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The Influence of Musical Abilities on ESL Learners' Verbal Skills: A Study of Language Processing and Phonological Competence

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By my signature below, I certify that my ELTE B.A. thesis, entitled **The Influence of Musical Abilities on ESL Learners' Verbal Skills: A Study of Language Processing and Phonological Competence**, is entirely the result of my own work, and that no degree has previously been conferred upon me for this work. In my thesis I have cited all the sources (printed, electronic or oral) I have used faithfully and have always indicated their origin. The electronic version of my thesis (in PDF format) is a true representation (identical copy) of the printed version.

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Abstract

Individual differences that shape language learning outcomes have been of great interest in the past decades, musical skills being one of the factors that could account for advantages in language learning. The shared auditory and syntactic features of language and music suggest a connection between the two. This thesis, informed by findings in neurolinguistics and psycholinguistics, investigates the influence of musical abilities on ESL learners' verbal skills and provides evidence for the positive transfer effects of music on language learning. Additionally, perspectives on music as an intelligence that could contribute to other cognitive intelligence will be discussed. The results highlight the potential benefits of integrating music into language and general education.

Keywords: music, language, ESL, SLA, phonological competence, neurolinguistics

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1. Introduction

With the increasing demand for English proficiency in the labour market, education, and social life, research on effective methods of language acquisition has gained significant attention. One approach to identifying factors that enhance language learning is to examine individual differences that can shape individual language learning outcomes. Among the various factors influencing language acquisition and proficiency, such as motivation, learning strategies, and beliefs (Dörnyei, 2005), as well as age (Johnson & Newport, 1989), there seems to be some sort of link between musical abilities and language skills. A common assumption is that musicians possess superior language skills compared to non-musicians (Besson et al., 2011; Christiner & Reiterer, 2013; Marques et al, 2007; Milovanov et al, 2009). Having a background in both studies, I have also encountered this belief on several occasions, and have known several musicians who achieved a high level of proficiency in English as their second language. My interest, knowledge and experience with the intriguing relationship between music and language have led me to select this relationship as the focus of my thesis, with the aim of investigating its potential impact on language acquisition.

In this thesis, I focus on language and music as auditory phenomena, specifically, language as spoken language and music as its auditory aspects within the realm of sound. When referring to music and language, I will use this understanding throughout my discussion. Since both have auditory aspects and involve similar syntactic processing, studies in the fields of cognitive psychology (Patel, 2008), cognitive linguistics (Moreno, 2009) and psycholinguistics (Levitin & Menon, 2003) have investigated the relationship between language and music, exploring the link between the two. There is growing evidence of a parallel between music and language. Beyond their shared foundation as auditory systems, both include sound elements such as pitch, rhythm, loudness, emphasis, and pauses. Furthermore, neurological findings indicate that music and language involve similar

cognitive mechanisms (Besson et al., 2007; Levitin & Menon, 2003; Marques et al., 2007). Neuroscientific research has shown that there are overlaps in the areas activated by the processing of language and music in the brain (Moreno, 2009; Patel, 2003). Further experiments have revealed that music is processed in brain regions that are traditionally associated with language. The use of MRI tests further supports these findings, revealing anatomical differences between the brains of musicians and non-musicians (Besson et al., 2007; Moreno, 2009), suggesting that musical training can lead to changes in brain regions at both the structural and the functional level.

Informed by these revelations in neurological research, this study aims to explore the relationship between music and language in the context of Second Language Acquisition (SLA) by examining:

1. How does musical training influence the neurological processes involved in auditory discrimination and verbal processing in L2 learners?
2. How does prior music education influence ESL learners' phonological competence and help them acquire native-like pronunciation?
3. How do findings on the transfer effects of music on language inform L2 education?

Adult learners of English are the focus of this study because, as suggested by the Critical Period Hypothesis (CPH) (Johnson & Newport, 1989), the age of immersion in a second language (L2) plays a crucial role in attaining language proficiency. Slevc and Miyake (2006) suggested that in order to examine the influence of musical abilities on language skills solely, other factors—such as age—that could contribute to language proficiency have to be ruled out. Though some argue that age alone cannot account for language learning success as both Dörnyei (2005) and Johnson and Newport (1989) stated that other individual differences also account for language proficiency. Dörnyei (2005) also

highlights that language aptitude is an innate trait, and assumes that, like intelligence, should be generally stable.

