Fostering phonetic input in the classroom. The case of very young learners acquiring English in a Brazilian bilingual school

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Abstract

The quality and quantity of phonetic input are considered the main factors in L2 sound acquisition (cf. Flege 1995; Flege/Bohn 2021; Kuhl 2011). Over the years, many empirical studies have supported the statement that for accurate perception and intelligible pronunciation, learners need to receive robust phonetic input to guide their attention to the acoustic cues used to distinguish L1 sounds from L2 sounds (cf. Flege 1995; Flege/Bohn 2021; Moyer 2009). These works have bolstered the widespread idea that when it comes to L2 acquisition, the more input and the earlier the exposure, the better. However, despite the growing interest in the area, research in classroom settings still needs to be conducted, particularly with very young learners (cf. Munro/Derwing 2015; Levis 2016; Levis 2017; O'Brien et al. 2018). This paper focuses on the work with L2 sounds in classroom settings with very young learners and integrates contributions from sound acquisition theory and pedagogical practice. It also discusses the role of the teacher in fostering phonetic input in bilingual education with very young Brazilian Portuguese L1 speakers acquiring English as an L2. To support this discussion, it presents the results of perceptual tests in a Brazilian bilingual school developed to investigate children's L2 sound perception. A pre-test was applied at the beginning of the school year, and a post-test by the end of the year. In between, playful mediation with L2 sounds took place (cf. Barros 2022). The comparison between the pre-test and the post-test suggests that teachers play a pivotal role in fostering phonetic input to enhance very young learners' perception of L2 sounds, thus leading to a more successful L2 acquisition. This paper also underscores the importance of linking theory to pedagogical practice so teachers can better scaffold learning.

1 Introduction

The widespread idea that accurate L2 sound acquisition depends on phonetic input has been addressed in an increasing number of papers over the years (cf. Flege 1995; Moyer 2009; Flege/Bohn 2021). According to research on the acquisition of L2 sounds (cf. Flege/Mackay 2011), other intervening factors that account for speakers' pronunciation, such as age and length of residence, are also likely to be connected to the quality and quantity of input received. Flege/Bohn (2021) describe input as "[...] the sensory stimulation associated with the L2 speech sounds that are heard and seen during the production by others of L2 utterances in meaningful conversations" (Flege/Bohn 2021: 20). This sensory stimulation is pivotal for L2 sound acquisi-

tion for it contains acoustic cues that will guide the speakers' perception and lead to L2 phonetic category formation.

In L2 category formation, the speaker's L1 phonetic inventory is likely to exert influence to some degree, which may cause some L2 sounds to assimilate into L1 similar sound counterparts (cf. Flege 1995; Flege/Bohn 2021). This assimilation blocks the creation of new L2 phonetic categories. The so-called assimilation process is essential when dealing with impairment in a speaker's L2 perception and production (cf. Munro/Derwing 2015). The assimilation process is mentioned in many works on L2 sound acquisition and phonetics (cf.Flege 1995; Flege/Bohn 2021; Kornder 2023), and its inclusion in studies that account for L2 teaching and bilingual education contexts is considered beneficial.

Indeed, there is a growing interest in L2 sound acquisition, as seen by the increasing number of thematic papers, journals, and conferences (cf. Munro/Derwing 2015; Nagle/Baese-Berk 2022). On the one hand, more studies have been dedicated to filling the gap in linking L2 sound acquisition theory and pedagogical practice in schools (cf. Jones 2020; Kirkova-Naskova 2019; Piske 2007; Levis 2016) and addressing this matter (cf. Abercrombie 1949; Dehaene 2021; Derwing/Munro 2005). On the other hand, these studies are still scarce (cf. Barros 2022; Levis 2016, 2017; O'Brien et al. 2018). This gap is even more pronounced when considering studies that integrate phonetic theory with classroom practices for very young learners.

Munro/Derwing (2015) argue that pronunciation studies are essential for providing empirically based information to L2 teachers and that the focus of research should be obtaining evidence of replicable and effective techniques for learners in the classroom. These techniques should be grounded on theoretical models of sound acquisition.

