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Original Research Article

Musical Intelligence to Improve Pronunciation

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Abstract

This article aims to analyze the use of musical intelligence (Howard Gardner) as a tool to facilitate individuals' pronunciation. A study with Emirati participants who have Arabic as L1 has been conducted to see if participants in the experimental group, who were trained in English pronunciation through music, achieve greater outcomes than those in the control group, who were trained through a more traditional way (by listening and repeating exactly the same content as the experimental group). The results will be compared to our previous studies also related to Multiple Intelligences.

Keywords: Multiple intelligences, musical intelligence, pronunciation, L2 acquisition, training, Arabic.

1. INTRODUCTION

The purpose of this study is to examine the use of the musical intelligence, as a tool to help individuals improve pronunciation. Musical intelligence is one of the eight in the Theory of Multiple Intelligences – from now on MI - developed by the American psychologist and educator Howard Gardner. The theory was first published in 1983 [1]. MI claims that human beings possess eight different intelligences rather than only one as previously defended by psychologists. These intelligences are bodily-kinesthetic intelligence, logical-mathematical, spatial, interpersonal, intrapersonal, linguistic, naturalist, and musical [2]. This paper will focus on the latter.

The capacity to discern tone, pitch, timbre, and rhythm is known as musical intelligence, which enables us to recognize, create, reproduce, and reflect on music, as demonstrated by composers, sensitive listeners, pianists, guitarists, violinists, and vocalists [1].

According to Campbell L., Campbell D., and Dickinson [3,] there are two basic strategies to incorporate MI in the classroom. The first is the multimodal model, which employs MI as entry points into disciplinary content [1]. Entry points refer to a student's strength, which may be any of the eight MI, being used to study and facilitate academic information. Musical intelligence is the entry point for our research. The second type is the arts-based model, when police makers implement arts as disciplines in their own right; for instance, by implementing music classes in the schools. As we are not policy makers, our study will apply the multimodal model. Conducting this study in the United Arab Emirates contributed to the multimodal model as this country has only recently begun to adapt to new methodologies and international schools; nonetheless, 20 years ago over 90% of schools in the Emirates were koranic based and there were no institutes with musical classes or music academies available in the country, for instance [4].

Researches of individuals whose brains have been injured confirm the uniqueness of musical perception. There are cases in which aphasic individuals (people who have had a partial or whole loss of the ability to communicate thoughts or understand both written and spoken language, resulting from brain injury) have also exhibited diminished musical ability while others can suffer considerable aphasia with no noticeable musical impairment, even if one loses his / her musical ability, one can still retain his/ her fundamental linguistic competences. This occurs on the grounds of linguistic functions, which are nearly entirely lateralized to the left side of the brain in normal right-handed individuals [1]. The right hemisphere houses the bulk of musical capacities, including the central capacity. Music appreciation seems to be harmed by right hemisphere disease as well. For instance, amusia is a condition which prevents the recognition or reproduction of musical sounds [1, 5, 6]. Because of these evidences we believe that activating one more portion of the brain to learn, in the case of this study the right hemisphere in which musical intelligence is located, will provide better results than just learning through the conventional way (repetition, reading, listening to the teacher, etc.).

A great variety of musical syndromes can be found even within the same population. Musical breakdown suggests no systematic connection with other faculties, such as linguistic, numerical, or spatial processing; music seems in this regard unique, just like natural language [1, 7]. Perhaps once the proper analytic tools for studying various forms of musical competence have been refined, we may find that it is even more lateralized and localized than language.

Accounts of astounding musical and acoustical feats executed by autistic youngsters fill the literature. Children who are able to play in the style of famous composers, such as Schubert, Mozart, Beethoven, and Verdi [7-13].

A phonetic experiment will be carried out in this study. It is known that phonetic drills help students improve their perception and production [7, 14]. This study, however, transcends teaching explicit phonetics in both control and experimental groups. Apart from improving their pronunciation considerably, we expect the experimental group to excel the control group, as the experimental group will be learning explicit phonetics as well as applying their musical intelligence.

We would like to highlight that this study uses music as an illustration of a possible area of strength; nonetheless, other types of arts can and should be used to support students, such as acting, dance, creative writing, and others.

The main aim of this work is to suggest that other intelligences, in the case of this study, musical, can be used to help improve pronunciation.

To investigate the effectiveness of teaching content through music the following research question was raised:

Is there a difference in result among the participants who learn through music and those who learn through the conventional learning (reading and repeating the content)?

To reinforce our research question, we will compare the results of this study with those obtained in two previous studies [7, 14]. The first used a similar experiment with the aid of body intelligence to improve the pronunciation of Spanish participants; whereas the second utilized a kindred training with the aid of musical intelligence to improve the usage of English prepositions of Emiratis participants.

2. THEORETICAL FRAMEWORK

The following literature shows how the theory of MI and, more specifically, musical intelligence has been treated over the years and its implementation in the health area, in various therapies and mainly in education.

2.1. Multiple Intelligences

Linguistically intelligent people have a deep understanding of words and sensitivity to the literal and figurative meanings of words, people such as poets, broadcasters, TV and radio presenters, writers and speakers have highly developed oral and/or written communication skills. They are sensitive to the musical qualities and rhythms of words, as well as knowledge of various uses of language, such as persuasion, information, or pleasure. One could not expect to proceed with any effectiveness in the world without a considerable mastery of the linguistic tetrad of phonology, syntax, semantics, and pragmatics [13]. Linguistic intelligence appears to be the broadest and most democratically shared by the human species. Linguistic Intelligence is also the basis of our research, as we will be using musical intelligence to improve linguistic areas.

The ability to quickly decode linguistic messages - a prerequisite for understanding normal speech - appears to depend on an intact left temporal lobe, so damage to or abnormal development of this neural zone is often sufficient to produce language impairments [1].

Body-Kinesthetic Intelligence is the ability to use the body in a highly differentiated and skillful way [1, 7]. Examples of body-kinesthetic intelligent people are actors, dancers, and mimes.

Spatial Intelligence is related to how well an individual processes visual information. This includes the ability to view objects and rotate, transform, and otherwise manipulate them. These capabilities often occur together in the space realm [1, 2, 7].

Personal intelligences: the interpersonal, which allows a skilled adult to read the intentions and desires of other individuals and act on that knowledge; and intrapersonal intelligence, which allows human beings to examine and know themselves [1, 2].

Naturalistic intelligence represents the individuals who are well aware of how to distinguish and classify the various plants, animals, mountains, cloud configurations of their environment. These are not purely visual capabilities; recognizing a bird's song, for example, requires auditory perception.

The study of brain damage shows evidence of individuals who lose the ability to recognize and name inanimate objects but retain the ability to remember the name of living things; less often, the opposite happens, there are individuals who lose the ability to recognize and name animated objects, but fail to do so with artifacts [1, 2].

2.3. Musical Intelligence

As explained in the introduction, musical intelligence is the ability of the skills used to compose, play, remember, feel, and understand music. Highly intelligent individuals are extremely sensitive to sound as well as rhythm. For example, they can easily distinguish the sound of a Spanish guitar from an acoustic guitar. They think in terms of musical patterns. Individuals who have high musical intelligence seek patterns in new pieces of information to acquire more learning. They seek for patterns in language and speech as well. They recollect things by turning them into lyrics or music.

This study is based on using music to remind participants of correct English pronunciation. Gardner's MI apply specifically to language teaching [15 -17] and argue that one of the main implications for teaching this theory was that students should not just be taught to increase their skills: verbal, spatial, and logical-mathematical intelligences, but also to nurture musicality, body-kinesthetic intelligence, and interpersonal and intrapersonal intelligences.

We have had studies on the use of music and songs in the English classroom for decades, even prior to MI. Bartle, Richards, and Jolly [18-20] already defended the use of music in a context of language acquisition for its linguistic benefits and the motivational interest it generates in language learners. We can argue the strong relationship between music and language since there are several researches in the fields of cognitive sciences, anthropology, sociolinguistics, psycholinguistics, First Language Acquisition and Second Language Acquisition [17].