To isolate the influence of musicality, it is necessary to account for other potential factors affecting L2 acquisition. Therefore, the studies discussed in this thesis concentrate on adult learners who began acquiring English after the critical period. Another variable that may influence ESL pronunciation proficiency is familiarity with tone languages (Slevc, 2012). Tone languages are "language(s) in which differences in tone can change the meaning of words" (Oxford Learner's Dictionaries), and this might contribute to heightened phonological sensitivity or even absolute pitch (Deutsch et al., 2004). To eliminate the potential influence of tone language experience, the studies reviewed in this thesis specifically selected participants whose first language is not a tone language and who have not been immersed in a tone language environment before.

This thesis aims to give an overview of the research done in the fields of neurolinguistics and psycholinguistics, with a particular focus on the relationship between language and musical abilities. The primary focus is to investigate the influence of musical abilities on verbal skills, specifically phonological and syntactic processing of language, as well as pronunciation. This thesis is structured into five main sections. The first section defines key terms essential for understanding the relationship between musical abilities and ESL learners' verbal skills. The second and third sections present a literature review, firstly examining research in the field of neurolinguistics, and secondly investigating studies on the influence of musical skills on ESL learners' verbal skills. The fourth section explores past perspectives on the role of music in education, followed by a discussion of the implications of the findings for L2 education. Finally, the fifth section provides a conclusion of the thesis, by summarizing the results of the studies and key insights and suggesting directions for future research.

2. Key Terms and Definitions

A clear understanding of the following terms is essential for the discussion that follows. The terms *musicality* and *musical abilities* are often used interchangeably because no clear, agreed-upon definition of the two exists. While musicality is defined as the "skill and understanding in performing music" by the Oxford Learner's Dictionary, some researchers (Malloch & Trevarthen, 2018; Trevarthen, 1999) argue that musicality is a biological and natural feature of the human species. Although research carried out in the field of genetics provides no evidence of the existence of a specific musical gene (Hallam, 2015), studies still suggest that the musicality of an individual is based on a mixture of several genes or their variants and the learning potential of their environment (Pulli et al, 2008). Trevarthen (1999) and Malloch and Trevarthen (2018) both explored the innate musicality of the human species by examining how infants react to music and singing. They examined the reaction and expressive movement of infants while listening to songs and music and found that their sensitivity to rhythm is evidence of musicality being an innate and biological feature of humans that is present from birth. Malloch and Trevarthen (2018) introduced the term *communicative musicality*, which is "our innate skill for moving, remembering and planning projects in sympathy with others through time, creating an endless variety of dramatic temporal narratives in song or instrumental music" (Malloch & Trevarthen, 2018, p.3), can also be perceived not only in adults but in infants, as they find a mean through music to communicate with their caregivers while being too young to be able to speak. Trevarthen (1999) explores the concept of innate musicality, referring to the biologically ingrained human ability to perceive, produce, and respond to musical structures. This capacity not only drives the desire to create meaning from the world and our experiences but also serves as a means of communication and cultural bonding. Musicality, also called musical talent (Seashore, 1915), is deeply embedded in human cognition,

influencing how individuals process rhythm, melody, and meaning in both music and language.

Language acquisition—which will be discussed later on—refers to the capacity to learn a language, while language skills evolve through consistent practice and training. This idea suggests a parallel in the domain of music. While musicality is often considered an innate, genetic, and natural human trait that varies among individuals, musical abilities and specific skills are also developed through practice and training. Martin (2016) similarly separated musicality, which reflects the innate qualities and talent of an individual, and musicianship, which involves learnt skills and education.