Two theoretical models of L2 sound acquisition that have focused on the relevance of input and the influence of L1 sounds on assimilation processes are the Speech Learning Model (SLM) (cf. Flege 1995) and, more recently, the Speech Learning Model-revised (SLM-r) (Flege/Bohn 2021). These two models aim to explain how the acquisition of the sounds of an L2 occurs and how the phonetic system reorganizes itself throughout a speaker's life in response to the received phonetic input.

Despite being pivotal, Flege's studies have received little attention from language teaching theories due to insufficient evidence involving students and classroom contexts. The choice not to focus on students and data collection in school environments has left Flege's extensive theory off the radar in the pedagogical sphere. However, even though the context of Flege's empirical collections is diverse, his theory contains assumptions and principles of interest for teachers in bilingual contexts.

This paper is grounded on the SLM and SLM-r postulates and hypotheses. We agree with Flege and Flege/Bohn's premise that L2 sound acquisition depends directly on the phonetic input received. This paper also considers a specific bilingual education context: Brazilian children who speak Brazilian Portuguese (BP) as their L1 and are acquiring North American English as an L2. In this context, BP is the language spoken by children in and outside school, and English is the language of instruction spoken by the teachers with children and among themselves. The teachers are Brazilians and speak English fluently. In this paper, the children referred to as

bilinguals have their first contact with English in school. These children begin to understand English after some time at school and are encouraged to start speaking English gradually. This specific context calls for strategies for enriching L2 phonetic input.

Throughout this paper, we will discuss the role of teachers in fostering phonetic input, aiming at smoother L2 sound acquisition and, hence, more accurate perception and production of L2 sounds. Exploring theoretical constructs and feasible practical examples of how teachers can implement this theory with very young learners in bilingual school settings is essential.

2 Theoretical framework

To better understand the role of the teacher in promoting smooth L2 sound acquisition in the classroom, it is important to briefly explore some constructs of how learning occurs in all its perspectives. This entails acknowledging neural processes involved in learning and specific L2 sound acquisition constructs.

2.1 Important considerations of the learning process

As for the learning processes, Dehaene (2021) argues that learning happens through synapses, the term used for neural communication. Four aspects must be considered for more potent and effective synaptic connections: attention, active engagement, error feedback, and consolidation. These are the so-called pillars of learning (cf. Dehaene 2021).

In a school context, where the aim is to promote learning, these constructs should be evident when planning, as they can foster or impede learning. Dehaene (2021) explains that attention activates neural circuits, propagating relevant signals and multiplying the impact of learning by up to a hundred times. When learning something, the individual needs to pay attention to important information. Otherwise, this process can be compromised due to insufficient or weakened synapses.

Along with attention, active engagement and error feedback play essential roles in the learning process. Learning requires motivation and curiosity as the dopamine circuit is activated when discoveries are made, releasing a feeling of happiness and satisfaction to the learner (cf. Dehaene 2021). Dehaene (2021) also claims that we learn through making hypotheses, which need to be tested, discarded, or validated. Therefore, feedback helps us correct our mental models and eliminate incorrect hypotheses, stabilizing the most accurate ones.

Lastly, consolidation is pivotal in any learning process as it enables new information to be stored in long-term memory. One of the fundamental aspects of this pillar is repetition. Through repetition, consolidation can become faster and more efficient. The pillars suggested by Dehaene (2021) are worth considering in creating opportunities for effective learning. That being said, the role of the teacher in fostering L2 sound acquisition is multifaceted, entailing an understanding of not only how learning occurs but also specific phonetic concepts.

2.2 L2 sound acquisition constructs

Other vital aspects teachers should consider are specific L2 sound acquisition issues. This paper emphasizes the SLM and SLM-r postulates and hypotheses, as well as some neurological perspectives related to sound development.

Concerning the latter, Dehaene's (2021) and Kuhl's (2011) studies enlighten the field by providing robust theory and empirical research. The notion that sounds begin to be recognized very early is well-known among studies. Babies can hear and identify sounds from the womb and become hypersensitive to sounds when born. During these first months, they can discern all the oral sounds of all languages (cf. Kuhl 2011). At around 9 to 11 months old, babies adjust their internal language model to the characteristics of the language or languages to which they are exposed. The phonetic input received shapes the baby's language. Research shows that with time, this hypersensitivity decreases, and L2 sounds gradually become more challenging to perceive (cf. Kuhl 2011). Research also shows that despite becoming more complex, learners retain the capability to acquire L2 sounds over their lifespan (cf. Flege 1995; Flege/Bohn 2021).

