teaching Pronunciation: Is Explicit Phonetics Instruction Beneficial for FL Learners?

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ABSTRACT

Pronunciation instruction has been shown to improve learners' L2 accent in some, though certainly not all, cases. A core component of traditional pronunciation instruction is explicit lessons in L2 phonetics. Studies suggest that Spanish FL learners improve their pronunciation after receiving instruction, but the effect of phonetics instruction has not been directly compared with other pedagogical alternatives. This study reports on the pronunciation gains that first, second, and third year learners (n = 95) made after receiving either explicit instruction in Spanish phonetics or a more implicit treatment with similar input, practice, and feedback. The target phones included a variety of consonants that are problematic for English speakers learning Spanish: stop consonants (/p, t, k/), approximants ([β, ð, □]), and rhotics (/□, r/). Learners' production of the target phones was measured in a pretest, posttest, delayed posttest design using a word list reading task. Learners in both groups improved their pronunciation equally, suggesting that it might be the input, practice, and/or feedback included in pronunciation instruction, rather than the explicit phonetics lessons, that are most facilitative of improvement in pronunciation.

Keywords: pronunciation, accent, phonetics instruction, Spanish

Foreign accent is typical of second language (L2) and foreign language (FL) learners.[1] Though accentedness might have only a minor impact on comprehensibility and intelligibility (Derwing & Munro, 2009), learners are concerned nonetheless with reducing the accentedness of their speech (e.g., Derwing, 2003; Harlow & Muyskens, 1994; Timmis, 2002), perhaps because they are aware that native listeners sometimes judge accents negatively (Derwing & Munro, 2009; Eisenstein, 1983; Galloway, 1980). The extent to which targeted instruction helps learners improve their L2 accent is still an empirical question. While the amount of general language instruction does not seem to affect global accent (Piske, MacKay, & Flege, 2001), pronunciation instruction has been shown to improve L2 production accuracy (Neufeld, 1977; Piske et al., 2001) in L2 as well as FL contexts, including English (Pennington & Richards, 1986), French (Clark, 1967; Walz, 1980), German (McCandless & Winitz, 1986; Moyer, 1999), and Spanish (Elliott, 1995, 2003; Lord, 2005), leading some researchers to suggest that most adult L2 learners do not achieve native-like pronunciation without the help of explicit instruction (Bongaerts et al., 1997; Fullana, 2006). Drawing learners' attention to particular acoustic features of the L2 system, even briefly, seems more expedient than merely exposing them to L2 sounds in the hope that they will discover those relevant acoustic features for themselves (Wipf, 1985).

The type of targeted instruction employed in the abovementioned studies includes several components considered important for facilitating learners' acquisition of the L2 phonological system, thereby improving their pronunciation. The instruction, logically, is often called *pronunciation instruction*. The central component of such instruction is usually explicit teaching of L2 phonetics, typically with an emphasis on the phonetic parameters relevant to segmentals (i.e., isolated consonants and vowels) such as place and manner of articulation. These are illustrated with drawings (e.g., Clark, 1967) or, more recently, animated diagrams of the vocal

tract and waveforms and spectrograms produced with acoustical analysis software (e.g., Lord, 2005). Though suprasegmental features may contribute more to accentedness than segmentals (e.g., Derwing, Munro, & Wiebe, 1997; Derwing & Rossiter, 2003; Missaglia, 2007), pronunciation instruction has traditionally emphasized segmentals (Jenkins, 2004), perhaps because they are easier to teach (Dalton & Seidlhofer, 1994).

Phonetics instruction in the FL classroom typically emphasizes the differences between learners' L1 and L2 phonological systems with regards to phonemic inventories, articulation of analogous phones, grapheme–phoneme correspondences, and phonological processes. In addition to this explicit phonetics instruction component, pronunciation instruction usually includes perception practice in the form of phoneme discrimination and identification exercises, often with feedback. Pronunciation practice is also included, with the format varying considerably from word reading to jazz chants, and feedback varying from teacher-fronted pronunciation modeling to the visual and individualized feedback provided by acoustical analysis software packages. All these exercises, in addition to the core component of explicit phonetics lessons, have been thought to facilitate acquisition of target-like L2 pronunciation (Arteaga, 2000; Elliott, 2003; Barrera Pardo, 2004).

Yet for all the apparent benefit of instruction, a thorough review of the empirical studies indicates that their results are in fact complex and sometimes even contradictory (Elliott, 2003; Piske et al., 2001). Some studies have reported that pronunciation instruction has little to no effect on learners' pronunciation accuracy (Purcell & Suter, 1980; Suter, 1976; Tominaga, 2009). Others have concluded that instruction improves segmental production but not comprehensibility (Derwing et al., 1997) or vice versa (Saito, 2011). Instruction is not equally effective for all the segmental phones taught (e.g., González–Bueno, 1997; Lord, 2005). Instruction might assist

learners in gaining explicit knowledge to support their performance on certain types of tasks, such as reading words from a list, but it may be less useful for spontaneous speech outside the classroom (Venkatagiri & Levis, 2007).

The conflicting evidence about the putative benefits of instruction may be due to differences in experimental methods (e.g., word lists versus spontaneous speech tasks), instructional techniques (e.g., traditional pronunciation drills versus acoustic analysis of speech) and learning contexts (e.g., input-rich L2 settings versus relatively input-poor FL settings). Additionally, a host of other factors influences the effectiveness of instruction, including the developmental readiness of learners, the particular L2 speech elements targeted, L1/L2 language pairs, and time on task (for example see Barrera Pardo, 2004, for a review of these factors in the EFL context). Therefore when evaluating the evidence regarding the value of pronunciation instruction, it is crucial to limit the scope of analysis and define precisely for whom and under what conditions the instruction is being evaluated.

PHONETICS INSTRUCTION FOR SPANISH FL

Though some prior research in the Spanish FL context addresses the suprasegmental features of stress and intonation (Bullock & Lord, 2003; Face, 2004, 2005; Lord, 2007; Nibert, 2005, 2006), the majority of research focuses on segmentals, as summarized in Table 1. Eight consonantal phones [p, t, k, β, ð, □, □, r] are prominent in this literature because they are widely recognized as being late acquired by English speakers learning Spanish (e.g., Castino, 1992; Díaz–Campos, 2004; Face & Menke, 2010; Reeder, 1998; Rose, 2010; Simões, 1996; Waltmunson, 2006; Zampini, 1993, 1998). These eight phones will now be described briefly,

because a basic knowledge of the target phones is necessary to fully understand the results of the studies that have gauged the impact of phonetics instruction on Spanish FL learners' accent.

<INSERT TABLE 1>

English speakers tend to produce Spanish /p, t, k/ in syllable-initial and stressed position (for example, in the Spanish words ***p****asa,* ***t****oro*, or ***c****oco*) with overly long voice onset times (VOT) and aspiration, leading to a noticeable accent (Hualde, 2005; Lord, 2005).[2] There is evidence that learners' VOT diminishes over time as they gain more experience with Spanish but does not fall within native speaker range even at very advanced levels of L2 Spanish proficiency (e.g., Lord, 2005; Reeder, 1998). As for Spanish /b, d, g/, English speakers have difficulty producing their approximant allophones [β□, ð□, □□] (usually represented without the diacritic, as [β, ð, □]) in the required contexts, which are everywhere except after a pause or nasal (Hualde, 2005).[3] Even advanced English-speaking learners tend to produce stops for Spanish [β, ð, □] (for example, in the Spanish words *o****b****oe,* *to****d****o*, or *la****g****o*), resulting in a noticeable nonnative accent (Zampini, 1993). The difficulties English speakers face when acquiring the Spanish rhotics, /□/ (an alveolar tap) and /r/ (an alveolar trill),[4] are multi-faceted. Substitution of the American English /□/ for Spanish /□/ or /r/ (for example, in the Spanish words *pe****r****o or pe****rr****o*) is noticeably nonnative, yet it is a pervasive feature of English speakers' production of Spanish (e.g., Elliott, 1997; Face, 2006; Major, 1986). The trill requires substantial articulatory force to produce, which perhaps explains why even professionals with more than 25 years of Spanish-speaking experience cannot always produce target-like trills (Face & Menke, 2010). Production of the Spanish tap, on the other hand, may have less to do with articulatory constraints than with L1-based routines of perceiving the alveolar tap /□/ as an allophone of /t/ and /d/ in post-tonic intervocalic positions (e.g., in words such as *letter* and *ladder*) (Reeder, 1998; Waltmunson,

2006). This discussion of the target phones is exceedingly brief, but the reader may consult Hualde (2005) for more detailed descriptions of the articulatory and acoustic properties of the target phones as well as a more detailed discussion of English speakers' pronunciation.

With the exception of /□/–/r/ in intervocalic position, these target phones do not form contrastive pairs in Spanish. In this way the set of target phones in the current study differs from much of the pronunciation research on other L2s, which has emphasized the acquisition of L2 contrastive phone pairs that do not exist in learners' L1, most famously the /□/–/l/ distinction in English (e.g., *road* versus *load*) as produced by Japanese speakers. However, the target phones of the current study have been examined repeatedly in investigations of Spanish FL phonetics instruction, summarized in Table 2, because they constitute some of the most salient features of an American English accented Spanish. In the studies summarized in Table 2, instruction ranged from 5–10 minute lessons to semester-long phonetics courses, learners' course levels ranged from low intermediate to advanced, and speech elicitation tasks ranged from word list reading to spontaneous production, yet all these studies reported positive effects of instruction for most if not all target phones. Reduction of VOT was reported for all the voiceless stops (/p, t, k/) in Elliott (1997) and Lord (2005) and for /p/ in González–Bueno (1997). Improvement in production of the approximants [β, ð, □] in required contexts was reported in Castino (1996) and Lord (2005). Lord (2010) suggested that a two-month summer immersion program was beneficial for all students' production of [β, ð, □], but those who had previously taken a phonetics course improved more dramatically. All studies that included rhotics reported improvement after instruction (Castino, 1996; Elliott, 1997; Lord, 2005), particularly for the trill (Elliott, 1997). Only Elliott (1995) reported effect size, concluding that instruction accounted for 14% of variance in posttest scores.