Determining what qualifies as *musical ability* is just as challenging as defining musicality, as experts in music education have different perspectives on the essential skills that define a musician. They must possess multiple skills to process and produce music simultaneously, though the required abilities vary depending on the instrument or in the case of vocalists, the voice. The distinctions between vocalists and instrumentalists will be discussed later on. Since perspectives vary on what constitutes musical ability, this thesis will consider several musical tests to provide an approximate definition. Many tests exist for the measuring of musical abilities, for example, the widely used Seashore Measures of Musical Talents, which looks at the most basic features of music and the qualities of an individual. Seashore (1915) breaks down music into three elements: pitch, time, and intensity, claiming that the capability to appreciate and express these elements is the key to evaluating one's musical talents. This is then further specified into the perception, expression, and understanding of music, along with the ability to feel and convey emotions through music. Other tests used in the studies are the Advanced Measures of Music Audiation (AMMA) (Christiner & Reiterer, 2013) and the Wing Measures of Musical Talents (Slevc & Miyake, 2006). The AMMA test examines musical aptitude by testing the

audiation abilities of students, which is hearing and comprehending music, and which greatly contributes to further developing their musical skills (Gordon, 1991). Chord Analysis, Pitch Change, and Tonal Memory tests were conducted in the Wing Measures of Musical Talents, which examined the participants' ability to perceive, discriminate and recall musical structures (Slevc & Miyake, 2006).

The term *musician* is generally used as an umbrella term including both vocalists and instrumentalists, with no strict distinction between the two, despite both requiring different skill sets and involving different generation methods. The generation of music usually involves playing an instrument, while the generation of sound involves vocal mechanisms. Additionally, singing and speech share more similarities in production, processes, and characteristics than music and speech, therefore it could be assumed that singing may be a better indicator of phonological competence. Christiner and Reiterer (2013) examined the connection between singing and L2 pronunciation, providing evidence of a positive correlation between singing skills and speech imitation ability in adult German ESL learners. Although this thesis focuses on verbal skills, and singing abilities appear to be more closely related to them than instrumental playing, the reason musicality and instrumentalists are also observed is the limited research done on the direct link between singing and verbal skills. Though musicality is hard to define, it seems to be a biological feature of the human species that is present from birth. As the concept of communicative musicality suggests, music provides a means of communication through cultures and a way for humans to express their emotions and connect. In conclusion, the tests and studies provide concrete examples of what musical skills include i.e., the perception and comprehension of music, analysis of sound, pitch processing, sense of rhythm and the production of music and sound.

Language aptitude is a key element in acquiring L2 proficiency as it shows the language learning ability of an individual. Dörnyei (2005) discusses the concept of language

aptitude in the context of individual differences, suggesting that language aptitude is a mixture of various cognitive abilities, rather than a singular trait. The main indicators of language aptitude include phonetic coding ability, grammatical sensitivity, rote learning ability and inductive language learning ability (Carroll, 1981). These elements reflect an individual's ability to identify and process phonetic and syntactic structure, recognize patterns and find associations between linguistic elements. Additionally, verbal intelligence, motivation, and auditory ability are other factors that may contribute to language learning ability (Pimsleur, 1966, as cited in Dörnyei, 2005). Results suggest that higher language aptitude indicates the learning success of students and predicts their learning rate.

Acquiring *native-like pronunciation* after the critical period is a frequently debated topic, and some argue that late learners are unable to reach the same level of proficiency in a foreign language (Johnson & Newport, 1989). The critical period refers to the period considered to be most optimal for language acquisition according to the CPH, extending from early infancy until puberty (Johnson & Newport, 1989). This view was challenged by examples of late learners with native-like proficiency in their L2, which was accounted for by their individual differences (Dörnyei, 2005; Johnson & Newport, 1989). Foreign accent seems to be the clear indicator in judging one's nativeness, as Saito (2021) states that comprehensibility and accentedness are the characteristics perceived in those with native-like pronunciation. Additionally, Saito (2021) found fluency and accuracy to be indicators of nativeness based on the judgements of native speakers of English. Overall, individuals who speak fluently and accurately without a foreign accent are considered to have native-like pronunciation.