During the first months of life, hypersensitivity to sounds promotes rapid acuity in acquiring the sounds of the languages babies are exposed to. Even though this hypersensitivity decreases, children remain sensitive to acquiring L2 sounds because they experience a period of extreme neural plasticity in which synaptic activities occur twice as much as an adult's (cf. Dehaene 2021). This period of more remarkable plasticity is often called a sensitive period (cf. Montessori 1967; Oyama 1979), indicating a facilitation in any learning process. For a speaker to perceive a sound more easily and create a phonetic category, the earlier exposure to a language, the better.

With time, L2 sounds are more likely to become more challenging to perceive, and the speaker's L1 might exert a stronger influence in this process. This influence happens because, according to Flege (1995), the L1 and L2 sound inventories coexist in a common phonetic space and, thus, influence each other. This influence has been studied over the years (cf. Best/Tyler 2007; Flege 1995; Iverson/Kuhl 1996; Kuhl 1991; Polivanov 1932/1978; Trubetzkoy 1939/1969). According to Flege (1995), it is responsible for one of the most common impediments for bilinguals to acquire L2 sounds: the assimilation process.

The assimilation process will likely impact how bilingual learners experience L2 sound acquisition in bilingual education settings. This is because, for an L2 sound to be acquired and a novel phonetic category created, bilinguals need to discern at least some of the phonetic differences between the L2 sound and the closest L1 sound at an allophonic level. As Flege (1995) pointed out and endorsed by several studies (cf. Barros/Madureira in press; Sacchi 2018; Listerri 2003), the more similar the sounds, the more challenging their distinction and perception. As further explored, this evidence is pivotal in mediating language acquisition in bilingual education settings.

Studies suggest that the assimilation process can be reversible and even avoided with robust work with L2 sounds (cf. Flege 1988; Barros/Madureira in press). In the following sections, we will delve into how the theoretical background hitherto explored can be combined with pedagogical practices and applied in classrooms with very young learners.

3 Issues related to linking theory to practice

This section addresses ways to plan pedagogical practices grounded on L2 sound acquisition theory. There has been a growing number of studies on how to join language acquisition theory and teaching practices in schools (cf. Jones 2020; Kirkova-Naskova 2019; Piske 2007).

However, much is still to be explored, especially in early childhood education. To contribute to this matter, more research in classroom settings and closer contact between L2 sound acquisition researchers and very young learners' teachers are needed.

Many challenges arise when conducting an empirical study in the classroom (cf. Munro/Derwing 2015). One of the most adverse is the difficulty, for ethical reasons, of forming control groups in experimental research. Schools and the Ethics Committee in Brazil disagree on teaching two groups differently. This condition challenges experimental studies in phonetics that use control groups.

However challenging, studies carried out in the classroom focusing on L2 acquisition benefit both teachers and students. Regarding the former, teachers need theoretical support to adjust their practices based on scientific evidence. As for the latter, students will have more meaningful and effective mediations to develop their L2. Following, we underscore some ways to link theory to pedagogical practice so teachers can better scaffold learning.

3.1 The role of the teacher when mediating L2 sound acquisition in bilingual education contexts

There is much to consider regarding the role of teachers in mediating L2 sound acquisition for very young learners who do not experience an interactive L2 learning environment outside the classroom. First, in bilingual education, teachers should offer accurate L2 phonetic input to learners. Considering non-native teachers, this entails being mindful of their L2 production and looking for phonetic knowledge to grant good-quality acoustic cues. Abercrombie (1949) emphasized this matter decades ago when he alleged that teachers need specific know-how to scaffold L2 development. For the author, teachers should understand learners' L1 and L2 phonetic systems, have tuned ears to notice when a sound is not produced accurately, and have articulatory control to reproduce L2 sounds in isolation.

Second, teachers should help learners in the areas of difficulty with a scientific basis, as pointed out by Derwing/Munro (2005). One area of difficulty in acquiring L2 sounds is that assimilation processes may occur. Hence, L2 teachers must be aware of the L2 sound contrasts that may be troublesome and help learners distinguish them.