<INSERT TABLE 2>

As can be surmised from Table 2, the experimental designs of these studies likely predisposed them to finding positive effects of instruction, which the authors readily acknowledge. Castino (1996) and Lord (2005) did not include a control group, so while learners' pronunciation improved from the beginning to the end of their semester-long phonetics course, it cannot be concluded that the improvement was due only to the instruction they received. Elliott (1995, 1997) and González–Bueno (1997) compared their instructed learners with an intact class of learners at the same curricular level who did not receive targeted instruction. Yet the classes differed in more ways than just explicit instruction, including the types of exposure, practice, and feedback learners received regarding the target phones. For example, the learners in Elliott's (1995, 1997) experimental group received immediate and consistent corrections on their pronunciation errors, whereas errors were largely ignored for the control group, perhaps because this feedback was viewed as an essential component of instruction. Unfortunately, such experimental designs do not permit the researcher to tease apart the effect of instruction from other factors that may contribute to improvement in pronunciation, such as learners' attention being drawn repeatedly to the target phones.

The present study, in contrast, evaluated the effectiveness of explicit teaching of Spanish phonetics as compared with a more implicit methodological alternative. Other researchers have examined various elements and methodologies of pronunciation instruction, with mixed results. Chung (2008) compared explicit, implicit, and noticing instruction for improving Chinese EFL learners' production of English word stress and found that all groups improved equally on the posttest, but the explicit group was significantly better in the delayed posttest. Macdonald, Yule, and Powers (1994) found no significance difference in the pronunciation changes of Chinese

EFL learners exposed to traditional drilling activities, self-study with tape recordings, or interactive activities, although all methods were superior to a no-intervention control condition. Moyer (1999) reported that feedback was a significant predictor of accent for English speaking German learners, and de Bot (1983) reported that Dutch EFL learners benefited from visual feedback in learning English intonation whereas auditory feedback alone (hearing themselves) was detrimental, yet Ducate and Lomicka (2009) found no benefit for practice and feedback in their podcasting experiment with German and French learners. Thus there is still work to be done unpacking the elements of pronunciation instruction so as to determine which are the most effective, whether in isolation or in combination.

It seems particularly relevant to question the effectiveness of explicit instruction in phonetics because it is precisely this element of pronunciation instruction that is least appealing to those who view it as overly form-focused and in opposition to their communicative, meaning-focused methodology (see discussions in Arteaga, 2000, and Morin, 2007) and argue that pronunciation instruction needs to be better integrated into communicative activities (Isaacs, 2009). Alternatives for bringing learners' attention to the L2 sound system, perhaps through targeted exposure, focused listening, dictation, transcription, or other means, should be explored and weighed against the potential benefits of explicit phonetics instruction.

Another ancillary but highly relevant question is when to provide phonetics instruction, if at all. There may be an optimal stage in the L2 acquisition process or an optimal moment in the L2/FL curriculum. The FL curricula that do include phonetics instruction typically offer a course at the advanced level, but whether or not this sequencing is optimal is still an empirical question. The relative contribution that pronunciation makes towards assessments of global language proficiency seems to be a U-shaped curve, with pronunciation being most important in the early

and advanced stages of L2 acquisition (Higgs & Clifford, 1982). If instruction leads to short-term improvements in pronunciation, then perhaps instruction is best provided early in the curriculum and then revisited in advanced courses. Certainly there are proponents of providing instruction at the outset of learning (e.g., Arteaga, 2000). Yet researchers investigating phonetics instruction in the Spanish FL context have more often recruited participants at the intermediate to advanced levels (see Table 2) and have encouraged others to replicate their studies with more novice learners (e.g., Elliott, 1995; Lord, 2005).

The present study attempts to address some of these remaining questions by evaluating the explicit teaching of L2 phonetics as separate from the other putatively beneficial aspects of pronunciation instruction and recruiting learners at multiple curricular levels. The research questions were:

1. Does instruction in L2 phonetics improve learners' ability to produce L2 phones?
2. Does the effectiveness of instruction depend on learners' curricular level?

METHOD

Participants

Participants (n = 95) recruited for this study were enrolled in introductory, intermediate, or advanced Spanish FL courses at a large, public university in the southeastern United States. Seven intact classes participated, taught by five instructors. Instructors were Spanish-dominant until at least adolescence, had formal education in Spanish, and had lived in the United States and taught Spanish for eight or more years. Learners were not tested for proficiency and will be referred to as first year, second year, and third year learners. Though the curriculum allowed for flexibility in course sequencing, students at this institution usually took these courses in their

first, second, and third year of FL study, respectively. Initially 124 participants were recruited, but the data of 29 participants were not included in the analysis because they missed multiple sessions or did not meet the background criteria: minimum 18 years old, no Spanish exposure before age ten, and no previous instruction in Spanish phonetics. Of the remaining participants, 58 were female and 37 were male. Their mean age was 22.06 (range 18 – 44) and their mean age at the onset of learning was 15.66 years (range 11 – 40). These background data, along with information about experience with other languages, were self-reported by the participants.

Native speakers (NSs) of Spanish (n = 10) were recruited to provide baseline data. The NSs were natives of Chile, Colombia, Mexico, and Spain. They resided in the United States to attend graduate school or to work as professionals. Half were males and half were females. Their mean age was 30 (range 24 – 37), their mean age at the onset of learning English (EFL) was 8.4 years (range 5 – 15), and their mean time of residence in the US was 4.42 years (range 2 months – 10 years). All reported advanced or very advanced English proficiency and no prior instruction in phonetics. It was expected that the bilinguals' pronunciation of the target phones would differ from monolingual Spanish speakers (Flege, 1981; Lord, 2008), yet because their speech exhibited no nonnative or nonstandard accent, their pronunciation of the target phones was considered an appropriate baseline with which to compare learners of Spanish. Though monolingual NSs of the L2 are often employed in L2 phonology research, NSs of the target language in a FL setting are more often than not bilingual, and so bilingual speakers of Spanish were recruited so as to provide baseline data that would be context-appropriate.

Materials

The experimental, phonetics instruction group (+ PI) completed four computer-delivered, interactive modules focused on (a) an introduction to articulatory phonetics, (b) voiced stops /p,

t, k/, (c) approximants [β, ð, □], and (d) rhotics /□, r/.[5] All learners began with the introduction to articulatory phonetics. The other modules were counterbalanced. The modules presented the following information and activities: an explanation of grapheme–phoneme correspondences, an explanation of the place and manner of articulation along with an animated diagram of the vocal tract, an explanation of differences in the articulation of analogous Spanish/English sounds and the phonological environments in which the sounds are produced in each language, and identification activities which required learners to identify Spanish and English sounds or identify the manner of articulation (e.g., occlusive [edo] versus approximant [eðo]).

After each section of the module, there was a brief multiple-choice comprehension check that participants had to answer accurately before proceeding. Finally, each module contained a pronunciation practice activity that directed learners to listen to and repeat after a native speaker producing Spanish phrases until their pronunciation approximated the native speaker. Learners received no additional feedback on their pronunciation. Appendix A contains screen shots displaying sample information and activities from one module. Though a time limit of 25 minutes per module was suggested, the modules were self-paced, and learners actually spent between 15 and 40 minutes on each. The instructional time per phone was thus brief but on par with the amount of time devoted to each L2 phone in other non-specialized FL classes in similar studies (e.g., Elliott, 1995; González–Bueno, 1997). The instruction exposed learners minimally to ten unique tokens of each target phone, three of which were contained in the pronunciation practice section.

Learners in the control group (−PI) completed self-paced, computer-delivered, interactive online modules that provided exposure, practice, and feedback like the +PI, but they received no explicit instruction in phonetics. The −PI modules consisted of video vignettes featuring native

speakers of Spanish talking about a variety of topics.[6] The vignettes feature speakers from the capital cities of Spain, Colombia, Peru, Ecuador, Costa Rica, and Guatemala, none of whom produce the target phones in non-standard ways. Learners watched the vignettes, completed a dictation, compared their dictation with the official transcript, read the English translation for meaning, commented on the speaker's accent, and repeated a particular sentence in the video until their pronunciation was like the speaker's. Appendix B provides an example of instructions given to the −PI group. The vignettes were level appropriate and related to the topics on the course syllabi. As different vignettes were chosen for each class level and all featured natural, authentic language, the −PI modules could not be so strictly controlled as to contain the target phones in exactly the same amounts as the +PI. On average learners in the −PI were exposed to the same number of unique tokens of the target phones as the +PI: ten unique tokens of each target phone, three of which were contained in the pronunciation practice section. However, learners in both groups could click again and listen to each token as often as they liked, and so learners likely heard and/or pronounced more than these minimal tokens during instruction.

The dictation exercises were comparable to the phonetics instruction in that both presented the target phones in roughly equal amounts, required that learners focus their attention on the target sounds, provided pronunciation practice with identical feedback conditions, and required equal time on task. The main difference was that the dictation exercises of the −PI provided no explicit instruction in phonetics. However, it must be noted that learners in the −PI were never told which phones were the linguistic targets of the study, which may have constituted an important difference between the conditions. Also, the pronunciation practice was slightly different in that the −PI group practiced with slightly longer phrases than the +PI.

The production test was a 28-item list of words and phrases that participants read aloud. The tests items are presented in Appendix C, with graphemes representing the target phones in boldface, though they were not bolded for students. A word list was used rather than a sentence task or spontaneous speech so that first year learners would not be cognitively overburdened by the task and could focus mainly on pronunciation. Of the 28 items, 20 were selected from the first year textbook. The other eight were, in my estimation, advanced-level vocabulary (e.g., *calaba* [was soaking]). These items were included in an effort to equalize the difficulty learners at different levels would face when producing the target items. Indeed, learners were highly accurate in translating the first year textbook words to English, but none was able to translate the words deemed advanced. In total, the test included four tokens of each target phone, in a variety of phonological environments. The items were presented in different orders on the pretest, immediate posttest, and delayed posttest.

Procedures and Analysis

The study was a pretest, posttest, delayed posttest design, summarized in Figure 1. Participants were randomly assigned to an instructional condition (+PI or −PI). They completed the study during normal class time without extra credit or compensation. In between the experimental treatment sessions, classes within each course level followed similar syllabi, which did not contain any phonetics or pronunciation instruction. Instructors reported that they typically listened for learners' pronunciation errors and corrected them on occasion during class meetings but also that they emphasized communication and fluency more than pronunciation accuracy. Instructors agreed not to provide any additional phonetics or pronunciation instruction during the study. Instructors were unaware of the research questions and target phones. Learners were told simply that the study was designed to develop instructional materials for listening and

speaking skills. Learners completed the study while seated at individual computer stations in a language lab, wearing noise-canceling headphones. They recorded their production tests as WAV files with a sampling rate of 22 KHz and sampling size of 16 bit. NS participants completed the study at a quiet location convenient to them and were recorded using Praat software at a sampling rate of 44 KHz and 16 bit.