Thomas Armstrong published the book Multiple Intelligences in the Classroom in 1994 [21], the first practical work on multiple intelligences. The author prepares the teacher to work in practice with each of the intelligences. Multiple Intelligences Developmental Assessment Scales - MIDAS was created by Branton Shearer as a means of improving a person's intellectual performance, career development, and personal satisfaction [22].

Gardner (2006) [2] provides us with an assessment of the practice of multiple intelligences in a conservative educational climate, new evidence on the functioning of the brain and how to assess students in the context of multiple intelligences.

2.4. Musical Intelligence, Autism and Music Therapy

Eddie Bonafe is by far the most outstanding musical scholar in professional literature [8-12]. Eddie at the age of ten exhibited the ability to play works at the level of Mozart's sonatas. Another child, Harriet, played “Happy Birthday” in the style of famous composers such as Mozart, Beethoven, Verdi, and Schubert. Harriet applied her musical intelligence in many other ways - she knew, for example, the personal history of the members of the Boston Symphony Orchestra. At age three, her mother called her by whistling incomplete melodies, which the child completed with the appropriate tone and rhythm [1].

Regarding music therapy, the literature is replete with research recommending that listening to or singing songs may benefit individuals with Alzheimer's disease, as well as other types of dementia, after strokes [23, 24]; in addition to improving emotional well-being and health, quality of life and alleviating anxiety [25].

Many clinics around the world use music therapy to treat patients with Alzheimer's and other dementias, [26, 27] the Spanish association Music for Awakening became extremely renowned when one of his videos went viral on social and traditional media in November 2020. In the video the former ballerina Marta Gonzalez listens to Swan Lake by Tchaikovsky. As she listens, she remembers the choreography and emotionally dances and interprets Tchaikovsky's music.

There is also a plethora of studies on the use of music to reduce pain during and after procedures [28; 29]. Apart from helping humans, music therapy can also be beneficial to animals. Kaavan, an elephant in a Pakistani zoo, has developed "stereotyped behavior in which he shakes his head and tube from side to side for hours." In order to prepare him for his release, which comprised a journey of 4,000 km in a steel cage, he underwent music therapy in an attempt to reassure and motivate him. This method worked. Frank Sinatra's "My Way" was his favorite; reduced Kaavan’s anxiety and harmful behavior.

The objective of adding this section into our study is to confirm that musical intelligence is separate from cognition. All the aforementioned children are autistic. Nonetheless, their musical abilities are superior to most humans with extremely high mathematical or linguistic intelligence, for instance.

As we saw in this theoretical framework, musical intelligence has a vast literature that supports us to develop works like this and similar ones: several studies on the benefit of music as therapy, to relieve stress and even assist in operations; autists with musical excellence even though they have obstacles in other areas; books such as Multiple Intelligences in the Classroom [21], *Multiple Intelligences - New Horizons* [2] and the MIDAS scale [22] are veritable manuals on how we can/should apply intelligences in practice. These last three tools were the basis of our study format.

2.5. Factors Concerning Pronunciation in Second Language Acquisition

As follows, we present below some important literature regarding pronunciation as our experimental group received trained in pronunciation.

2.5.1. The Direct Method and the Reform Movement

This is one of the first methods of language instruction to deal with the learning of sounds. "Direct Method" claims that the meaning must be taught directly into the second language (from now on L2) through demonstration and visual aids. Therefore, speaking is the first skill taught and only then reading or writing. It acquired acknowledgment in the 1890's. Students imitated a model of the L2 that was spoken by the instructor (and later by recordings) then they repeated in order to get closer to the model [30]. Asher's [31] *Total Physical Response* and Krashen and Terrell's [32] *Natural Approach* is built on this approach. At the point when learners later on start to speak, their pronunciation is supposed to be quite good, although they never received explicit pronunciation guidance [33].

However, it may be argued that speakers tend to assimilate a new phoneme which they lack in the L2 to a similar one of their first language (from now on referred to as L1). For instance, Arabs do not distinguish between /p/ and /b/ in their production, so they tend to pronounce the words ***p**ark* and ***b**ark* in the same way. Nevertheless, if students' attention is not drawn to the differences, they might not realize such differences, especially if they are not children. Later in this section age factor and assimilation of L2 sounds to L1 inventory are dealt with in more details.

Henry Sweet, Wilhelm Viëtor and Paul Passy led a movement in language teaching that was known as the *Reform Movement in the 1890's* [30] for a period of about twenty years, not only did these phoneticians co-operate towards a shared educational aim, but they also succeeded in attracting teachers and others in the field to the same common purpose. The movement of a remarkable display of international and interdisciplinary co-operation in which specialist phoneticians took as much interest in the classroom as the teachers did in the new science of phonetics. These phoneticians influenced the teaching of pronunciation with their contribution to the implementation of a system for describing and analyzing the sound systems of languages. They advocated the following guidelines [33]:

(1) Speaking is primary and ought to be taught first.
(2) The results of phonetics research ought to be applied in the classroom.
(3) Instructor must have well-founded training in phonetics.
(4) Learners should be given phonetic training in order to acquire good speaking habits.

These guidelines established two centuries ago are still valid nowadays. The case study in this paper is based on them, in addition to a subsequent concept of the phoneme as a minimally distinctive sound [34].

The simplest way of representing the Scope of the Reform Movement may be to outline a higher perspective of its achievements between 1882 when it first attracted attention, and 1904 when Jespersen [35] summarized its implications for the classroom teacher.

Unlike many examples of educational change, the Reform Movement began suddenly, with the publication of Viëtor's pamphlet *Language teaching must start afresh,* in 1882. Four years later, Passy set up the Phonetic Teachers' Association which was later to become the International Phonetic Association. The Movement at the turn of the century reached its climax with the appearance Sweet's classic *The Practical Study of Languages,* published in 1899.

2.5.2. Audiolinguism and the Oral Approach

The contribution of the latter analytic linguistic approach to pronunciation pedagogy led to a very popular movement in the 1940's and 1950's. In the United States it was named *Audiolinguism* and in Britain the *Oral Approach. These* two methodologies were built upon the explicit instruction of phonological aspects of language [30]. The educator drew on their knowledge of phonetics and creatively used phonetics simplified charts of the IPA and articulatory models in the classroom. The use of minimum pairs for listening exercise and oral output was also established. This strategy was founded on the notion of the phoneme as a minimally distinguishable sound [34] and was employed, and perhaps overused, by Baker [36] in her widely used course book *Ship or Sheep?* on contrastive segmental teaching.

The use of minimal pairs in classroom is very helpful given that it elicits the differences between two similar sounds, which differ in only one phonological element, one voiced and the other unvoiced, for instance [37]. This assists students in the understanding of the differences between /s/ and /z/, just by making them aware that what differentiates these two sounds is the use of the vocal folds.

2.5.3. The Cognitive Approach

The 1960's was the decade which was to have a profound destabilizing effect on the teaching of pronunciation:

Transformational-generative grammar, or Universal Grammar (UG), credited to Chomsky [38]. For L2 learning, access to UG could theoretically be complete, partial, or dual [39]. Learners with complete access to UG are exemplified by the so-called "talented" learners, one of which will soon be described in this paper. Learners with no access will rely on general learning strategies and never achieve full competence. Learners with partial access will be able to switch to L2 parameter settings but only with the help of direct instruction. And lastly, learners with dual access will employ both UG and general learning strategies but UG will be blocked by the general strategies, producing "impossible" errors. Because UG's advocates argued firstly that native-like pronunciation was an unrealistic objective and could not be achieved [40]; and secondly, as noted by Celce-Murcia *et al.*, [33], time would be better spent on teaching more learnable items, such as grammatical structures and words.