Third, teachers should also consider that similar sounds are more challenging to perceive and more likely to be assimilated (cf. Flege 1995). Insisting on techniques such as listening and repeating is ignoring the fact that, due to the L1 system, the speakers, no matter how much they listen to the L2 words, are perceiving them with the influence of their L1 (cf. Listerri 2003). In these cases, the speakers are repeating what they hear but usually do not hear them accurately, not discerning the acoustic characteristics of the sounds.

Another aspect to consider is that mere exposure to input does not necessarily enable L2 sound categories to be acquired, as supported by some studies (cf. Flege/Liu 2001; Smirnova et al. 2020). For this matter, Flege (1988) suggested that robust and intentional work with sounds is essential to revert or even avoid the assimilation process and promote the creation of new phonetic categories. In Flege's studies, however, there is no indication of how this work could be done, as the author did not extend his research to classroom settings, especially with very young

learners. Nevertheless, his studies offer a vast range of essential theoretical points that, alongside pedagogical knowledge, can help in strategies that unite practice and theory.

Flege's constructs and the formerly explored theory support the core idea of this paper: the work with L2 sounds with very young learners should be intentional and follow a play-based approach. Children should explore L2 sounds through games, songs, storytelling, and age-appropriate activities. Also, teachers should consider both L1 and L2 sound inventories to mediate sound acquisition more effectively. Combining these premises, we now explore a possible tool to help teachers work with L2 sounds effectively and playfully: a mediation program developed to cover some of the specificities of bilingual very young children when acquiring L2 sounds.

4 The impact of a mediation program on very young learners' perception of English sounds in a Brazilian bilingual school

Establishing a relationship between the L2 sound acquisition theory and pedagogical practices with very young learners in bilingual contexts can be challenging. First, there is a lack of research in the field of L2 sound acquisition that accounts for this specific age group and scenario. Second, the misconception is that phonetic training is a burden and cannot happen playfully.

To account for this matter and evidence how playful mediation with sounds can be done in bilingual education classrooms with 3 to 4-year-old children, a mediation program based on sound acquisition theories and pedagogical knowledge was developed (cf. Barros 2022). This program aims to call children's attention to the acoustic cues that differentiate L2 sounds from L1 sounds so that their perception is more accurate and L2 phonetic categories are created. It offers practical examples of how teachers can work with sounds with very young learners following L2 sound acquisition constructs. The mediation program is under Flege's (1988, 1995) claim that the assimilation process can be avoided or reverted with constant work with L2 sounds. The following sections briefly explain this mediation program and its results. This paper suggests that its application helps teachers optimize their roles by fostering L2 phonetic input.

Children should explore and play with environmental sounds to tune their ears, followed by playful work with oral sounds to enrich their phonetic input (cf. Barros 2022). These two steps originated the two-part program, divided into sound and phonemic awareness. The program's originality comes from the fact that it was developed specifically for L2 speakers studying in bilingual schools. Also, it brings the work with sounds down to very young learners in a playful and meaningful way, as explored in Barros (2022) and Barros/Madureira (in press).

Even though diverse materials exist for sound exploration in education (cf. Adams et al. 1998; Leu/Kinzer 2016), they are usually created for native speakers and do not consider the specificities of the L2 sound acquisition processes by L1 speakers. Despite being helpful and having relevant information and practice to guide teachers in working with sounds, these materials do not fulfil the needs of children acquiring an L2 in school, with two phonetic inventories overlapping.

Following the previously explored theoretical premises, the program comprises two main factors:

1. It combines phonetic knowledge in a playful and age-appropriate way with games designed to call children's attention to acoustic cues.
2. It proposes a specific order to play with L2 sounds, respecting the perceptual difficulty bilingual learners may face. Following the premises of the SLM (cf. Flege 1995) and the SLM-r (cf. Flege/Bohn 2021), Barros (2022) and Barros/Madureira (in press) propose that a way of reverting the assimilation process is to gradually insert the L2 sounds that are more likely to be assimilated by the L1 speakers. Thus, the program's proposed order follows diverse consonant sounds, similar consonant sounds, diverse vowel sounds, similar vowel sounds, and minimal pairs.