< INSERT FIGURE 1>

An independent rater transcribed the production data and assigned scores to the approximant and rhotic phones. The rater was a native speaker of Spanish pursuing a PhD in Spanish linguistics with an emphasis on phonetics and phonology. He was unaware of the research questions and hypotheses of the study. The approximately 400 sound files were coded so as not to indicate time of test, learners' class level, or learners' group assignment, and they were rated in random order. The rater used auditory cues as well as waveforms and wide-band spectrograms (window of .005s) in Praat. Only a few productions were not rated because the participant misread the word and did not include the target phone or the sound quality was poor due to background noise, participant whispering, etc. Productions of rhotics and approximants were assigned three points if they demonstrated all the auditory and acoustic properties that are associated with their ideal Spanish pronunciation, one point if they demonstrated all the auditory and acoustic properties that are associated with an English-accented pronunciation, and two points if they demonstrated a combination of the auditory and/or acoustic properties of both languages. The rating scale is detailed in Table 3. In order to construct this rating scale, the researcher and the independent rater discussed these properties at length while analyzing a representative sample of Spanish learners' and NSs' recordings for each test item. Table 3 lists the relevant properties analyzed for each phone. Figures 2 – 4 display spectrograms illustrating

the acoustic evidence supporting various ratings of one target phone. The rating was reliable; I independently rated a randomly selected 10% of the approximant and rhotic data (770 target phone productions) and found inter-rater agreement on ratings for 95% of those data (Cronbach's alpha of .96).

<INSERT TABLE 3>

<INSERT FIGURES 2–4>

I measured the VOT of /p, t, k/ tokens using evidence from waveforms and wide band spectrograms displayed in Praat, measuring manually from the release of the stop closure to the first glottal pulse. Since this measurement technique is objective and reliable, a second rater was not used. Due to the nature of the word reading task, intra-speaker and inter-speaker differences in speech rate were considered immaterial and were not controlled for. VOT data are presented in the results section separately from approximant and rhotic rating data, though the VOT data were also transformed into the 1– 3 points rating scale so that an 8-phone aggregate score could be calculated.[7]

RESULTS

The +PI and −PI groups were compared at each course level (first, second, and third year) on many relevant variables using independent samples T-tests. No significant difference between the +PI and −PI groups was found (all $t < 2.27$, $p > .05$) in terms of: sex, current age, age at the onset of Spanish learning, number of Spanish courses taken in high school, number of Spanish courses taken in college, number of native speaking teachers,[8] time spent using Spanish outside of class, and languages other than Spanish learned to a high proficiency. One significant difference was found, which was time spent abroad using Spanish. The third year +PI learners

spent more time abroad ($\bar{x}$ = 91.85 hours, s = 101) than the third year –PI learners ($\bar{x}$ = 12.26 hours, s = 22.04) ($t(17) = 2.30$, $p = .03$, CI 6.64 – 153). Time spent abroad was calculated by multiplying the number of weeks spent abroad by the number of hours spent each week using Spanish while abroad. However, a closer look at the data showed that the group difference was related to just three individuals in the +PI who had immersion experiences of two weeks, one month, and two months, respectively. It was decided that these participants would be kept in the analysis.

The average VOTs produced for the target phones /p, t, k/ by learners and NSs are presented in Table 4. Note that NSs in this task produced relatively long VOTs; the widely cited Lisker & Abramson (1964) study reported that the average VOT is 4 ms for Spanish [p] as compared to 58 ms for English [p^h], 9 ms for Spanish [t] as compared to 70 ms for English [t^h], and 29 ms for Spanish [k] as compared to 80 ms for English [k^h]. Several factors may have coincided to produce the relatively long VOTs. Task effects may have been at issue, as the task in this study involved word reading rather than continuous speech, and all phones were word-initial (Torreblanca, 1988). Also, the bilingual speakers' VOTs in Spanish may have been longer due to influence from English phonology (Flege, 1981; Lord, 2008). Table 5 presents the average ratings assigned to learners' and NSs' productions of the approximant and rhotic target phones.[9] Note that NSs' average ratings ranged from 2.43 – 3.00. Recall that tokens were assigned three points only if they fit all the auditory and acoustic criteria of an idealized realization of the target phone. The NSs were bilingual speakers with dialectal differences, and though nothing about their speech sounded nonnative, some of their utterances were not acoustically ideal, as described in the phonological literature. No NS received fewer than two points on any token, however. Even though the NSs had longer VOTs and lower ratings than one might expect, still

learners' pronunciation was found to be significantly less target-like than the NSs, using independent samples T-tests. This was true of every phone and for learners at all course levels, before and after instructional intervention.

<INSERT TABLE 4>

<INSERT TABLE 5>

A repeated measures analysis of variance (RMANOVA) was used to compare the effects and interactions of test time, instructional condition, and course level, after verifying that the data met the assumptions for an ANOVA. The within-groups factor was time of test (pretest, immediate posttest, and delayed posttest) and the between-groups factors were instructional condition (+PI and −PI) and course level (first, second, and third year). On the full production test (aggregate of eight phones), there was a main effect for time $F(1.64, 125) = 4.34$, $p = .02$, $\eta_p^2 = .05$, and level $F(2, 76) = 12.83$, $p < .001$, $\eta_p^2 = .25$, but no interaction reached significance (all $F \leq .82$, all $p \geq .05$). The results of the RMANOVA are presented in Table 6. The pairwise comparisons, presented in Table 7, indicated that first year students' scores were significantly lower than those of second and third year students. This finding was not surprising, and because the level by time interaction did not reach significance, there was no evidence that course level affected change across time, after instruction. More interestingly, the pairwise comparisons indicated that learners' posttest scores ($\bar{x} = 15.29$, $s = 3.80$) were significantly greater than their pretest scores ($\bar{x} = 14.89$, $s = 3.80$), but their delayed posttest scores ($\bar{x} = 15.29$, $s = 3.78$) were not. Thus for the production test overall (aggregate of eight phones) learners improved slightly immediately after instruction, with time of test accounting for 5% of the variation in scores, but instructional condition and course level did not have a significant effect. The aggregate

production test scores for the +PI and the –PI groups are plotted in Figure 5. Figure 6 displays learners' scores on individual target phones, with the results of the +PI and –PI grouped together.

<TABLE 6>

<TABLE 7>

<FIGURE 5>

<FIGURE 6>

RMANOVAs were also used to analyze scores on each phone, with the within-groups factor of test time and the between-groups factors of instructional condition and course level. Since there was a paucity of significant differences, full RMANOVA tables will not be presented. Furthermore, only the significant main effects and interaction effects related to the variable of time will be discussed, because it is the *change* in scores *over time after instruction* that is the main concern of the present study.

<B>/p, t, k/

While there was no significant main effect or interaction when all four items of each voiceless stop were included in the analysis, significant effects were found when the analysis was limited to the items in which the target phones were in stressed syllables (i.e., *para, perro, pace*, *tal, tú, talle, que, como,* and *cace*, but not *pintar*, *tocar,* or *cubano*). Both types were included because it was expected that learners would aspirate /p, t, k/ word-initially even in unstressed syllables (as reported in Hualde, 2005). However, since a clear pattern emerged with /p, t, k/ in stressed syllables, and the stimuli of similar studies (e.g., González–Bueno, 1997) have analyzed /p, t, k/ in stressed syllables only, the results of those analyses will be presented below. For all stop consonants in initial, stressed position there was a significant effect for time (all $F >$ 4.23, $p < .02$), with time of test accounting for 7 – 13% of variance in scores. Pairwise

comparisons confirmed that posttest VOTs (in milliseconds) for all stop consonant phones were shorter than pretest VOTs, indicating improvement after instruction: /p/ (pretest $\bar{x}$ = 51, s = 26; posttest $\bar{x}$ = 44, s = 22), /t/ (pretest $\bar{x}$ = 61, s = 30; posttest $\bar{x}$ = 56, s = 28), and /k/ (pretest $\bar{x}$ = 65, s = 23; posttest $\bar{x}$ = 58, s = 22). However, only for /k/ was the delayed posttest VOT significantly shorter than the pretest (pretest $\bar{x}$ = 65, s = 23; delayed posttest $\bar{x}$ = 61, s = 21). One interaction reached significance, which was the interaction of time by condition by level for the phone /t/ (F(3.69, 144) = 2.63, p = .04, n_p^2 = .06). This interaction was analyzed with corrected paired samples T-tests, which indicated that there were no significant differences in the VOTs that subgroups of learners produced for /t/.[10] In sum, then, learners in both instructional conditions reduced VOTs for the stop consonants in initial, stressed position immediately following instruction. This was retained three weeks later in the case of /k/.

<B>[β, ð, □]

The results of the RMANOVAs for the scores of the approximant target phones [β, ð, □] were quite disparate. For [β], there were no significant main effects or interactions (all F < 1.56, p > 0.20), suggesting that neither instructional condition was useful for improving learners' production of [β], at least during the time period of this study. For [ð], there was a main effect of time F (2, 154) = 6.02, p < .01, n_p^2 = .07), but no significant interaction was found (all F < 2.36, p > 0.08), suggesting that instruction of either type was associated with a small but significant change in the ratings learners received on their production of [ð]. Pairwise comparisons indicated that ratings of learners' production of [ð] on the pretest ($\bar{x}$ = 1.43, s = 0.58) were not significantly different from their posttest ratings ($\bar{x}$ = 1.35, s = 0.57) or their delayed posttest ratings ($\bar{x}$ = 1.44, s = 0.52) but rather that the significant effect was the increase in ratings from their posttest to delayed posttest. It should be noted that there was no qualitative difference in learners'

production between pretest and posttest productions of [ð]. Rather, learners tended to incorrectly realize [ð] as [d] on both tests, but they did so more often on the posttest, particularly for the test items *adiós* (28% decrease in accuracy compared to pretest) *computadora* (15%), and *avenida* (11%). As for [□], there was a significant main effect for time $F(2, 154) = 3.27$, $p = .04$, $n_p^2 = .04$, but pairwise comparisons indicated that neither the posttest nor delayed posttest ratings were significantly different from the pretest (all $p > .05$). There was also a significant interaction between time, condition, and level $F(4, 154) = 3.37$, $p = .01$, $n_p^2 = .08$. This interaction was analyzed with corrected paired samples T-tests, which indicated that there were no significant differences in the ratings subgroups of learners received for their production of [□]. In sum, then, neither instructional condition was associated with an increase in the ratings of learners' productions of [β, ð, □] over time. There was no change over time for [β], a small decrease in ratings post-instruction for [ð], and little change over time for [□].