3. The Relationship between Music and Language

In what follows, the relationship between music and language is reviewed through the topics of neurolinguistics, psycholinguistics, and SLA. The effects of musical training on

second language (L2) verbal skills have long interested researchers and practitioners. Particularly, this section explores the advantages of musicians in terms of language processing over non-musicians with the important reminder that musicians are defined differently in various studies. The shared characteristics and mechanisms of language and music suggest a link between these two meaning-making systems, which have been a topic of great interest in recent decades. Besides educators, many experts in the field of neurolinguistics have investigated this relationship, finding mounting evidence for a connection between language and music (Besson et al., 2007; Levitin & Menon, 2003; Marques et al., 2007).

3.1 Neurological perspectives on the relationship between processing of language and music

Advances in brain imaging techniques, such as functional Magnetic Resonance Imaging (fMRI) and Event-Related Brain Potentials (ERPs), have provided greater insight into the neurological mechanisms underlying the cognitive processes related to language and music. When studying the brains of musicians and non-musicians using MRI, functional and anatomical differences were discovered (Besson et al., 2007; Moreno, 2009).

Based on research until the present day, certain brain regions, such as the left inferior frontal cortex (LIFC) containing Broca's and Wernicke's areas, are typically referred to as language areas (Moreno, 2009; Slevc, 2012). Research conducted on the processing of music and language has revealed an overlap in the neural regions involved across both domains (Moreno, 2009; Patel, 2003, 2008). This suggests that these regions are not exclusively dedicated to language-related cognitive mechanisms. Neuroimaging studies further support this overlap, showing that listening to, and processing sentences and musical sequences demonstrate activation in brain areas generally associated with language processing, such as Broca's and Wernicke's area (Besson et al, 2011; Levitin & Menon, 2003; Patel, 2003).

Patel's (2003) 'shared syntactic integration resource hypothesis' (SSIRH) suggests that certain brain regions, referred to as 'processing regions', help activate 'representation regions' to reach the necessary threshold where integration and therefore syntactic processing can occur. Neurological findings suggest, on the one hand, that music and language have some kind of a connection, and that some cognitive mechanisms involving language and music overlap in the brain (Levitin & Menon, 2003; Moreno, 2009; Patel, 2003, 2008). On the other hand, the idea that language areas are involved in music processing has been challenged by some. Though many findings agree that there is a neurological relationship between music and language (Besson et al., 2007; Levitin & Menon, 2003; Marques et al., 2007), there are examples of individuals with musical deficits—such as amusia—who do not necessarily have difficulties with speech and language, and vice versa (Slevc, 2012; Patel, 2008). These instances suggest a separation between the two domains and are in contrast with the findings discussed in this thesis as they support the view that music and language are distinct domains.

From a neurological perspective, both music and language rely on syntactic hierarchical sequences—the combination of words or notes respectively—governed by structured rules that determine their organisation and meaning (Patel, 2003; Slevc, 2012). The LIFC is involved in the production, comprehension and processing of spoken language (Levitin & Menon, 2003), and the shared characteristics of musical and linguistic structures suggested a connection between comprehending musical and linguistic syntax. Levitin and Menon (2003) hypothesised that the Brodmann Area (BA 47)—a part of the LIFC—which is typically associated with language processing, might be involved in other cognitive processes than just language. They observed the brain activation of non-musicians while listening to excerpts of classical music and their scrambled version. The scrambled versions maintained fundamental acoustic properties like pitch, loudness, and timbre, but the melody,

rhythm, and harmony were disrupted. This allowed researchers to examine how the brain, more specifically the BA 47, responds to the presence or absence of temporal coherence in music. Functional MRI was used to acquire the images of the brain activation and as anticipated, considerable activation was found in the Brodmann Area while listening to structured music in both hemispheres, though activation was less significant in the right hemisphere than in the left. The experiment done by Levitin and Menon (2003) indicates that BA 47 is not exclusive to language processing only, but is involved in musical structure as well. These findings support the idea that music and language share overlapping neural networks, particularly in processing syntax and structure. Evidence of these overlaps between brain activation in language and music processing aligns with Patel's (2003) SSIRH hypothesis. These findings provide strong support for the connection between music and language, as they offer neurological evidence of overlapping cognitive mechanisms. This has important implications for second language education, suggesting that musical training could enhance language processing skills, particularly in areas such as phonological awareness or syntax.