Cognitivism may be regarded as a very negative approach in the sense that it takes for granted that phonetics is difficult and almost nothing can be done. Avoiding a "problem" does not make it less important. If we go back to the guidelines of the Reform Movement (see 2.7.1.), this "problem" can be faced and tackled. Pronunciation can be taught at any stage, for instance, a teacher can instruct: "Open more your mouth to produce the sound /æ/, in **a**pple". We trained 2 groups in this study to show that by teaching pronunciation explicitly the students can acquire a much better pronunciation and when we add music to the explicit pronunciation training, we can boost the results.

2.5.4. The Silent Way

In the early 1970's pronunciation regained favor with the development of the *Silent Way* [41]. This system emphasizes segmental as well as suprasegmental features from the start of training. As the name indicates, instructor speaking is limited to a minimum with this strategy. Instead of complex articulatory and phonological explanations, the teacher indicates what the students ought to do. Also central to the Silent Way are visual teaching aids that have been found useful in demonstrating some of the more abstract principles of pronunciation to second language learners:

- **The color-sound chart:** For convenience of reference, each phoneme on a phonemic chart is assigned a color and is referred to by color.
- **Fidel wall charts:** A color classification system that divides letter-to-sound rules into phonetic bundles. A color is assigned to each letter or combination of characters that represents a phoneme in English.
- **Cuisenaire rods:** These colorful pieces of wood of varying lengths, which are also used to teach children fundamental arithmetic, have a variety of purposes in the teaching of pronunciation in the classroom. Rods can be used to construct and visualize intonation patterns, vowel length, and lexical stress.

The combination of Reform Movement standards, the use of minimal pairs, and Silent Way procedures may result in an ultimate education in phonetics. As stated by the Reform Movement in guideline (2), phonetics results should be adapted to language education rather than a new finding to the disadvantage of others. Nonetheless, most instructors do not use or join these concepts in the classroom.

2.5.5. The Communicative Approach

The current and one of the dominant methodologies rose to popularity in the 1980's [30]. Although pronunciation is not explicitly mentioned in this form of training, its relevance has been highlighted. By emphasizing active communication in the classroom, it has been shown that pronunciation skill below a particular threshold renders even the most grammatically and lexically advanced student incomprehensible [42]. This heightened emphasis on pronunciation has created a slew of new issues for teachers using the Communicative Approach. One issue is that a strict teacher-centered approach to teach pronunciation does not match well with the discourse-based Communicative Approach [43].

Materials authors have produced materials that focus on suprasegmental characteristics of pronunciation in an attempt to maintain pronunciation communicative.

Nowadays the important aspect of learning a foreign language is the communication, so intelligibility is considered more important than a native-like pronunciation. This study tries to reinforce the importance of phonetics / pronunciation by showing that with a greater input from the teachers; students show a much better phonetic performance after training. Students improve both their perception and oral production. By making progress with their perception, students understand better their listening activities, television programs, movies; and by improving their oral production, students become more effective and intelligible speakers [7, 14, 44, 45].

2.6. Theories and Hypotheses on Language Acquisition

So far, we have been discussing the different theories, methodologies and their view of phonetics and their changes. Now, let us look into the Theories and Hypotheses related to phonology and language acquisition.

2.6.1. Theories of Speech Perception

According to the Motor Theory of Speech Perception [46], humans have two different brain modules, one for speech and the other for processing general auditory inputs. Whalen and Liberman [47] contend that phonetic stimuli are the first to elicit brain potentials. In recent decades, the Motor Theory of speech perception has been scrutinized. The three assertions have been reexamined by Galantucci *et al.*, [48]: (1) Speech processing is unique, (2) seeing speech is similar to perceiving movements, and (3) perceiving speech requires the use of the motor system. It was discovered that just principles (2) and (3) can be confidently supported by the available evidence.

Most scholars believe that children are born with the capacity to discern the sounds of all languages, but that this sensitivity quickly fades, save for native language phonemes. This prompted Lenneberg [49] to propose a key window of language-learning that ends before the start of puberty, after which our ability to acquire language is significantly reduced. This is a problem of speech perception as much as speech production. Kuhl [50] proposes a “perceptual magnet effect” to justify the sensitivity developed as infants. Kuhl’s perceptual magnet effect is in keeping with the notion of the phonetic prototype. The notion of a “prototype” is drawn from psychology literature, particularly from Rosch’s [51] who defines a prototype, at the basic level, good instances of categories. A phonetic prototype is thus, at the basic level, a good instance of a phoneme. The infant learner who has tuned his ear to the input of his language will develop a prototype of each phonetic category in his language [50, 52]. Thus, the magnet effect implies reduced discrimination sensitivity for the area around a phonetic prototype. For Kuhl, the adult second language learner encounters the same distortion of the perceptual space and will compare incoming L2 sounds to L1 prototypes, thereby submitting those sounds to the warping effects of the L1 perceptual space. To suggest that speech perception occurs solely at the level of the phoneme would be to misrepresent its complex nature. The literature on speech perception includes studies which further subdivide perceptual skill into distinct modes or tasks. According to Wode [53], the human auditory system is capable of both categorical and continuous perception. Categorical perception classifies stimuli as belonging to one of two categories, with no concern for intermediate values. For example, /k/ is classified as /k/ regardless of how much puff of air it has, whether it is entirely, partly, or barely spoken. The obvious advantage of categorical perception is the speed with which incoming information may be examined, classified, and processed. The continuous mode of perception is another form of perception in which the human auditory system discriminates distinctions in sound on a progressive scale. In the preceding example, the listener applying the continuous mode of perception would attend to degree of the amount of puff of air in /k/ and would theoretically recognize the stimulus as a good or bad instance of the category.

One part of a theory offered by Hume and Johnson [54] argues in favor of the interaction between speech perception and phonology, addressing the question of how speech perception influences phonological systems. They offer three possible explanations for this: inability to perceptually correct for articulatory effects, avoidance of barely detectable contrasts, and avoidance of prominent alternations. The first scenario is when a listener misunderstands the speech and then makes speech to fit the misinterpreted elocution. The avoidance of faintly perceptible contrasts can be noticed in circumstances when pronounceable but minor contrasts are avoided in speech. Third, avoiding conspicuous alternations may have an impact on phonological systems.

2.6.2. Psycholinguistics

Psycholinguistics, the discipline of linguistics that analyzes the mental processes involved in language learning and use [39], is a crucial area to research pronunciation. First language transmission is arguably the most thoroughly researched subject in psycholinguistics. The transfers with regard to L2 learners are the Zero transfer, which describes the case where a structure or sound found in the L2 is not a feature of the L1; the negative transfer, which occurs when an L1 feature is found in the L2 but not in the same environment or distribution; and the positive transfer, which characterizes the situation where the L1 and L2 share a feature in terms of both its structure or features and its distribution [55].

The Contrastive Analysis Hypothesis (CAH) is a pioneering concept for studying transfer effects. According to CAH, the challenges in L2 speech stem from the distinctions between L1 and L2. It was assumed that aspects of L2 familiar to the student from L1 would be simple to learn, but elements unfamiliar to the learner from L1 would be challenging [14]. The CAH began to fade, in part because it was easy to locate evidence of learners who did not struggle with new and varied phonemes in the L2. The CAH inspired Flege's Speech Learning Model (SLM) [14, 56], which asserts that diverse sounds are simpler to learn since the learner is compelled to categorize them. SLM is not in keeping with this study, due to the fact that the participants in this study assimilated most of the L2 sounds to their L1; for instance, most of the /p/ sounds in English, as in ***p**o**p**corn*, were assimilated to the Arabic letter b, as in ‘baba’ (meaning papa) whose sound is like the English /b/, as in *bar*; the same happened to the sound /æ/, which was associated to the Arabic phoneme /a:/.