To guide learners' perception of L2 sound distinctions, playful activities pairing words with distinct consonant articulatory features such as *pear* and *goat* are first introduced, followed by similar consonant articulatory features such as *pear* and *ball*. Progressively, pairings of vowels with distinct height and/or anteriority, such as *boot* and *bat*, and then words with similar height and/or anteriority, such as *boot* and *look*. Last are the minimal pairs that contain difficult contrasting consonant or vowel sounds for Brazilian learners of English, such as *sheep* and *ship*, *pen*, and *pan*. The contrast between /æ/ and /ɛ/ is the most difficult to perceive (cf. Sacchi 2018).

Furthermore, following Dehaene's constructs, the program is composed of engaging and age-appropriate games that facilitate learning. Some of the games that compose the mediation program are described below, and the effectiveness of applying the mediation program is delineated.

4.1 Gaming in the mediation program

The games suggested in the mediation program are easily incorporated into the curriculum and help children to engage and perceive phonetic details. The idea is that teachers include games that work with L2 sound perception and offer accurate acoustic cues in their daily practices. The games were created or adapted to prioritize the work with L2 sounds, and their introduction into the daily planning of a group of very young learners was beneficial for a better L2 sound perception (cf. Barros/Madureira in press). The games proposed are: "I Spy", "What's Missing?", "Scavenger Hunt," "Creative Storytelling," "Flip Flop," "Odd One Out," "Sequencing Cards," "Up and Down," and "Where is it?" (cf. Barros 2022; Barros/Madureira in press). A brief explanation of some of the games follows.

The materials needed to play some of the games are flashcards with the vocabulary containing the target L2 sounds. To play "I Spy," teachers call a group of children and spread the cards on the table. The aim is for each child to point at the image corresponding to the teacher's instruction: When the teacher says, "I spy the sheep," for example, the child is expected to find the sheep image among the flashcards. It can be played individually or in small groups.

For the game "What's missing," the flashcards with the target sounds should be placed on the table where the game will take place. The game is played by allowing children to look at the cards attentively and close their eyes before the teacher turns one of the flashcards over. The aim is for the children to tell which image is missing.

The games "Scavenger Hunt" and "Up and Down" are more active and can be played with larger groups. For "Scavenger Hunt," the teacher hides the flashcards with the appropriate

vocabulary and asks the children to find them individually by saying the words and offering the acoustic cues. For the game "Up and Down," the teacher chooses two flashcards and instructs the children that one image refers to the act of standing up and the other to the act of squatting down. For example, every time they hear the word *pear*, they should stand up, and when they hear the word *bear*, they should squat down. These words are pronounced randomly in a chain to make the game fun and dynamic.

For "Creative Storytelling," the teacher should select some flashcards and create a nonsense story by picking one image at a time and adding the element. The phonetic input comes from the repetition of words while telling the story. The aim is to include the children's ideas to continue the story when the game is played in the following days.

These games, combined with storytelling moments, songs, and nursery rhymes, and following the suggested progression, are thought to help very young bilingual children to perceive L2 sounds better. It is one possible and effective way to enrich L2 phonetic input in bilingual education contexts with very young children. It was planned to help teachers align daily pedagogical practices with theoretical processes. In the next section, we will explore the impact of the mediation program on very young Brazilian learners' L2 perception.

4.2 Results

The effectiveness of the proposed mediation program was tested with 12 children from 3 to 4 years old in a bilingual school in Brazil. No control group was allowed due to ethical reasons. Results from a phonetic perceptual pre-test and a phonetic post-test were compared. The test aimed to investigate whether the games proposed would positively impact children's perception of the English plosives and challenging contrasts in English vowels (/ɛ-æ, i-ɪ, u-ʊ/) for Brazilian speakers. The hypotheses were that children would have some English sounds assimilated to their BP counterparts at the beginning of the school year. After completing the mediation program, they would better perceive the contrasts of the selected sounds. The results were collected through a perceptual test applied at two moments, at the beginning of the school year and by the end of the year, after the mediation program was applied. The perceptual test was designed for young children and was validated with a former pilot test.