More perspectives can be gained from examining studies conducted in different languages. In the context of native French speakers, Besson et al. (2007) and Marques et al. (2007) both tested the influence of musical expertise on pitch processing in language to investigate its transfer effects. They hypothesised that musicians are required to have greater pitch discrimination skills, therefore it might contribute to pitch discrimination in language as well, which is relevant in expressing emotions and has linguistic functions. The Event-Related Brain Potentials (ERPs) method was used to examine the brain activity of the participants, and both musicians and non-musicians were inspected. The participants were presented with musical and linguistic materials, such as children's songs or utterances, where the phrases ended with the usual or a manipulated ending, and they were asked to

identify if the ending was normal (congruous) or strange (incongruous). Results of the experiment supported the hypothesis that musicians possessed greater pitch discrimination skills than non-musicians, as they were more successful in detecting incongruities in music and language as well. ERP data showed that both musicians and non-musicians automatically detected the unexpected pitch changes, however the place of activation slightly differed. Musicians exhibited a more symmetrical (bilateral) activation compared to non-musicians, which aligns with previous findings about musical abilities leading to functional and anatomical brain differences (Besson et al., 2007; Moreno, 2009).

Besson et al. (2007) provided evidence of a positive transfer effect of music on language, however, their experiment focused solely on French speakers and their first language (L1). Marques et al. (2007) applied the same experiment but investigated the effect of musical expertise on foreign language skills. This time, participants were native French speakers who did not speak Portuguese. Utterances from children's books in Portuguese were used to examine whether musicians and non-musicians can detect incongruities in a language foreign to them. Besides accuracy, reaction times were also accounted for and results showed that musical expertise was relevant in detecting weak incongruities, where musicians had a hit rate of 85%, compared to 61% of non-musicians' hit rates. The analysis of response time also showed differences between the two groups, musicians needed less time to detect pitch violations than non-musicians.

In conclusion, this section highlighted the growing body of evidence supporting the connection between music and language processing, particularly in terms of brain mechanisms. Neuroimaging data has revealed that brain areas typically associated with language also play a key part in cognitive processes related to music, such as the Broca's and Wernicke's Area, or the BA 47. Studies have supported Patel's (2003) SSIRH hypothesis, as the processing of linguistic syntax and musical structure seem to share

overlapping neural networks. Musicians also demonstrated advantages in language processing, particularly in pitch discrimination and syntactic processing. This implies that musical training and skills could result in functional and structural differences in the brain. While there is evidence of both overlap and separation between music and language processing in the brain, the findings suggest that musical expertise could enhance language processing abilities.

3.2 The influence of musical skills on pronunciation

Elaborating on the connection between music, pitch discrimination and language processing, studies suggest that musical training can have a positive impact on pronunciation in second language learning (Christiner & Reiterer, 2013; Milovanov et al., 2009; Slevc & Miyake, 2006; Pastuszek-Lipinska, 2008). Both music and language have auditory aspects, and they rely on similar auditory features, including pitch, rhythm, volume, stress, and pauses, essential for producing meaningful sound patterns in both domains. Several studies have focused on the pronunciation skills of ESL learners who are also musicians, showing that individuals with musical skills demonstrate better speech imitation abilities and more native-like pronunciation in their L2 than non-musicians (Christiner & Reiterer, 2013; Milovanov et al., 2009; Pastuszek-Lipinska, 2008; Slevc & Miyake, 2006).

Standardised musical ability tests, such as the Seashore Musical Aptitude Test, the Wing Measures of Musical Talents, and the AMMA test were often used to account for participants' musical abilities (Christiner & Reiterer, 2013; Milovanov et al., 2009; Slevc & Miyake, 2006). However, some studies employed non-standardised tests, which included the production of sounds followed by expert ratings (Christiner & Reiterer, 2013; Pastuszek-Lipinska, 2008). Consequently, the required musical skills varied across studies, further highlighting the lack of a clear, universally accepted definition of musical ability.