The Perceptual Assimilation Model (PAM) also resembles the ideas of Flege’s SLM, but it focused on nonnative listeners’ behavior [14, 57], proposing that the apparent resemblance of L2 categories to L1 categories can be used to predict the difficulty of nonnative contrast discrimination. PAM, in other words, accounts for learner perception of nonnative sounds in terms of L1's phonological system. PAM suggests, more specifically, that the articulatory properties of nonnative sounds will affect the amount to which they will be assimilated into L1 phonemic categories. In turn, the learner's capacity to identify any contrast will be determined by the degree of assimilation of the nonnative sound.

The role of awareness is another aspect studied by Psycholinguistics. Discussions on the function of awareness may be traced back to Stephen Krashen's Theory of Second Language Acquisition, which suggests the distinction between "acquired" and "learned" L2 cognition [14, 58-60]. The assertion that they were autonomous knowledge systems sparked debate, prompting Schmidt to address the then-overgeneralized usage of the term "consciousness" in SLA. Schmidt [62, 63] eventually maintained that awareness may take numerous forms, such as 'intentionality' and 'attention,' and that noticing is a necessary component of learning. Schmidt's theories on the role of consciousness in learning have had far-reaching implications in SLA, sparking more than a decade of study on the interaction of attention, awareness, perceiving, and many other elements.

It's unclear what function consciousness plays in L2 speech perception and acquisition. Based on what has been observed so far, it appears that learning the sounds of the L1 requires little conscious effort. Rather, the amount of attention paid to various auditory signals is done on an unconscious level. It is possible, nonetheless, that the teenage or adult student of a second language uses conscious processes in some way. In contrast to studies of production, the majority of research on L2 phonological acquisition does not raise the topic of awareness (i.e. grammatical or conversational structures) [14].

2.6.3. A Review of the Critical Period Hypothesis

The Critical Period Hypothesis (CPH) [40, 49] proposes that an L2 must be mastered early, maybe as early as six years of life, in order for the learner to acquire native pronunciation. Some writers argue that rather than a crucial phase, adults have a "sensitive" or "optimal" period; others dispute the explanations, stating that adults have greater physical maturation and cognitive elements that may improve their learning. In addition, the length of the era differs widely amongst accounts. According to the rigorous form of this idea, learners lose their capacity to properly learn a language at the age of 12.

Based on a review of studies on speech perception, Wode [53] warns that there are several ways in which age might impair language learning, and that no one theory can account for all the data at this time.

Flege and colleagues have done a lot of studies on the impact of exposure duration on L2 perception and production. Flege *et al.,* [61] conducted research with native Italian-speaking English learners on the production of the /e/ vowel. Participants were divided into two groups based on their age of arrival (AOA) and the amount of time they spent using L1 (Italian). Early bilinguals (i.e. earlier AOA) tended to generate English vowels more precisely than late bilinguals, and low-L1-use bilinguals tended to produce English vowels more accurately than high-L1-use bilinguals, according to the ratings. MacKay *et al.,* [64] looked at bilinguals in Canada and found that their AOA and quantity of continued L1 usage vary.

The results of this investigation were not the same as those of Flege *et al.,* [61]. MacKay *et al.,* [64] looked at how English /b/ is produced and how short-lag /b d g/ tokens are perceived. The disparities between early and late bilinguals were linked to variations in the volume and quality of English input rather than any possibility that early learners had an edge over late learners in terms of generating new phonetic categories. Indeed, the effect of L2 exposure period is not well understood. All individuals in a study of Spanish-Catalan bilinguals had at least 12 years of Catalan exposure [65], but they had not mastered the perceptual distinction between Catalan between /ʎ/−/ʒ/. These findings, according to the authors, provide significant evidence that bilinguals' sound systems are heavily influenced by their native language, and that these speakers do not have two sound systems to switch between.

Students’ aptitude, or a laser profile according to Gardner’s terminology [2], which is an internal individual variable might also be relevant. A student, who has strong linguistic intelligence, may learn pronunciation faster than another student with weaker linguistic intelligence.

Another important component is motivation, which can be one of three types: instrumental, integrative, or intrinsic [66]. Instrumentally motivated students make an effort to acquire a language in order to meet school or professional requirements, or maybe to progress in such surroundings. The instance of the learner who is interested in the culture of the people who speak the language in question is described as integrative motivation. Finally, the intrinsically motivated learner is similar to the integrative motivated learner, but this learner considers the learning exercise activity to be stimulating in and of itself.

The aforementioned methodologies and their aids, for instance, minimal pairs, phonetic drills, IPA chart, and also Perception, Psycholinguistics and age factor were used to structure and support this study. The IPA chart was fundamental in the organization of this paper, for instance, to show that students pronounced /p/ in lieu of /b/ (Arabic lacks the sound /p/ and native speakers tend to assimilate /p/ of the L2 to /b/ of their L1. The age factor contradicts the CPH, as all the participants in our study were older than 28 years old; this shows that motivation and determination may be important factors to acquire a better pronunciation.

3. METHODOLOGY

3.1. Participants

Twenty UAE (United Arab Emirates) natives were chosen to form part of the control group and 20 others to form the experimental group. The age of the participants is between 29 and 38 years old. All participants attended public schools in Dubai and Abu Dhabi, where English was taught for just two hours a week. They started studying English in primary at 8 years old. All English teachers were non-native, most teachers from Egypt and Jordan, native Arabic, so they shared the same L1 as the students. Informants were never corrected in pronunciation when studying English, only in grammar. To find out participants' musical proclivities, a questionnaire was administered to informants from both groups (see Appendix A). Whenever participants answered five or more questions (out of seven) of this questionnaire positively - for example, if music is important in their lives, if they play any instruments - then they were able to participate in the experimental group; however, of the total 40 participants from both groups, only six did not meet the requirement of a minimum five positive questions about musical trends. This fact suggests that we have two almost homogeneous groups in which informants have musical propensities.

3.2. METHOD AND MATERIALS

3.2.1. Pretest

In order to appraise the experiment, the following standard pretest was administered in all two groups. In Part 1 of the pretest participants had to read the 22 words below containing the 4 analyzed sounds: /p/, /r/, /v/ and /æ/ sounds that usually Arabic speakers have difficulty in pronouncing either because the sound is performed differently in their language or because it is absent.

Part 1: Take a look at the following words and then repeat them please

Sad	Rev	Peep	Mad
Pave	Deep	Van	Root
Ask	Rat	Vet	Pat
Pad	Meet	Rave	Popcorn
Zac	River	Very	Review
Ram	Vegetable		

In the case of the phoneme /p/, it is absent in Arabic and its speakers pronounce the words with the letter p in whatever language they speak as if it were the letter b /b/, since b is present in the Arabic language, pronouncing words like "bark" instead of "park" or "baba" instead of "papa".

In the case of the phoneme /r/, it is pronounced as simple alveolar vibrant [67], as in Spanish, Italian, Catalan and Portuguese (in the middle of words when followed by a vowel), an example would be the word "ba**r**ato" in Portuguese and Spanish, and the word *però* (meaning "but"). In Catalan and Italian. Let us not forget that this is the way Scottish English pronounces the phoneme /r/. There is also the multiple apical vibrating sound, or multiple alveolar vibrating sound (the double r sound), as in Spanish, Italian, and Catalan in the word *bu**rr**o* (meaning "donkey" in Spanish and Catalan; and "butter" in Italian). This double r sound is absent in English.

The phoneme /v/ is absent in Arabic, there is a minimal pair /f/, so it is typical to hear words like "ferry", instead of "very" or "fitamin" when Arabs mean "vitamin".

Finally, the phoneme / æ /, as in the words cat /kæt/ and /bæd/, does not occur in Arabic. Arabs pronounce it either as /e/, present in most Arabic dialects as in bed /bed/or as /ɑ/ as in car /kɑr/.