The perceptual test was composed of some of the games of the mediation program, namely, "I Spy," "Sequencing Cards," "Odd One Out," and "Choose the Image". The pre and post-tests were applied on a tablet with a sound box, and the answers were registered on a table. The following images exemplify a part of the tasks present in the perceptual test. Image 1 refers to the task "Choose the Image," in which the participant heard one isolated word and had to point at the image corresponding to the word heard. Image 2 refers to the "I Spy" task in which the participant listened to a stimulus such as "I spy the pen" and had to choose the corresponding image. Image 3 is part of the "What do you Hear?" task, in which a chain of four words (minimal pairs) was uttered, and the participant had to point at the images corresponding to the stimulus heard. Image 3's chain was "bee – bee – pea – bee."

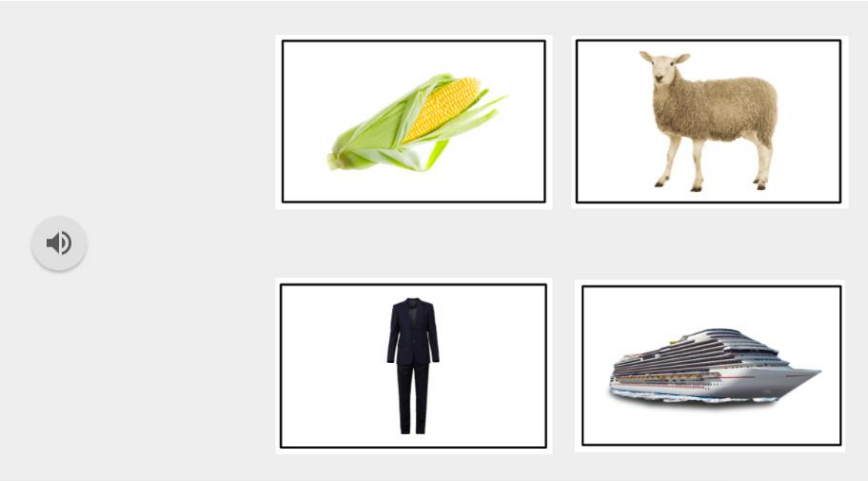

Figure 1: Example of the perceptual test task "Choose the Image" (Barros in prep)

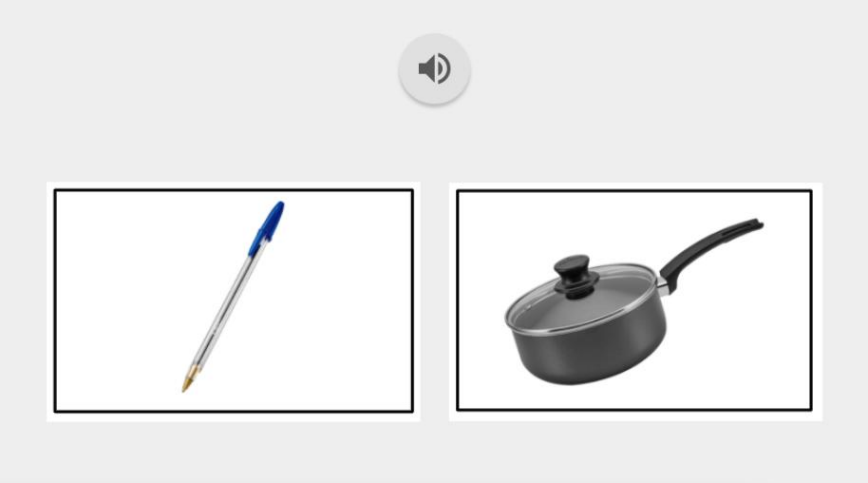

Figure 2: Example of the perceptual test task "I Spy" (Barros in prep)