<B>/□, r/

The change in learners' productions of the rhotic phones over time was more similar to that of the stop consonants than the approximants. The RMANOVAs on the rhotic data indicated that there was a significant main effect of time for both /□/ ($F(1.85, 143) = 3.63$, $p = .03$, $n_p^2 = 0.05$) and /r/ $F(2, 146) = 4.19$, $p = .02$, $n_p^2 = .05$. There were no significant interactions for either phone (all $F < 2.02$, $p > 0.10$). Pairwise comparisons indicated that ratings of learners' posttest productions of /□/ ($\bar{x} = 2.40$, $s = 0.64$) were significantly higher than their pretest ($\bar{x} = 2.24$, $s = 0.72$) but that their delayed posttest ratings ($\bar{x} = 2.29$, $s = 0.71$) were not significantly higher than the pretest. Likewise, ratings of learners' posttest productions of /r/ ($\bar{x} = 2.09$, $s = 0.50$) were significantly higher than their pretest ($\bar{x} = 1.95$, $s = 0.53$), but their delayed posttest ratings ($\bar{x} = 2.07$, $s = 0.57$) were not significantly higher than their pretest. In sum, learners in both conditions

made some small but significant improvement in their production of the rhotic phones after instruction but did not retain gains by the 3-week delayed posttest.

DISCUSSION

The first research question asked whether instruction in L2 phonetics would improve learners' ability to produce more native-like L2 phones. Based on the generally positive effects found in the literature, it was hypothesized that phonetics instruction would prove beneficial for learners' production of the target phones. However, the data did not suggest that the phonetics instruction provided any advantage in the production test, either for individual phones or for all the phones analyzed together. The only effect that reached significance for almost all phones and for the aggregate test was the main effect of time, which indicated that learners in both instructional conditions improved their pronunciation of most phones immediately following instruction.

The second research question asked whether the effectiveness of the instruction would depend on learners' curricular level. It was hypothesized that the effectiveness of instruction would vary by target phone and would interact with learners' course level in possibly complex ways. There was an interaction with course level for two phones: /t/ and [□], but for both, the only differences found involved learners in the control group, and these differences did not reach statistical significance once corrected for multiple comparisons. Therefore the data did not suggest that learning from the phonetics instruction was influenced by course level.

The present study replicated much of what had been reported in previous pronunciation research. Learners improved their pronunciation of these consonantal phones as they gained L2 experience yet did not reach native speaker norms even after reaching advanced-level courses

(e.g., Face & Menke, 2010; Reeder, 1998). Phonetics instruction produced modest improvement in learners' pronunciation overall and for some phones in particular, namely the stops /p, t, k/ in stressed syllables and the rhotic phones /□/ and /r/ (Elliott, 1995, 1997; González–Bueno, 1997; Lord, 2005). However, the approximant phones [β, ð, □] did not improve post-instruction in the present study, which concurs with Elliott (1997) but stands in opposition to Lord's (2005) study with more advanced learners in a full semester phonetics course.

As in previous studies, here instruction did not affect all target phones in equal measure. Elliott (1997) provided an extensive discussion of why target phones respond to instruction differently, basing his claims variously on known contrasts between Spanish and English phonologies, notions of universal markedness, and general theories of phonological development. Empirical data suggest that the Spanish approximants are resistant to instruction and are late acquired (Díaz–Campos, 2004; Zampini, 1993), perhaps because approximants are more universally marked than stops (Eckman, 1977; Jakobson, 1941). Also, it may be the case that the acoustic cues differentiating the approximants from their analogous L1 stops (/b, d, g/) are less well perceived by English speaking learners than those differentiating the stops and rhotics from their analogous L1 phones, which may affect learnability (e.g., Flege, 1995). Furthermore, González–Bueno and Quintana–Lara (2010) suggested that learners begin to recognize the spirantization rule (the rule for when stops should be realized as approximants) for [ð] and [□] around the intermediate proficiency level, whereas [β] is not acquired until more advanced levels. The data in the present study partially supported that finding, because the (intermediate) learners in the current study did not change their pronunciation of [β] in response to either instructional condition. In fact, [β] was the only target phone that did not change.

The greatest contribution of the present study was its demonstration that the control condition (focused listening with dictation) was just as effective for improving learners' pronunciation as the phonetics instruction. In the past, pronunciation instruction for Spanish L2 had been assessed holistically, as a set of methodological tools including instruction in phonetics, repeated exposure to target phones, production practice, and feedback. The design of the present study allowed the effect of explicit phonetics instruction to be separated from other factors that could influence learners' pronunciation, and no added benefit was found. The result represents a challenge to the belief that it is precisely the explicit component of pronunciation instruction that is most beneficial to learners (Derwing & Munro, 2005; Fullana, 2006; Venkatagiri & Levis, 2007). Elliott (1997) suggested that instruction was likely to affect performance on discrete word-level tasks more than spontaneous speech, and yet even when a word reading task was used, no significant effect for instructional condition was found, which strengthens the argument that phonetics instruction may be less impactful than previously thought.

The null result begs the question of which component or components of pronunciation instruction actually do have the most impact on learners' pronunciation. Ducate and Lomicka (2009) found that pronunciation practice with feedback alone did not improve French and German learners' accentedness or comprehensibility. Chung (2008) argued that exposure and attention to the target feature were more relevant than other instructional characteristics for improving L2 speech. Taken together with the results of the present study, one might conclude that the most valuable component of pronunciation instruction is drawing learners' attention repeatedly to the target phones and thereby helping students orient their attention towards relevant features of the L2 speech. However, this conclusion is preliminary and must be explored with more research. Importantly, the result did not support a rejection of explicit phonetics

instruction wholesale but rather indicated that several components of pronunciation instruction were helpful for developing learners' productive skills and that these components could be incorporated into a variety of other instructional methods. Also, it should be emphasized that the effect size of both types of instruction was small, around 5%, and was not retained three weeks post-instruction for most phones. Neither instructional treatment was a panacea for improving accent.

One might argue that a longer instructional treatment is required to produce greater improvement in learners' pronunciation, particularly for the later acquired approximant phones. Evidence to the contrary is that learners' pronunciation of the approximants actually worsened immediately following instruction, though it is possible that this worsening was a temporary decline as the result of learners beginning to restructure their L2 phonetic categories. Furthermore, the instructional time allotted was appropriate for imparting explicit phonetics instruction, which was the focus of the study. In their post-module and post-study questionnaires, learners reported that they had sufficient time to fully understand and complete the modules. The frequent comprehension checks ensured students' comprehension after each subsection of each module. Although the time allotted to the instructional treatment was briefer than in some prior studies (e.g., Elliott 1995; Lord 2005), it was equivalent to others (e.g., González–Bueno, 1997). The type and length of the instructional modules assessed in the present study indeed could be viewed as assets of the study design, as the modules are easily incorporable into Spanish FL curricula. The modules are free and available online. They require neither an onerous time commitment nor expertise in phonetics on the part of the instructor.

The second contribution made by the present study was to address the issue of curricular sequencing for phonetics instruction. Previous investigations of FL Spanish had included only

learners enrolled in intermediate or advanced classes (e.g., Elliott, 1995, 1997; González–Bueno, 1997; Lord, 2005), yet those researchers expressed the need to carry out similar studies with more novice learners. In the typical undergraduate FL curricular sequence of American universities, study of phonetics is relegated to a third or fourth year course for language majors and minors (Correa, 2011). Those courses aim to improve learners' pronunciation while they teach students about theories of sound production and perception as well as Spanish dialectology (Correa, 2011). Celce–Murcia, Brinton, and Goodwin (1996) characterized phonetics instruction as generally having two pedagogical foci. The first, intuitive–imitative in nature and focused on making learners' pronunciation more target-like, is best suited for beginning learners. The second, more analytic and explicit in nature and focused on analyzing linguistic features of the language in detail, is best suited for advanced learners (Brown, 1995; Celce–Murcia et al., 1996). The present study provided first, second, and third year FL learners with instruction that included a highly explicit but brief introduction to Spanish phonetics and emphasized imitation of target-like pronunciation, which presumably was developmentally appropriate for most of the learners recruited. The study compared the learning effects of those explicit lessons with an alternative that could be considered more intuitive but was otherwise comparable in terms of time on task, exposure to the target phones, pronunciation practice and feedback. Contrary to the notion that earlier is better for pronunciation instruction (Arteaga, 2000), course level did not emerge as a significant factor in this study. The data suggested that first, second, and third year learners responded similarly to the phonetics instruction and the dictation exercises for most phones. Type of instruction and course level interacted for just two phones, /t/ and [□], but the (non-significant) differences were found to be associated with the control group, not the experimental group.

The present study had several limitations, perhaps the most consequential of which was its limited inventory of phonological targets. The eight target phones were selected because they were extensively researched in the Spanish SLA literature, but they were all consonantal segments and therefore represented just one small part of learners' phonological competence. It has been rightly argued that pronunciation teaching must expand beyond the segmental level (Barrera Pardo, 2004; Pennington & Richards, 1986) and that segmentals are not as important as suprasegmental features and even more macroscopic elements like volume (Derwing & Munro, 2009). It is possible that shifting the focus of the explicit phonetics instruction from segments to suprasegmental features, like prosody, could have been even more beneficial to learners' segmental production (Missaglia, 2007). The range of phonological environments included in the present study was also limited. Learners may have performed differently when producing the segments in other environments, such as consonant clusters (Colantoni & Steele, 2008).