Subsequently, in Part 2 they had to look at 14 pictures (see, Figure 1 below) and make a sentence which contains the objects, food, sport, or instrument shown in each picture, as the analyzed sounds will be also taken from the images. For instance, of the 22 words in the pre-test, the ones that comprise the phoneme /p/ are: pave, pad, deep, peep, pat and popcorn; the word peep being analyzed twice, once by the sound of the initial /p/ and secondly by its final /p/. We therefore have a total of 7 analyze of the phoneme /p/, the remaining 3 were extracted from images below and these 3 words are: potato, pizza, and panda.

Part 2 Name the following objects, animals, food, and sport in English (you can speak freely, make sentences, ask questions, for example: If you see a picture of a dog, you may say: "Here I can see a dog", or "I have a dog at home", or you may ask: "Do you like dogs?"

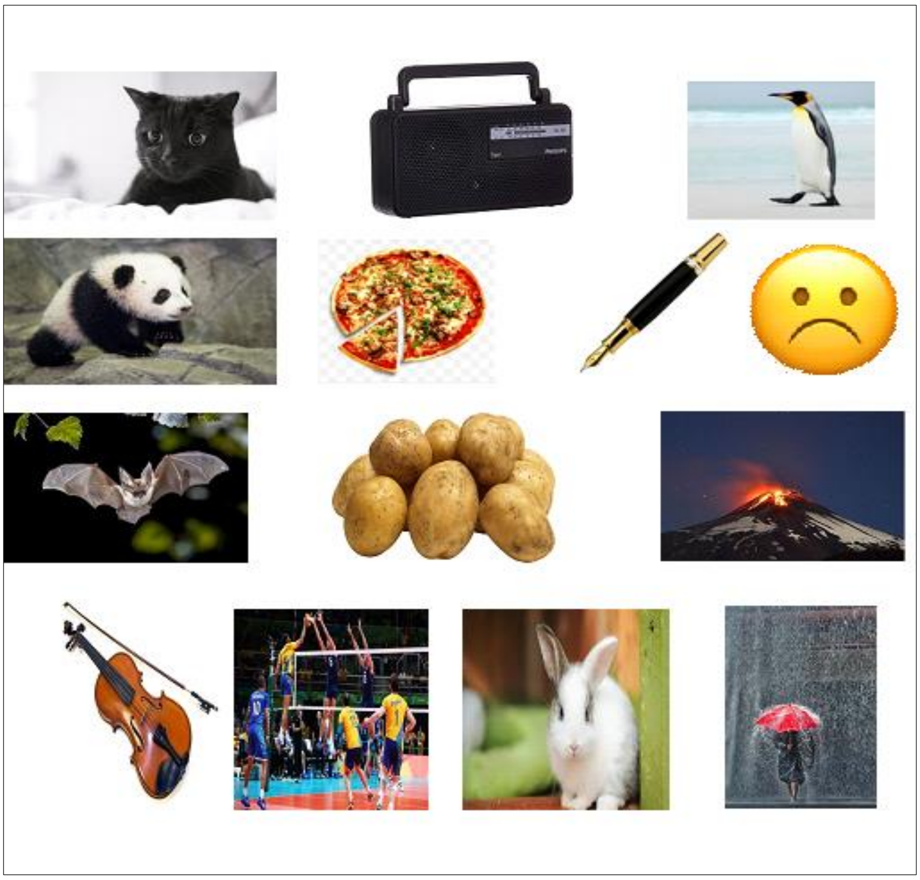

Figure 1: Name the objects, animals, food, and sport in the picture

3.2.2. Pronunciation Training

There were 6 training sessions of 10 minutes each. After taking the pretest participants had session one in which each sound was explained in detail, how to articulate each analyzed sound **/æ/, /v/, /p/** and **/r**/. In the case of the **/æ/,** participants initially made the sound **/a/** but then they were told to make the sound **/e/** existent in Emirati Arabic and open up their mouths until they reached the sound /æ/; regarding the /v/ sound, they were told to say words in English that are the same in Emirati Arabic such as 'video' and the noun 'live'. They were explained that they had to vibrate their vocal cords so that it does not sound /f/. With regard to /p/ it was the opposite as Arabs have the sound /b/ but lack the sound /p/ so they were instructed not to use their throats, close their lips and open them with a puff of air. Concerning the sound /r/, participants were explained that they should attempt to pronounce the "Standard" R: postalveolar approximant [ɹ]; nevertheless, it would be okay if they "flapped" or "tapped" the letter 'r' (one single alveolar flap) as in Scottish and northern England English and in Welsh. Most participants tended to trill or roll the letter 'r' as in the word *perro* in Spanish, and *corro* in Italian and Catalan. As Arabs have the flapped 'r' in their alphabet it was not hard to correct it. This explanation was more detailed before the beginning of the first session and was explained before the beginning of the following five sessions but each time more concisely. After this explanation the training started by reading the words (see appendix B). Each sound was represented by a color (color-sound chart, see section *2.5.4*) and subsequently students sang a song (see appendix B.2).

After session 3 students took the first posttest, which was the same material used for the pretest (see method and materials) and after session 6 students took the posttest a second time.

The sounds were analyzed by two professors of linguistics, who are native English speakers. One of them also speaks Arabic fluently. One of the professors did not know if the participants belonged to the experimental or control group. The sounds were analyzed from a video in which the mouths of participants were clearly seen. The recordings were made in a room deprived of external sounds.

4. RESULTS AND DISCUSSION

4.1 First Recording: Production Pretest

Participants of both groups took pretest 1 (Appendix A.) and each studied sound, **/æ/, /v/, /p/** and **/r/,** was analyzed ten times in the speech. The occurrence of correct pronunciation for each word can be observed in Table 1 below. If only one student pronounced one word correctly, for instance, there is a number 1 under the word, if everybody was wrong, there is a 0. In case those four participants pronounced a word well, there is a 4. A rule of three was used to calculate the percentage of correct answers. In this case, 200 is the extreme of the proportion (the total amount of correct answers, 20 students x 10 words= 200).

Table 1. Production Pretest

/æ/	cat	bat	sad	dad	pad	Zac	ram	rat	van	pat	
Control	3	3	1	1	0	0	0	0	0	0	X=800/ 200 = 4%
Exper.	4	4	0	1	0	0	0	0	0	0	X=900/ 200 = 4.5%
/v/	volcano	volleyball	violin	van	vat	rave	very	vegetable	review	rev	
Control	10	9	9	9	9	0	9	8	7	0	x=7000/ 200 = 35%
Exper.	9	8	9	10	8	0	10	8	7	0	x= 6900/ 200 = 34,5%
/p/	panda	potato	pizza	pave	pad	deep	peep	peep	pat	popcorn	
Control	6	5	5	4	5	6	5	6	5	5	X=5200/ 200 = 26%
Exper.	4	5	4	4	4	4	4	5	5	5	X=4400/ 200 = 22%
/r/	radio	rabbit	ram	rev	rat	river	rave	very	root	review	
Control	1	0	0	0	1	2	0	2	2	1	x=900/200 = 4,5%
Exper.	2	1	0	0	0	1	0	1	2	3	X=1000/ 200 = 5%

In order to better visualize these figures, let us insert them into graphics:

As evidenced by Figure 2 below, we can notice that only 4% of the participants were able to pronounce the sound **/æ/** correctly, and 4.5% pronounced the sound **/r/** properly. Regarding the sound /p/, we can see that the position of the letter did not affect the performance, that is, in the word peep, the letter in initial and final position obtained similar results.

The mean in the graph shows the average of correct pronunciation; the sum of the four analyzed sound divided by four. Thus, control group mean = 4% + 35% + 26% + 4.5% / 4. Therefore, the control group mean = 69.5 / 4 = 17.37%.