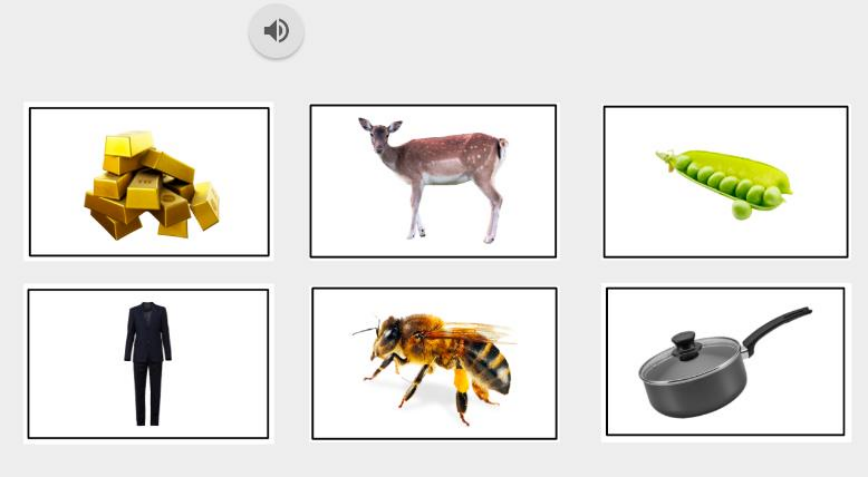

Figure 3: Example of the perceptual test task "What do you Hear?" (Barros in prep)

The results were analyzed after completing the program and the post-test data collection. The results explored in Barros/Madureira (in press) indicate that the mediation program positively affected children's perception of L2 sounds. After implementing the games, respecting the sound clusters' order, all participants' values were significantly higher when comparing the

pre-test and post-test, both in L2 consonant and vowel discrimination. Both pre-test and post-test used the same flashcards and tasks. As for the plosives, the /p-b/ sounds had an initial value of 51% discrimination on the pre-test, compared to 81% accuracy on the post-test. The discrimination of the sounds /k-g/ was 41% on the pre-test and 85% on the post-test. The sounds /t-d/ had 43% correct answers on the pre-test and 90% on the post-test.

The results were also positive for the vowel contrasts. The pair /ɛ-æ/ had an initial value of 22% of correct answers on the pre-test, as opposed to 62% on the post-test. The sounds /i-ɪ/ were correctly discriminated 44% of the time on the pre-test and 97% on the post-test. And the sounds /u-ʊ/ improved from 22% to 77% on the post-test (cf. Barros/Madureira in press). Barros/Madureira (in press) show that the most challenging vowel contrast was the /ɛ-æ/, followed by /u-ʊ/ and /i-ɪ/. As for the consonants, there was no difficulty concerning the place of articulation plosives, but voicing discrimination in the pre-test was troublesome.

The collected data confirmed both hypotheses. The mediation program succeeded in catching the children's attention. They enjoyed the playful activities with the L2 sounds and improved their perceptual abilities. Its implementation showed that the work with L2 sounds positively impacts L2 sound acquisition in very young learners who study in bilingual schools. Also, it shows that the work with L2 sounds can be playful and appropriate to enrich the phonetic input and revert the assimilation process (cf. Flege 1995).

Implementing the mediation program is also thought to help bilingual children in their phonological awareness and phonics process due to their better perception of L2 sound contrasts. Further studies and data collection are necessary to fully evaluate the impact of introducing a ludic mediation program to help young children attending bilingual schools in Brazil acquire English sound contrasts.

5 Conclusion

This paper explored ways to foster L2 phonetic input in the classroom with very young learners in bilingual education contexts. It underscored the urge for more research in classroom settings, especially with young children, to account for enriching phonetic input and, thus, promote better L2 sound acquisition opportunities. The shift in this scenario will likely benefit both teachers and researchers as it would bolster teaching approaches with theory and provide researchers with questions for further investigation (cf. Munro/Derwing 2015; Levis 2016).

The theory explored throughout this paper corroborates that teachers who deal with L2 need a certain level of phonetic knowledge to foster young learners' perception of L2 sounds. Teachers can improve students' L2 sound discrimination when mindful of the theoretical issues explored in this paper, such as assimilation, and can base their pedagogical practices on these constructs. This paper suggests that playing with L2 sounds following a specific order can enhance very young learners' L2 sound perception and help them create L2 phonetic categories of challenging contrasts.

This paper attempts to contribute to filling the literature gap concerning the lack of research on L2 sound acquisition by very young learners. It comments on theoretical principles of sound acquisition alongside pedagogical strategies to account for teachers' role in enriching learners' phonetic input. Motivating ludic teaching strategies like those introduced in the mediation

program discussed in this paper are thought to improve perceptual abilities to discriminate L2 sounds because they foster L2 sound awareness.

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