Other limitations resulted from the choice of experimental task, class recruitment, and timing. The production test required learners to read isolated words and phrases from a printed list. Word reading could have exaggerated learning effects from instruction or have had the opposite effect and incited more native language interference as compared with spontaneous, unmonitored speech (Tarone, 1979). The results here cannot be directly compared with studies that utilized other types of tasks and should not be extrapolated to infer the accuracy with which learners would have produced the same phones in spontaneous speech. Also, two items in the production test were Spanish–English cognates (*agosto, cubano*) that may have exacerbated transfer effects for the relevant target phones. In order to begin to address the issue of curricular sequencing, classes at three curricular levels were recruited, roughly beginners (first year), low intermediate (second year), and high intermediate (third year). The study did not recruit very

advanced learners or true beginners, as almost all students reported having studied Spanish in high school, and so the range of course levels analyzed was limited. The delayed posttest took place only three weeks after the last module was completed, which was the maximum length of time available given the limitations of a short college semester and the schedules of multiple participating classes. The delayed posttest in the current study, in terms of post-treatment timing, was more akin to the *posttest* in studies of semester-long treatments. A better measure of the effects of instruction over time would be given six months or more after treatment (Elliott, 2003).

CONCLUSION

By means of conclusion, I wish to emphasize three issues that will be important to advancing research in phonetics instruction and pronunciation instruction. I addressed the first issue directly in the current study, which is the need to tease apart the many elements of pronunciation instruction in order to better understand the relative contribution of each and thereby improve and tailor instructional techniques for teaching pronunciation to L2 learners.

The second issue was incorporated in the present study's design but not addressed directly, which is the need for L2 pronunciation research to take the bilingual turn being advocated for SLA research more generally (Ortega, 2009) by reevaluating the idealized, monolingual native speaker norms we often take for granted. For example, Lord (2005) recruited native speakers only to provide baseline data for the VOT of /p, t, k/, but assumed for all other phones and features that any native speaker would perform consistent with previously established norms. The present study, however, recruited college-educated, balanced bilingual speakers with native accents in Spanish. Their VOTs for stops were longer than expected, and

their productions of the approximant phones did not receive perfect ratings, so their speech did not reflect the idealized norms described in previous literature. Yet, in my opinion, their speech was still an appropriate target for the learners. In fact, these bilingual speakers may represent a more suitable target for the FL learners recruited than a monolingual Spanish speaker because the learners are more likely to interact with bilingual speakers living in the United States than with monolingual Spanish speakers outside the country.

The third issue is whether accentedness is in fact worthy of future study. It has been argued here that accent is important both because learners are concerned with their accent and because accentedness can in some cases impact comprehensibility and intelligibility, which are themselves arguably more consequential to L2 speakers than accent alone (Derwing & Munro, 2009). Achieving a target-like accent may even be an unrealistic and de-motivating goal for learners (Levis, 2005). Thus researchers, teachers, and learners alike need to consider carefully what level of relative importance they are willing to assign to accentedness. The most interesting research in the future will balance measures of all three: accentedness, comprehensibility and intelligibility.

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NOTES

[1] Except in instances when making a distinction between the two is relevant, henceforth both second language (L2) and foreign language (FL) will be generally referred to as L2, following current norms of nomenclature in the field of second language acquisition (Ortega, 2009).

[2] The emphasis on English speaking learners should not be taken as a suggestion that L1 is the only factor that impacts production of the L2. Nevertheless, L1 figures as enormously important in the L2 speech literature, especially for L2 learners who are immersed in a heavily L1-dominant environment, as were the learners in the present study.

[3] This predictable distribution of allophones is found throughout the Spanish-speaking world. There are exceptions, such as some Central American dialects in which occlusive forms are realized when in combination with /s, r, l/ and glides (Canfield, 1962; Zamora Munné & Guitart, 1982).

[4] Both phones can be realized as a voiced apico-alveolar sibilant in some regions of Latin America (Canfield, 1962; Resnick, 1975). The assibilated variant is not considered standard and generally is not taught to L2 learners, nor is it referenced in the instructional modules used here.

[5] The modules are part of an online instructional series called Tal Como Suena, created by Dr. Gillian Lord at the University of Florida (http://talcomosuena.spanish.ufl.edu/).

[6] These video vignettes were created by Orlando Kelm at the University of Texas Austin (*http://laits.utexas.edu/spe/*).

[7] This transformation was performed on each test item separately, utilizing the VOTs produced by NS to determine the categorical ratings as follows: 3 points were assigned to VOT values that fell within the NS range, i.e., no longer than the longest VOT produced by any NS on

that test item; 2 points were assigned to VOT values that were no longer than the NS maximum plus the value of the NS range; and 1 point was assigned to all others. For example, for the test item *para*, the VOT values produced by NS had a minimum of 5ms, a maximum of 21ms, and thus a range of 16ms. For *para*, then, learner-produced VOTs of 0–21ms were assigned 3 points, VOTs of 22–37 ms were assigned 2 points (because 21 + 16 = 37), and VOTs longer than 37 ms were assigned 1 point.

[8] This measure was collected as an approximation of exposure to non-accented Spanish. Flege's (1991) accented L2 input hypothesis claims that learners will not be able to perceive and produce L2 sounds accurately if they have received accented input in the L2.

[9] The differences in N between Table 4 and Table 5 reflect the fact that some learners' data were removed from the analysis because the learners did not complete the posttest or took the posttest at the wrong moment in the session. These types of problems occurred most often with second year learners during the third session, because there was no lab assistant present that day to help keep all learners following instructions.

[10] The uncorrected paired samples T-tests indicated that the only significant change in VOT of /t/ occurred with third year learners in the –PI group, whose posttest VOT for /t/ ($\bar{x}$ = 35 ms, s = 19 ms) was significantly shorter than the pretest ($\bar{x}$ = 43 ms, s = 21 ms) ($t(8)$= 2.68, p = 0.03, d = 0.37). However, once the alpha level was submitted to a Bonferroni correction, the difference found for third year learners did not reach statistical significance.

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TABLE 1

Empirical Studies Describing L2 Spanish Learners' Segmental Development

Author	Participants' Level(s)	N	Targets	Results *
Castino (1992)	3rd semester	20	[p t k β ð □ □ r x]	Markedness predicted difficulty.
Díaz–Campos (2004)	study abroad program or advanced at home language course	46	[p t k β ð □ l □]	No advantage for study abroad. [β ð □] were highly resistant to improvement.
Face & Menke (2010)	4th semester to professional level		[□ r]	Experience correlated with target-like production, but even the most advanced were not always target-like.
Reeder (1998)	novice to advanced levels	70	/ a e i o u p t k s r /, orthographic *h*	All phones improved with increasing experience, but even very advanced learners were not within NS range.
Rose (2010)	3rd semester to graduate level	24	/ □ r /	Delineated several developmental stages in acquisition of /□ r/.
Simões (1996)	5 weeks study abroad program	5	/ a e i o u /, overall fluency	Vowels were inconsistent. Fluency generally improved, but not significantly for all learners.
Waltmunson	1st–6th semesters	22	/ t d □ r /	Assessed relative degree of difficulty.

(2006)				
Zampini (1998)	advanced phonetics course	13	/ p b /	No correlation found between learners' perceptual abilities and production of /p b/.
Zampini (1993)	2nd & 4th semesters	32	[b d g β ð □]	Learners were highly accurate in producing /b d g/ but produced [β ð □] in fewer than 25% of required contexts.

* Results refer only to production, not perception, with the exception of Zampini (1998).

TABLE 2

Empirical Studies Assessing Learners' Pronunciation After Phonetics Instruction

Author	Participants' Level	N Exp	N Con	Targets	Instructional Time	Post-instructional* Activities and Practice (where described)	Control condition (where present)	Testing (Pre and Post)	Results
Castino (1996)	6–8th semester, phonetics course	40	n/a	[β ð □ □ r x]	full semester course	"Extensive pronunciation drilling." Audio recordings of student productions and subsequent transcribing.	n/a	1. Dialogue reading, 2. Spontaneous speech during communicative task.	Significant improvement for all phones. Spontaneous speech was more accurate than dialogue reading.

Elliott (1995, 1997)	3rd semester	43	23	[a e i o u p t k b d g β ð □ □ r □ s z w]	10–15 min/class, 21 periods	Pronunciation practice: repetition, jazz chants, rhymes, and tongue twisters. Immediate and consistent correction of pronunciation errors.	Regular section of same course taught by same instructor. Little to no correction of production errors.	1. Word repetition, 2. Sentence repetition, 3. Word reading, 4. Spontaneous speech in picture task	Instruction was significant predictor of aggregate posttest scores on tasks 1–3 (not 4), and of posttest scores of liquids and stops (not fricatives, nasals, or vowels).
González –Bueno (1997)	4th semester. OPI	30	30	/ p t k b d g /	5–10 min/class, 3 times/week,	Perceptual discrimination. Transcription.	Regular section of same course	OPI	Significant reduction of VOT of /p/ and

	determined all were intermediate				full semester	Production practice: sentence repetition and expanded dialogues.	taught by same instructor (the researcher).		/g/ only.
Lord (2005)	phonetics course	17	n/a	[p t k β ð □ r], diphthongs	full semester course	Use of voice analysis software to analyze spectrograms of student productions.	n/a	Literary passage reading. Same passage was used as an in-class activity for self-analysis.	Significant improvement in producing [β ð □ r] and diphthongs. No significant reduction of VOT for / p t k /.
Lord (2010)	6–8th semester,	4	4	[b d g β ð □]	8 weeks	Study abroad immersion	In same study abroad	Word list reading	Group with prior phonetics

	study abroad	following semester-long phonetics course.	program as experimental group, but no prior phonetics instruction.	instruction improved 17% more than control (not tested for statistical significance).