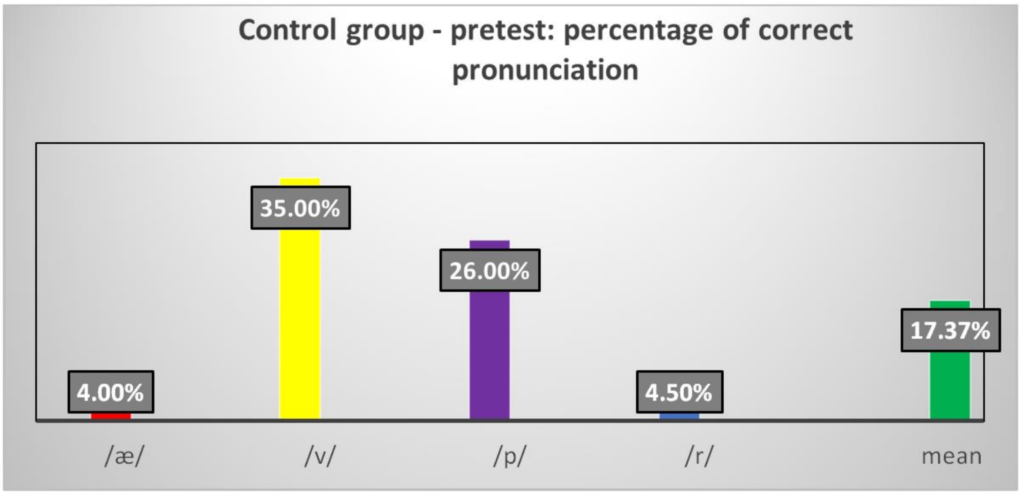

Figure 2: Control group Production pretest – percentage of correct pronunciation

The mean of 17.37% percent of correct answer in this pretest suggest that participants in the control group had problems dealing with these sounds. During the following six session we will try to improve these figures.

Figure 3 shows us the sum of the percentage of the correct pronunciation for the four analyzed sound divided by four gives us the mean of correct pronunciation. Thus, experimental group mean = 4.5% + 34.5% + 22% + 5% / 4. Therefore, the Exper group mean = 66 / 4; Exper group mean = 16.5%.

As we can observe in Figure 2 below, there is less than 1% of difference between the mean of correct pronunciation between the control and experimental groups. The relative low performance of these sounds that are uncommon in Arabic may be due to the fact that participants always had nonnative teachers of English.

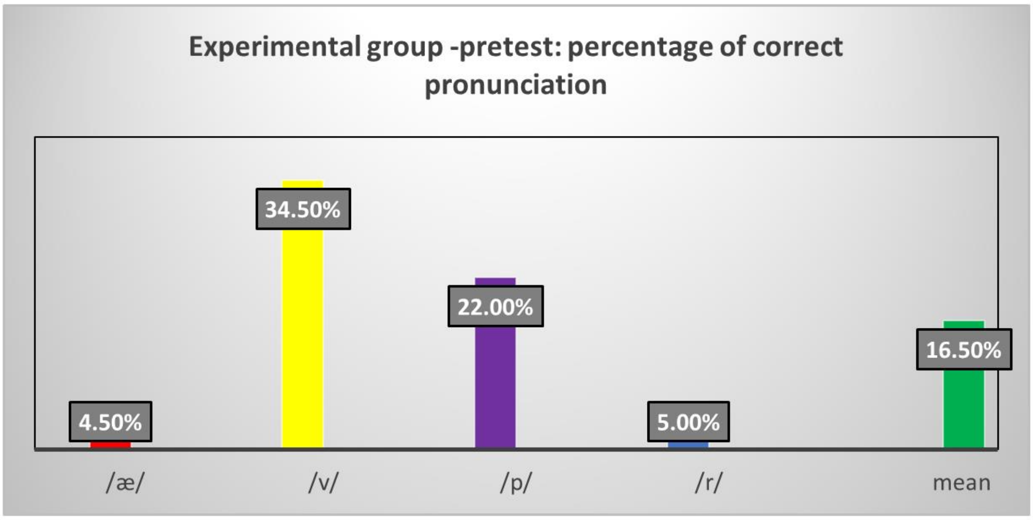

Figure 3: Experimental group Production pretest – percentage of correct pronunciation

5.2. Second Recording: Production Posttest 1

Both control and experimental groups had six ten-minute training sessions. The third training session was followed by the immediate posttest1. The results are shown in the graphs below:

4.2.1. Control Group Production Posttest 1 – Percentage of Correct Pronunciation

As we can notice in Figure 4 below, the control group improved all the sounds. In the pretest, only 4% of the participants were able to pronounce the sound **/æ/** correctly; however, in the posttest 1, they achieved 27,5% of correct pronunciation. Regarding the sound **/r/**, it improved from 4.5% in the pretest to 21%. The mean increased from 17.37 percent of correct answers to 30.12 percent. The sound **/v/**, improved from 35% in the pretest to 44 percent of correct pronunciation in the posttest 1.

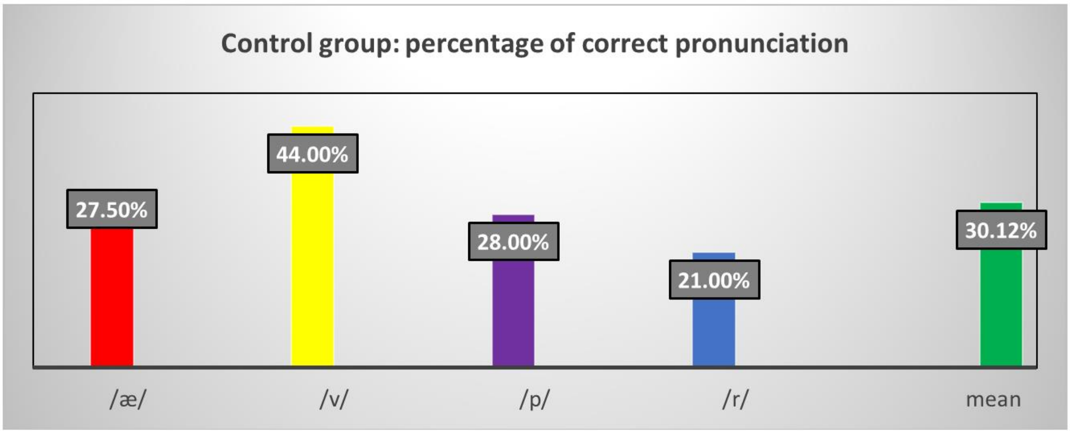

Figure 4: Control group Production posttest 1

4.2.2. Experimental Group Production Posttest 1 – Percentage of Correct Pronunciation

As evidenced below in Figure 5, the mean is 48.50% of correct pronunciation, over eighteen percent better than the control group. The performance of the sound /v/ improved from 34,5% in the pretest to 63.5% in the posttest 1. We justify this outstanding performance of the /v/ sound due to the fact that English is indeed the most spoken language in the UAE. Although the /v/ sound is absent in the Arabic alphabet, participants already had a reasonable performance in the pretest.

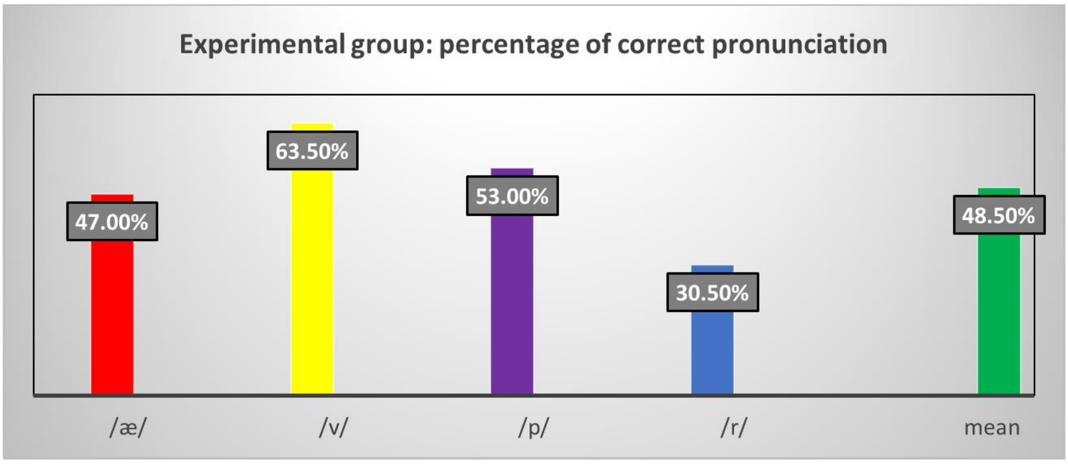

Figure 5: Experimental group Production Posttest

4.3. Third Recording: Production Posttest 2

After the six and final training session participants were submitted to the posttest 2.

4.3.1. Control Group Production Posttest 2 – Percentage of Correct Pronunciation

As evidenced by Figure 6 below, the mean of correct answers for the control group is of 51.25 percent. The best performance was now, however, the pronunciation of the sound /p/, which obtained 60 percent of correct answers. This great improvement was most likely because participants were shown a short 3 minute-video with a joke of an Arab driving examiner asking a foreigner to “park”, but he pronounces “bark” instead, the test-taker ends up failing his driving test because he didn’t “bark”. The performance of the sound **/æ/** improved from 4 % in the pretest to 43% of correct answers in the posttest 2.

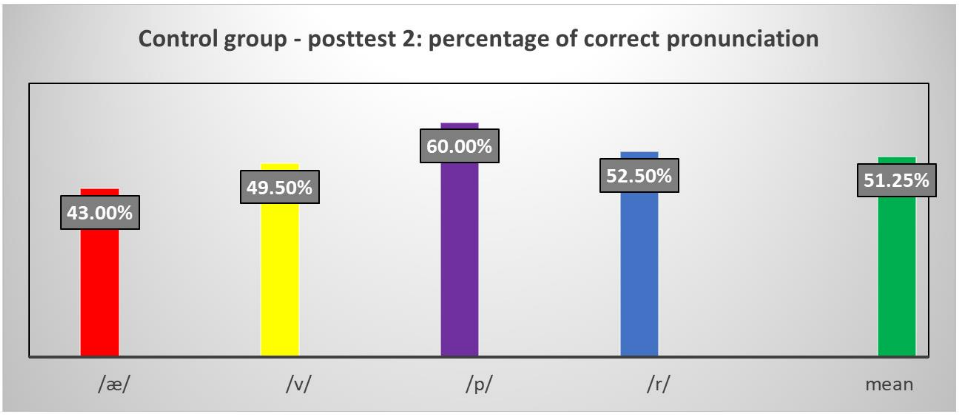

Figure 6: Control group production posttest 2

4.3.2. Experimental Group Production Posttest 2 – Percentage of Correct Pronunciation

Figure 7 shows us that the phoneme /v/ was again the best performed sound with a total of 95.5% of correct pronunciation. The mean of correct answers for the experimental group is of 87.75 percent of correct answers. If we compare the control group mean of correct answers (56.52%) with the experimental group mean (87.75%), we notice that the experimental group performance was over 30% better than the control group. The only element that differentiated both groups was the music, as both groups had access to the exam amount and source of input. The activation of the right hemisphere [1] in which music is located seems to have boosted the learning of pronunciation. The same area that when music is used as a stimulus can reduce pain during and after a surgery [28; 29], or that makes a ballerina with Alzheimer remember her choreography [26, 27].

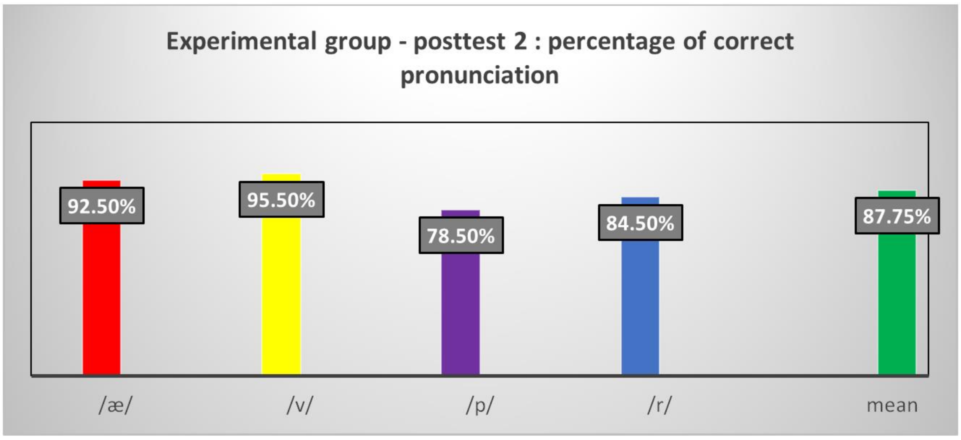

Figure 7: Experimental group production posttest 2

So far we have discussed the improvement of the sound in pretest, postest 1 and posttest 2 of each group. Nevertheless, it is crucial to analyze the different performances by comparing both groups and see how much music benefited the experimental group. Both groups started homogeneously in the pretest; performances varied from 0,5 to a maximum of 4% depending on the sound. In the pretest 1, we can realize that music has played a great role to improve pronunciation in the experimental group. The sound **/æ/**, for instance, obtained 27,5% of correct answer in the pretest 1 in the control group while the experimental group obtained 47% of correct answers. The difference between groups is of 19,5%. In the posttest 2, this difference becomes even more evident. The control group obtained 43% of correct answers for the sound /æ/ (this performance is inferior to the experimental group in the pretest 1) while the experimental group obtained 92,5% of correct answers. We have 49,5% of difference between both groups in the pretest 2. These figures provide supporting evidence that music has a positive impact on pronunciation performance.

4.4. Descriptive Analysis

In order to make a descriptive analysis, the Friedman test was applied. We decided to use the Friedman test as the sample is of less than 30 participants per group.

Table 2 below indicates the descriptive statistical values for the control group.

Table 2: Descriptive analysis control group

	N	Mean	Deviation	Minimum	Maximum	Percentiles 25	50 (Median)	75
pretest	20	6.95	6.452	1	26	2.00	4.50	12.25
posttest1	20	12.05	5.326	6	31	8.00	12.00	14.00
posttest2	20	20.50	6.460	10	34	15.00	19.50	25.00

Table 3 below refers to the descriptive statisticians of the experimental group.

Table 3: Descriptive analysis experimental group

		Mean	Deviation	Minimum	Maximum	Percentiles 25	50 (Median)
pretest	20	6.40	4.627	0	18	2.25	6.00
posttest1	20	19.40	4.828	12	28	14.25	20.00
posttest2	20	35.05	2.417	31	39	33.25	35.00

Applying the Friedman test, we observe in Figure 8 the difference in the mean in the pre-test, post-test 1 and post-test 2.

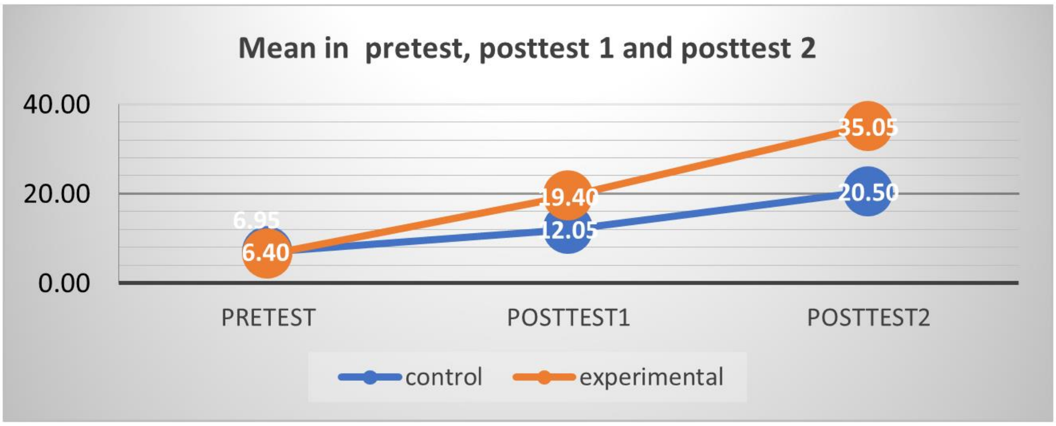

Figure 8: Mean in pretest, posttest 1 and posttest 2

Table 4 below gives us the values for p-value and chi-square. To assess the control group and the experimental group and whether there were statistically significant differences at the three measurement times, we calculated the Friedman test, obtaining in the control group a chi-square = 39.519 with an associated p-value <0.001 and in the experimental group a chi-square = 40,000 with an associated p-value <0.0001, it can be concluded that both in the control group and in the experimental group there was an increase in the scores due to the different sessions.