* Instruction included explanations of Spanish/English contrasts, place and manner of articulation, and grapheme–phoneme correspondences

FIGURE 1

Experimental Design

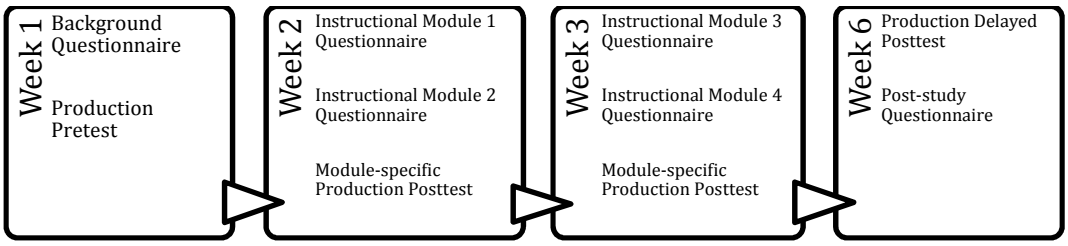


TABLE 3

Auditory and Acoustic Properties Used for Scoring of Production Test

		English-like (1 point)	(2 points)	Spanish-like (3 points)
[β]	auditory	heard as stop		heard as approximant
	acoustic	full occlusion, amplitude drops precipitously, release burst possibly apparent	e.g., no formants	formant structures and voice bar evident; no evidence of occlusion, burst, or frication; little to no decrease in amplitude from surrounding vowels
[ð]	auditory	heard as stop (e.g., [d]) or as [□]		heard as approximant
	acoustic	full occlusion, amplitude drops precipitously, release burst possibly apparent	e.g., no formants	formant structures and voice bar evident; no evidence of occlusion, burst, or frication; slight to moderate decrease in amplitude from surrounding vowels
[□]	auditory	heard as stop		heard as approximant
	acoustic	full occlusion, amplitude drops precipitously, release burst possibly apparent	e.g., no formants	formant structures and voice bar evident; no evidence of occlusion, burst, or frication; moderate to significant decrease in amplitude from surrounding vowels

/□/	auditory	heard as [□]		heard as [□], with no r-coloring on vowels
	acoustic	no occlusion, formant structures evident, possibly with low F3	e.g., closure too long (e.g., [d])	brief lightened band, no formants evident (except for *para* and *número*, in which [□] may be reduced)
/r/	auditory	heard as [□]	e.g., heard as [□]	heard as [r] or another target-like dialectal variant of [r]
	acoustic	no occlusion, formant structures evident, possibly with low F3	e.g., low F3	two or more lightened bands, no formants evident

FIGURE 2

Spectrogram of Sample [ð] Token Assigned 3 Points

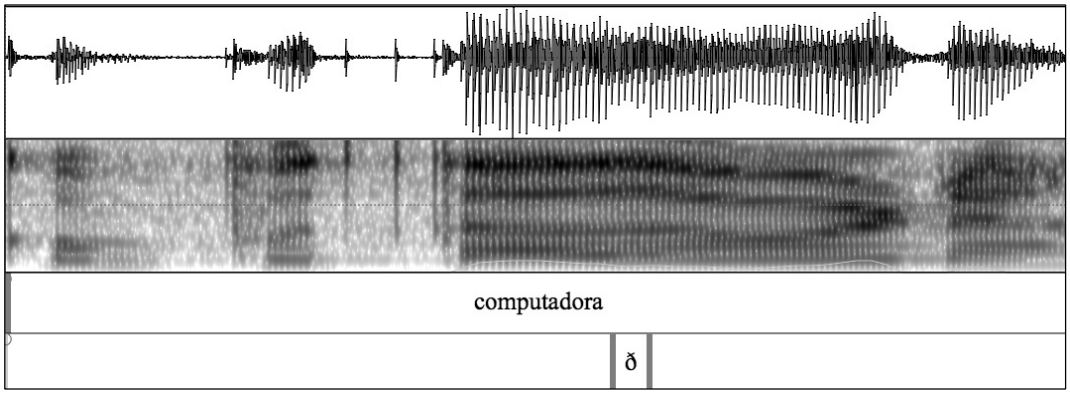


FIGURE 3

Spectrogram of Sample [ð] Token Assigned 2 Points

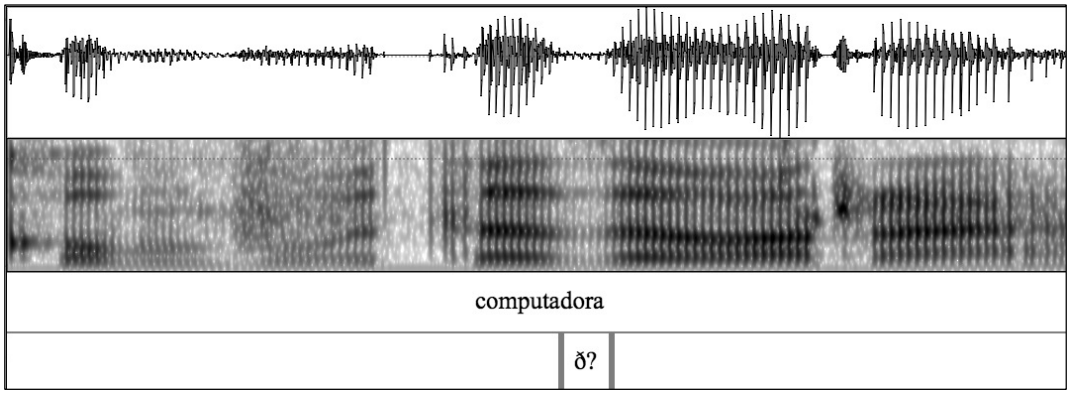


FIGURE 4

Spectrogram of Sample [ð] Token Assigned 1 Point

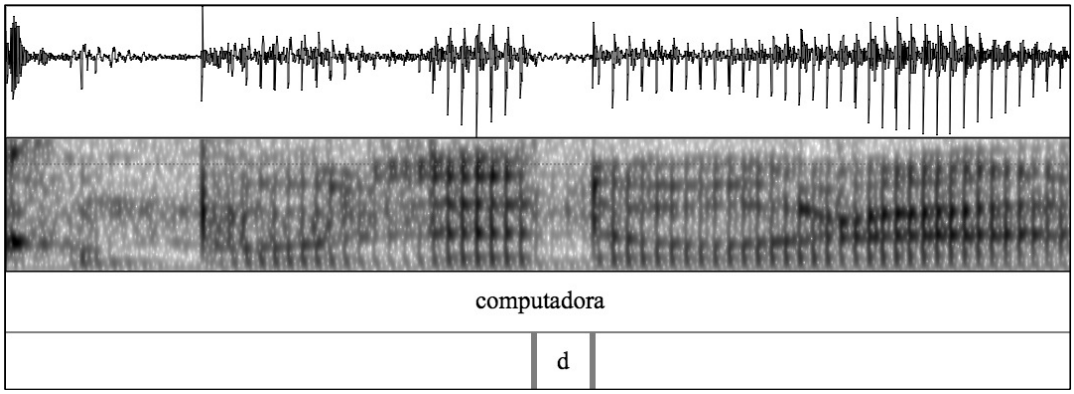


TABLE 4

Average Voice Onset Time in Production of Stop Consonants (in milliseconds)

		First Year		Second Year		Third Year		
		+PI (n = 22)	–PI (n = 23)	+PI (n = 18)	–PI (n = 14)	+PI (n = 10)	–PI (n = 9)	NS (n = 10)
		Avg (SD)	Avg (SD)	Avg (SD)	Avg (SD)	Avg (SD)	Avg (SD)	Avg (SD)
/p/	Pre	64 (25)	58 (21)	42 (21)	38 (29)	37 (17)	35 (12)	13 (4)
	Post	54 (20)	52 (20)	36 (18)	38 (21)	37 (23)	27 (10)	
	Delayed	58 (24)	58 (23)	41 (21)	44 (24)	35 (19)	37 (18)	
/t/	Pre	70 (24)	67 (23)	46 (20)	46 (26)	51 (33)	34 (17)	18 (5)
	Post	65 (22)	63 (28)	46 (22)	46 (23)	41 (21)	28 (14)	
	Delayed	65 (23)	67 (27)	44 (15)	47 (26)	43 (21)	36 (21)	
/k/	Pre	72 (22)	77 (18)	57 (16)	54 (17)	60 (30)	46 (14)	38 (8)
	Post	66 (19)	68 (21)	51 (17)	54 (21)	58 (18)	44 (10)	
	Delayed	66 (19)	71 (24)	57 (14)	63 (24)	55 (18)	48 (9)	

TABLE 5

Average Rating (1–3 points) of Approximant and Rhotic Phones

		First Year		Second Year		Third Year		
		+PI (n = 19)	–PI (n = 20)	+PI (n = 17)	–PI (n = 9)	+PI (n = 10)	–PI (n= 8)	NS (n = 10)
		Avg (SD)	Avg (SD)	Avg (SD)	Avg (SD)	Avg (SD)	Avg (SD)	Avg (SD)
[β]	Pre	1.33 (.34)	1.24 (.28)	1.44 (.44)	1.25 (.22)	1.35 (.43)	1.47 (.59)	2.61 (.54)
	Post	1.24 (.42)	1.13 (.36)	1.24 (.36)	1.11 (.33)	1.6 (.52)	1.38 (.35)	
	Delayed	1.24 (.27)	1.31 (.38)	1.32 (.26)	1.28 (.40)	1.4 (.39)	1.38 (.40)	
[ð]	Pre	1.12 (.24)	1.19 (.24)	1.51 (.61)	1.27 (.35)	1.43 (.41)	1.56 (.46)	2.78 (.49)
	Post	1.11 (.25)	1.09 (.17)	1.35 (.42)	1.24 (.32)	1.17 (.25)	1.66 (.64)	
	Delayed	1.11 (.28)	1.23 (.32)	1.52 (.43)	1.31 (.37)	1.35 (.47)	1.83 (.61)	
[□]	Pre	1.29 (.33)	1.61 (.55)	1.54 (.53)	1.19 (.27)	1.45 (.54)	1.78 (.66)	2.43 (.61)
	Post	1.35 (.29)	1.38 (.39)	1.46 (.49)	1.31 (.27)	1.24 (.36)	1.81 (.68)	
	Delayed	1.41 (.45)	1.58 (.45)	1.56 (.39)	1.44 (.35)	1.58 (.55)	1.69 (.65)	
[□]	Pre	1.78 (.78)	2.13 (.68)	2.47 (.64)	2.67 (.47)	2.21 (.75)	2.66 (.38)	2.89 (.32)
	Post	2.06 (.74)	2.38 (.64)	2.49 (.47)	2.78 (.34)	2.45 (.73)	2.59 (.67)	

	Delayed	1.86 (.66)	2.16 (.70)	2.51 (.54)	2.69 (.66)	2.28 (.73)	2.69 (.70)	
[r]	Pre	1.74 (.53)	1.8 (.42)	2.03 (.52)	2.39 (.52)	2.03 (.70)	2.25 (.23)	3.00 (.00)
	Post	1.94 (.51)	1.95 (.37)	2.15 (.56)	2.37 (.54)	2.15 (.66)	2.38 (.27)	
	Delayed	1.82 (.56)	2.01 (.55)	2.15 (.61)	2.09 (.45)	2.1 (.65)	2.32 (.54)	

TABLE 6

RMANOVA of Production Test: Aggregate of 8 Phones

Source	*SS*	*df*	*MS*	*F*	η_p^2	*Power*
Between subjects						
Time	6.02	2	3.66	4.34*	0.05	0.69
Level	521.95	2	260.97	12.83***	0.25	1.00
Condition X Level	99.10	2	49.55	2.44	0.06	0.48
Error	1546.04	76	20.34			
Within Subjects						
Time X Condition	0.16	2	0.10	0.12	0.00	0.07
Time X Level	2.27	3	0.69	0.82	0.02	0.23
Time X Condition X Level	1.14	3	0.35	0.41	0.01	0.13
Error (Time)	105.33	125	0.84			

Note. Significant at *p <.05, **p < .01, ***p < .001. With a Greenhouse–Geisser Correction.

TABLE 7

Pairwise Comparisons of Production Test: Aggregate of 8 Phones

Comparisons	*MD*	*SE*	*95% Confidence Interval*	
			lower	*upper*
Level				
1st year–2nd year	−2.32***	0.68	−3.98	−0.65
1st year–3rd year	−3.57***	0.77	−5.45	−1.70
2nd year–3rd year	−1.26	0.84	−3.30	0.79
Time				
Pretest–Posttest	−0.39***	0.10	−0.64	−0.14
Pretest–Delayed Posttest	−0.32	0.16	−0.71	0.06
Posttest–Delayed Posttest	0.06	0.16	−0.32	0.45

Note. Significant at *p < .05, **p < .01, ***p < .001. Adjustment for Multiple Comparisons: Bonferroni.

FIGURE 5

Production Test: Aggregate of 8 Phones

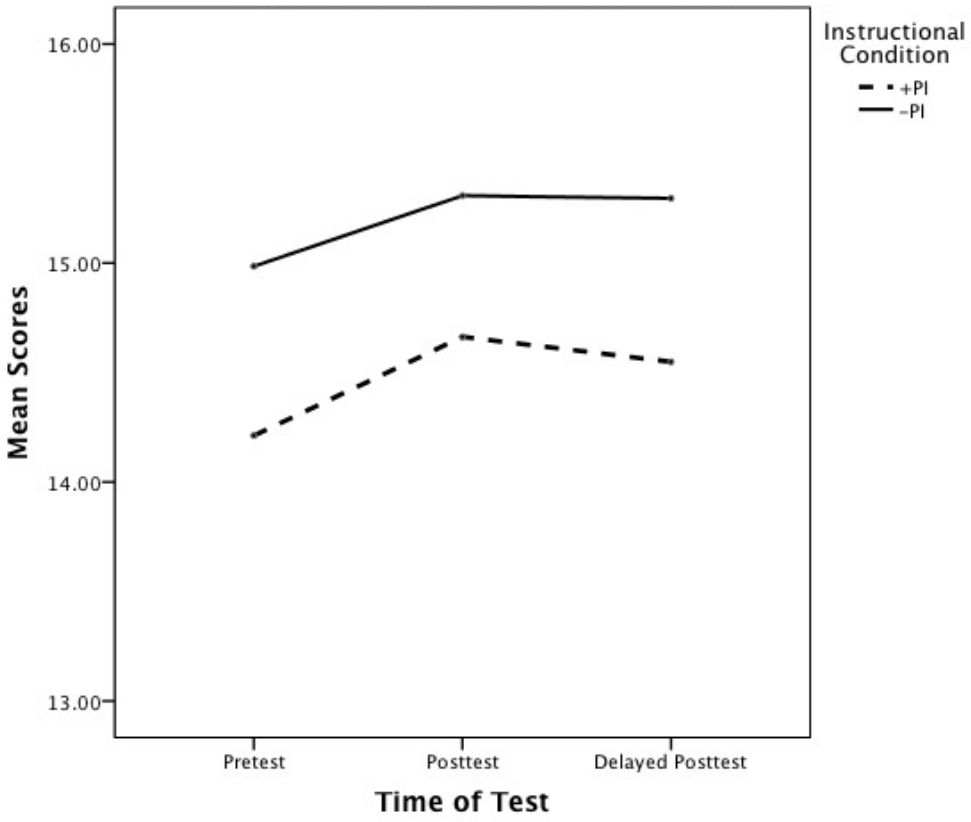
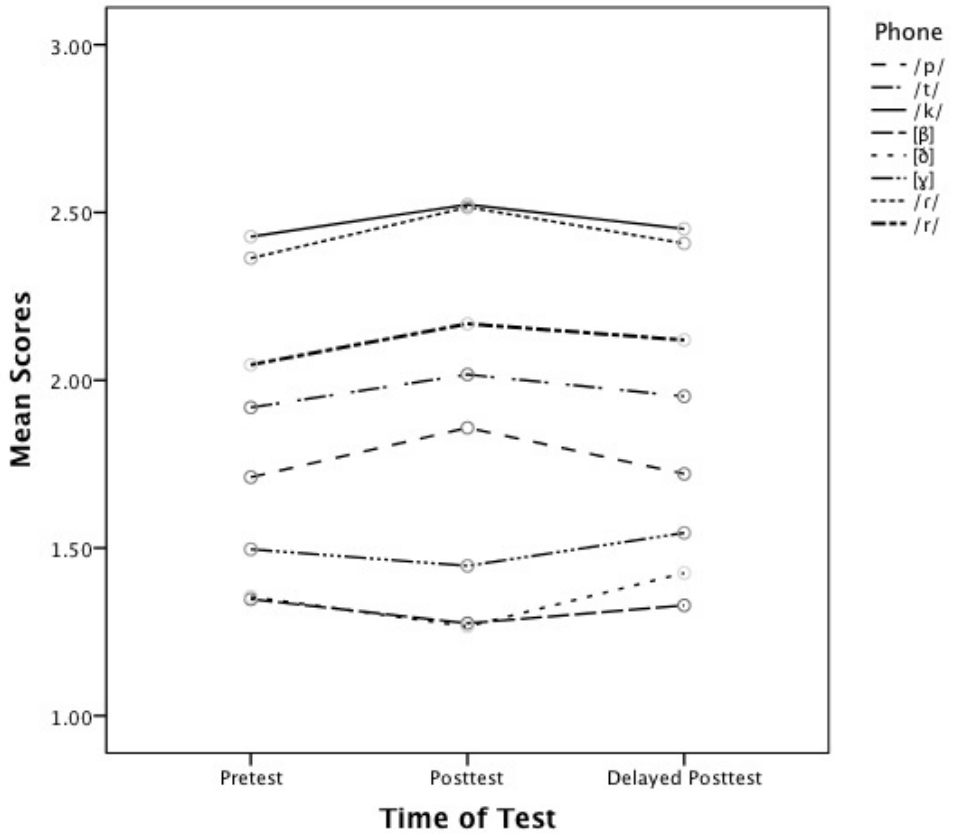