Table 4: Pretest, posttest 1, posttest 2, Chi square and p-value

	pretest			posttest 1			posttest 2			Friedman	
	Mediana	RI	RP	Mediana	RI	RP	Mediana	RI	RP	Chi-sq.	p-value
Control	4,50	10,25	1,03	12,00	6,00	1,98	19,50	10,00	3,00	39,519	< 0,001
Experimental	6,40	7,50	1,00	20,00	7,75	2,00	35,00	3,75	3,00	40,000	< 0,001

5. CONCLUSION

It was evidenced in the results that training is an effective way to improve pronunciation of individual phonemes within words at least in the short run. This is in accordance with our previous study in 2011. A great improvement can be observed after each posttest, mainly in the experimental group in which music was used as a potent stimulus to help students to better take in the content. All trained students achieved a better pronunciation. The study showed that a low performance in pronunciation may have as one of its causes the lack of phonetic teaching, and that phonetic training contributes to an improved performance in the discrimination and identification of L2 as proposed by Ribeiro Daquila [7, 14, 68], Evans & Iverson [69], and Logan & Pruitt [70] as well as a better oral speech sound production.

All the participants were aged 29-38; on this basis, this paper is not in accordance with the Critical Period Hypothesis [40, 49, 71], which suggests that an L2 must be learned early, perhaps as early as six years of age, for the learner to acquire native pronunciation. Our study is in keeping with Moran & Fitch [72] and Werfel [73] that a better performance in pronunciation may be achieved at any age when well-prepared practitioners teach adults phonetics explicitly.

After performing the Friedman test, it was confirmed that the experimental group had a higher mean value when compared to the control group. These results agree with those of similar studies: In 2014 [7] bodily kinesthetic intelligence was used with Spanish participants. In this study, the experimental group, composed of professional dancers, obtained a statistically significant difference in relation to the control group when trained in the pronunciation and in chemistry. In 2021 [14], Emirati participants were trained with the aid of music in order to improve English prepositions. The experimental group also presented a statistically significant difference when compared to the control group, who received the same amount of training without the aid of music. Nonetheless, it is crucial to highlight that both groups benefited from the training of explicit phonetics. In addition to the studies previously mentioned that show the benefits of the use of song in the classroom [15-20], other studies are in keeping with our research: the first study with 3-year-old participants [74] showed significant differences between children trained in music and children trained in visual arts, with the music group students showing significantly greater improvement in phonological awareness tasks. Music students outperformed the children trained in visual arts. Children trained in music revealed significant differences between the results before and after the training period, showing great improvement in phonological awareness skills from the pretest to the postest. A second study [75] concluded that by using songs, the students could improve their pronunciation in English like short vowels /ə/, /ʌ/, /ɒ/, /ɜː/, long vowels /ɔː/, /æ/, consonants /ʃ/, /θ/, /h/, /tʃ/,and diphthongs /əʊ/, /aʊ/, /ɔɪ/, /ʊə/. A third study [76] concluded that there are linguistic, cognitive, and affective reasons to use songs in the classroom.

Regarding musical intelligence, the literature reveals its importance in different areas of activity: such as music therapy with Alzheimer's patients and other types of dementia [23], for a better quality of life after a stroke [24l], to alleviate depression and improve general behavioral problems, in addition to improving emotional well-being and quality of life, alleviating anxiety [25]; in the educational area, however, little research has been carried out. Maybe because educators still see music as a mere aid for fun. Research using musical intelligence in the educational area reveals an improvement in pronunciation, chemistry, and grammar [7, 14].

This study presents a few suggestions to be improved in further research. The first suggestion would be to apply a similar training to other intelligences such as naturalistic, mathematical, and inter-intrapersonal and check if similar results are obtained. Another suggestion for future works would be the analysis of an experimental group of participants who do not have an inclination to the intelligence in question, that is, if the focus is musical intelligence, that the participants do not have proclivities for music. If such work still presents superior results in the experimental group, we will be able to verify the effect that the intelligence analyzed in such work would have on individuals regardless of their propensities for the intelligence in question. Let us not forget that although most participants in the control group had proclivities for music- and this part of the brain was not activated - these participants did not make use of their musical strength.

This study has attempted to show that individuals' strengths and weaknesses should be taken into consideration and with only six sessions of ten minutes, students can achieve a much better performance. We would like to reinforce that phonetics was used arbitrarily in this study; educators can and should use any subject topics to assist learners. Because this study was implemented to be used either separately or in the classroom, but also with the objective of helping teachers improve their students' deficiencies in any topic, a short session was favored over a long one. Because instructors frequently work in institutions where they are expected to meet deadlines and teach all of the material in textbooks, extensive training sessions may be hard to complete while meeting the needs of the institutions.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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7. APPENDIX

A. Questionnaire to select participants to the experiment and control group:

1. Do you usually listen to music?

Yes, every day. _____ Yes, between 5 to 6 days a week. ____

Yes, 3 to 4 days a week. ____ Yes, one or two days per week. ____

No, never / almost never. ___

2. Is music important in your life?

____

____

3. Do you like to sing along when you are listening to music?

____

____

4. Does music relax you?

____

____

5. Can music change your mood for the better? In other words, can you feel happier / more motivated when listening to music?

____

____

6. Do you play any instruments?

___ yes ___ no

If yes, which instrument do you play?

____

And how long have you been playing it?

____

7. Are your parents or siblings musicians or do they play any instruments?

____

If so, which instruments do they play?

____

B. Training phonetics part I (input and practice)

/æ/

sad

mad

ask

pad

Zac

ram

/v/

van

very

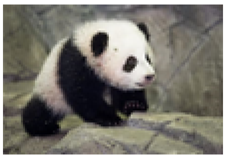
volley

review

vegetable

vet

/p/



panda

pat

pea

popcorn

peep

pave

/ r/

rat

rap

root

rev

river

rave

rabbit

B.2. Training phonetics part II – song (practice)
(The experimental group will have the same text, but in a song which they will sing and drill at once. This song was sang along with the karaoke version of Gloria Estefan, available at https://www.youtube.com/watch?v=z3gckvyPDj4 last accessed on October 17, 2020)

Bæd bæd bæd bæd boy
You make me feel so good
You naughty
Bæd bæd bæd bæd boy
You make me feel so good
Knew you would

Pæt has a boy
And he has a væn

He **p**icks Pæt at night
And the væn **r**evs, **r**evs, **r**evs, **r**evs, **r**evs up
Bæd bæd bæd bæd boy
You make me feel so good
You naughty
Bæd bæd bæd bæd boy
You make me feel so good
Knew you would

He **p**icks up **v**iolets
and **p**lays the **v**iolin
Oh! **V**ery **v**ery nice!
And the **v**æn **r**e**v**s, **r**e**v**s, **r**e**v**s, **r**e**v**s, **r**e**v**s up

Boys will be boys bæd bæd boy
Boys will be boys bæd bæd boy

Bæd bæd bæd bæd boy
You make me feel so good
You naughty
Bæd bæd bæd bæd boy
You make me feel so good
Knew you would
Boys will be boys
bæd bæd boy
Boys will be boys
bæd bæd boy