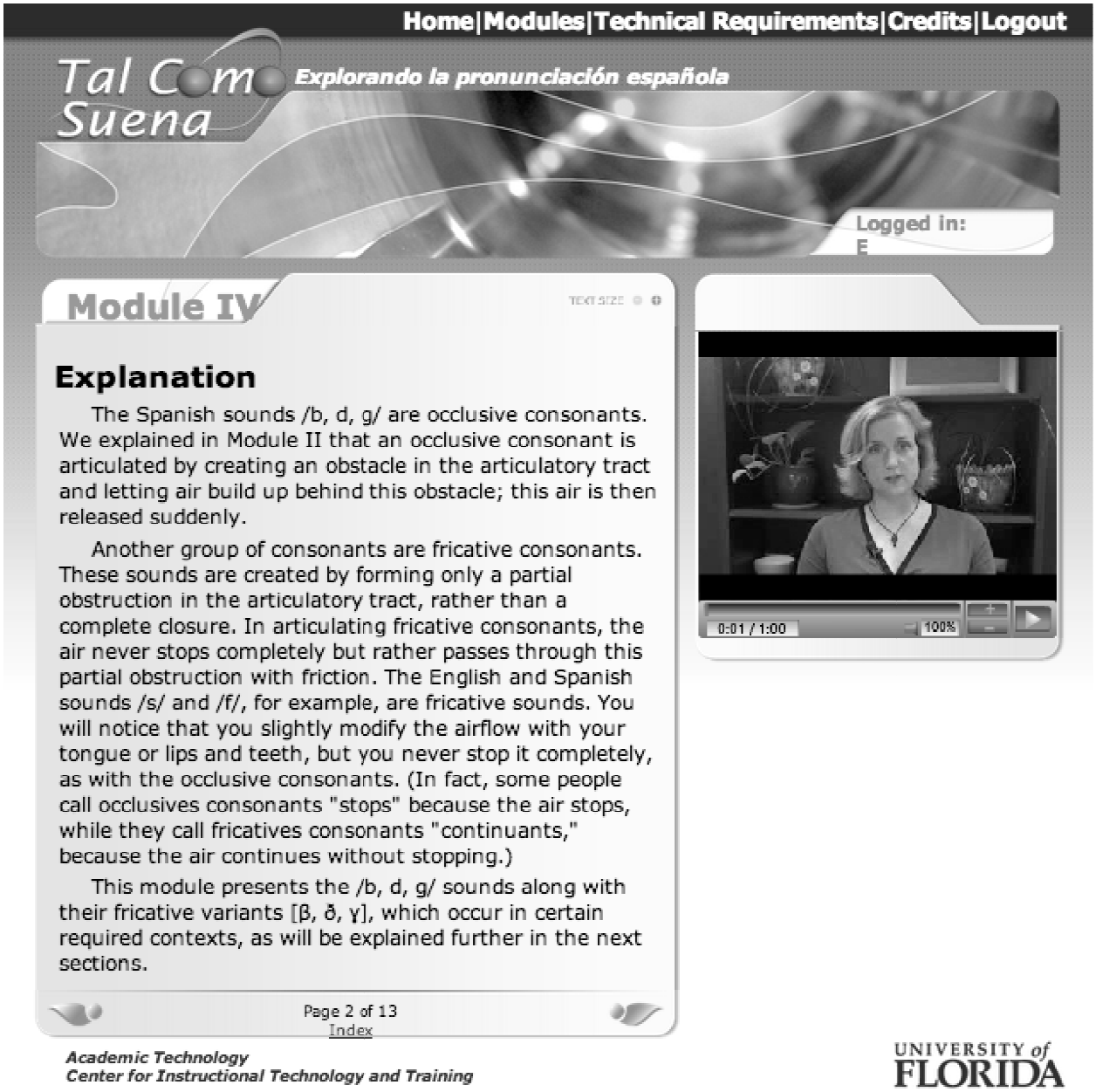
FIGURE 6

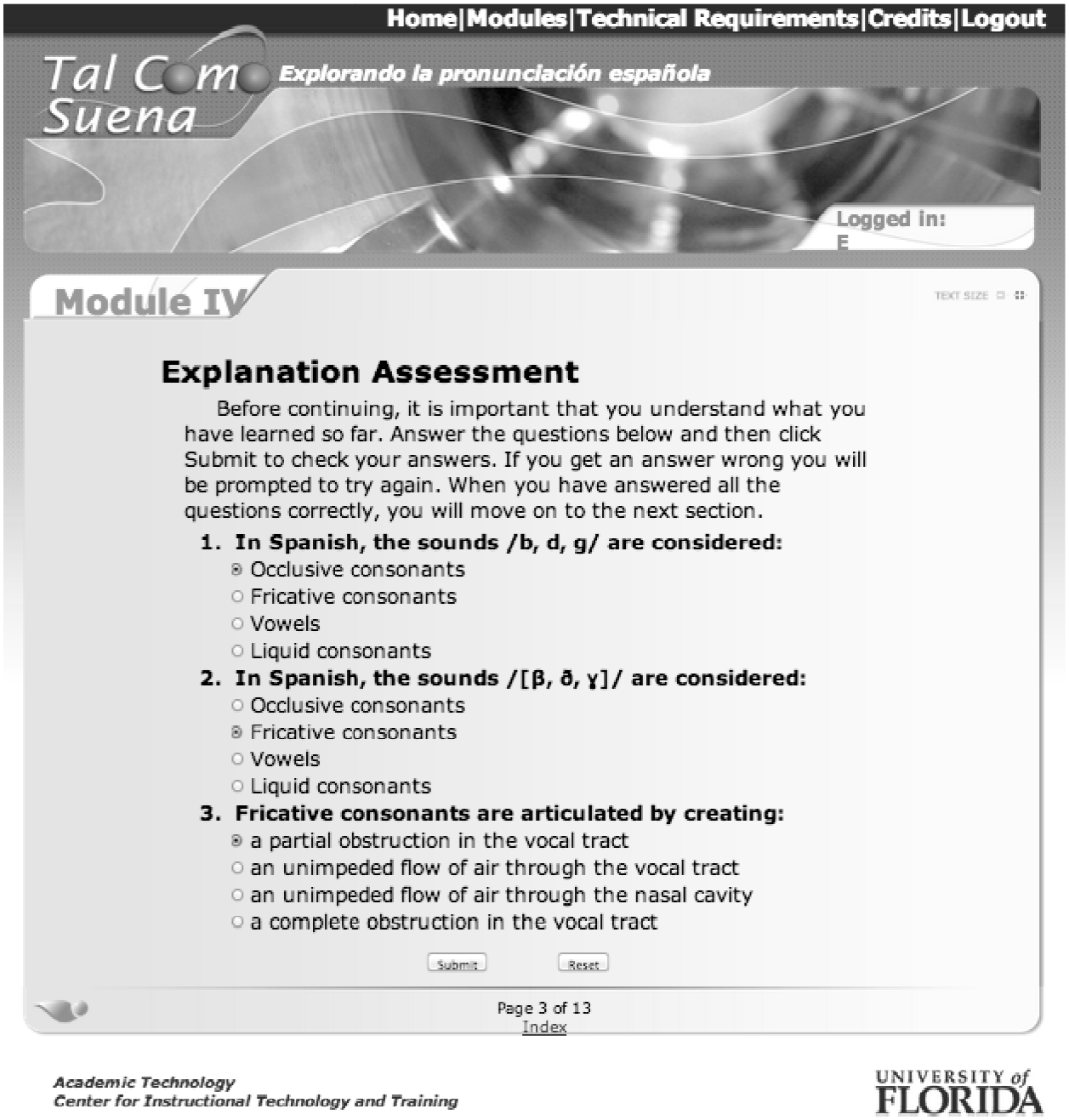
Production Test: 8 Individual Phones



APPENDIX A

+PI Module for [b, d, g, β, ð, □]: Sample Screen Shots




Home|Modules|Technical Requirements|Credits|Logout
Tal Como Suena
Explorando la pronunciación española
Logged in:
E
Module IV
TEXT SIZE
Explanation Assessment
Before continuing, it is important that you understand what you have learned so far. Answer the questions below and then click Submit to check your answers. If you get an answer wrong you will be prompted to try again. When you have answered all the questions correctly, you will move on to the next section.
1. In Spanish, the sounds /b, d, g/ are considered:
Occlusive consonants
Fricative consonants
Vowels
Liquid consonants
2. In Spanish, the sounds /[β, ð, ɣ]/ are considered:
Occlusive consonants
Fricative consonants
Vowels
Liquid consonants
3. Fricative consonants are articulated by creating:
a partial obstruction in the vocal tract
an unimpeded flow of air through the vocal tract
an unimpeded flow of air through the nasal cavity
a complete obstruction in the vocal tract
Submit
Reset
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Tal Com Suena
Explorando la pronunciación española
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Module IV
TEXT SIZE
Articulation - 1
With the articulation of each of the occlusive sounds /b, d, g/, there will be a complete closure or obstacle created in the mouth that keeps the air, momentarily, from escaping. In the pronunciation of /b/, the obstacle is created by the top lip and bottom lip coming in contact with each other. In the pronunciation of /d/, this obstacle is created through the tongue touching the back of the upper front teeth. In the pronunciation of /g/, the obstacle occurs with what is known as the velum. Which is the very back of the mouth, almost your throat. Examples of these sounds can be found in words such as: voy, doy and qué. (Note that in most dialects of Spanish, there is no "v" sound. Accordingly, here we assume that the letters "b" and "v" in Spanish represent the same sound, /b/ or [β] according to the context.)
You may notice that these sounds are articulated in exactly the same places in your mouth as the consonants /p, t, k/ are; the only difference is that /b, d, g/ are voiced consonants, meaning that the vocal chords vibrate when you say them, whereas /p, t, k/ are voiceless.
The animated diagrams to the right side of the screen will help you visualize how and where each of these sounds is articulated.
0:03 / 1:01
100%
b d g β ð γ
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APPENDIX B

–PI Instructions Example

Today you are going to do watch some videos of native Spanish speakers talking about a particular topic. You will also perform dictation exercises, typing what you hear in the videos. There will be some parts of the videos that you won't understand, but don't stress out about it! Just relax and keep an open mind. This activity should take you no more than 30 minutes.

Instructions:

1. Go to the page *http://laits.utexas.edu/spe/*, which should be open for you already.

2. Click on the ***Intermediate A*** level, and from the drop-down menu, choose ***Task 12: Talk about yourself***

3. Click on the **'Regina Ruiz: (Peru, Lima)'** video. IMMEDIATELY click on 'N' so that you can listen without reading. Listen and watch the video several times, without reading any transcript or translation. When you think you understand a good bit, start your dictation. That is, type exactly what the speaker says in Spanish. Pause the video after every few words if you need to. Go back and repeat the entire video as often as you need to produce what you think is a good dictation. (But stop after 15 minutes, regardless of how far you've gotten.)

Type your dictation here:

4. When you have finished your dictation, click 'S' to see the Spanish transcript. Compare it with your own. Where did you find difficulty? Can you find any patterns to your mistakes?

Type your thoughts here:

5. Do you think you understand the meaning? Click on 'E' to see the English translation of the transcript. Are there words or phrases that are new to you? Are there some words that you think would be helpful for you to remember and use in the future?

Type your thoughts here:

6. Pronunciation practice. Now you'll listen carefully to some specific parts of the video, paying as close attention as possible to the speaker's pronunciation. Then, read the same sections out loud, in a natural voice, trying to pronounce the words exactly as the native speaker does. You can listen to and read the sentences as many times as you want until you are satisfied that you have the correct pronunciation. The sections you should focus on are:

The first clause ("Mi nombre es Regina Ruiz")

The third sentence ("Me gusta mucho . . . Latino América")

The last sentence ("Y el lugar . . . México")

7. Now, click on the other videos related to this topic and listen to them. You may click on the Spanish transcript and/or English translation; do whatever you think is most helpful.

8. Now that you have watched all the other videos about this topic:

a. do you notice anything interesting about the speakers' pronunciations of certain sounds or words, or anything about their accents? **Type your thoughts here:**

b. do you notice any phrases or words that are new to you and particularly interesting or useful?

Type your thoughts here:

Thank you for your work today!

APPENDIX C

Production Test Items

1. ¿**C**ómo?	‘What?’
2. ¿**Q**ué **t**al?	‘How are you?’
3. señ**o**rita	‘Miss’
4. aveni**d**a	‘avenue’
5. Hasta lue**g**o.	‘See you later.’
6. **p**e**rr**o	‘dog’
7. a**g**osto	‘August’
8. **c**u**b**ano	‘Cuban’
9. ru**b**io	‘blonde’
10. **p**a**r**a ella	‘for her’
11. **t**ú y yo	‘you and I’
12. **p**intar	‘to paint’
13. a**b**u**rr**ido	‘bored’
14. ¿Dónde vives?	‘Where do you live?’
15. lle**g**ar	‘to arrive’
16. computa**d**ora	‘computer’
17. ba**rr**io	‘neighborhood’
18. A**d**iós.	‘Good bye.’
19. núme**r**o	‘number’
20. **t**ocar	‘to touch’
21. **t**alle	‘figure’

22. **c**ace ‘hunt’ [3 sing., pres. subjunctive]

23. **p**ace ‘graze’ [3 sing., pres. indicative]

24. ama**g**a ‘threaten’ [3 sing., pres. indicative]

25. cala**d**a ‘soaked’ [adj., fem. sing.]

26. a**r**a ‘altar’

27. a**rr**as ‘wedding coins’

28. cala**b**a ‘was soaking’ [3 sing., past imperfect]