L2 pronunciation abilities were examined in the context of the English language. Both Milovanov et al. (2009) and Slevc and Miyake (2006) investigated how participants pronounce words containing English phonemes that are not present in their first languages (L1)—Finnish and Japanese—and which were expected to be particularly challenging for them. Participants were asked to pronounce words containing these phonemes, and in Slevc and Miyake's (2006) study, they also completed a productive phonology test involving minimal pair words and sentences featuring the target phonemes. Additionally, both studies included a minimal pair phonemic discrimination task to assess participants' phonemic awareness and auditory processing. Both Milovanov et al. (2009) and Slevc and Miyake (2006) agreed that musical ability correlates with L2 pronunciation skills. However, their findings diverged when examining the connection between musical abilities and phonological processing, which was tested with a minimal pair discrimination task in both cases. Milovanov et al. (2009) found no correlation between phonemic discrimination ability and either musical skills or pronunciation skills, suggesting that musical ability does not necessarily influence this aspect of phonological skills. In contrast, Slevc and Miyake (2006) found a correlation between musical ability and receptive phonology, indicating that musical skills may facilitate the perception of phonemes in a second language. These differing results highlight the complexity of the relationship between musical abilities and language skills, suggesting that different phonological skills may be influenced by musical training to varying degrees.

While some studies focused solely on ESL learners' English phonological skills, others have examined musicians' phonological abilities in the context of foreign languages (Christiner & Reiterer, 2013; Pastuszek-Lipinska, 2008). In these studies, besides English, participants were presented with a variety of foreign languages, including Hindi, Dutch, French, Italian, Spanish, and Japanese. Their phonological skills were assessed through

word and utterance imitation tasks. Results indicated that musical ability may predict speech imitation skills, as musicians demonstrated more fluent and native-like pronunciation than non-musicians. However, Christiner and Reiterer (2013), who specifically studied singers, suggested that singing ability might be an even stronger indicator of speech imitation skills and phonological competence. Moreover, Christiner and Reiterer (2013) also emphasised the importance of distinguishing vocalists and instrumentalists when examining musicianship.

The studies reviewed in this section suggest that musical training positively influences L2 verbal skills, particularly in pitch discrimination, speech imitation, and phonological competence. Musicians demonstrated more native-like pronunciation and better speech imitation abilities than non-musicians, with a strong correlation observed between musical abilities and L2 pronunciation skills in ESL learners. These findings highlight the potential benefits of musical training for language learners. Additionally, the type of musical ability—vocal or instrumental—may play a significant role, which might be another important direction for future investigation. Overall, there appears to be a connection between music and language, but more research is needed to fully understand this connection, particularly regarding the potential applications of music in second language education.

4. Pedagogical Implications of the Research on Music and Language

The results of these studies show that individuals with musical abilities have advantages in foreign language learning, especially in verbal skills. All the advantages of musical immersion have their roots in neurology, as studies based on brain imaging data suggest that musical abilities may lead to functional and anatomical differences in the brain (Besson et al., 2007; Levitin & Menon, 2003; Marques et al., 2007). Further research has revealed that language and music are interconnected in the brain, as they engage overlapping

brain areas and neural networks. The neurological connection between language and music, along with the differences in brain activation between musicians and non-musicians, has encouraged further research into the transfer effects of musical abilities on language skills. Studies examining pitch discrimination and phonological competence have shown that musicians significantly benefit from their musical training, particularly in speech imitation. As a result, they support the integration of music into both general and language education, offering a helping tool for those struggling with language learning.

The neurological and cognitive findings discussed in this thesis have already informed language pedagogy, supporting the integration of music in the L2 classroom (Bokiev et al., 2018; Failoni, 1993; Grimm, 2020; Khaghaninejad & Fahandejsaadi, 2016; Lems, 2001, 2005). However, an important contribution stands out among the practices. Long before brain imaging techniques provided empirical data, Hungarian composer and music educator Zoltán Kodály emphasised the importance of musical training in the early 20th century (Houlahan & Tacka, 2015). He advocated for the inclusion of music education in the school curriculum, highlighting its benefits for the spirit, body, and overall well-being. He considered music to be nourishing and fundamental for a child's development, fostering self-knowledge, self-awareness, and emotional growth. Music programs based on Kodály's philosophy and methodology have been shown to contribute to advantages in several other academic areas among preschool children (Goopy, 2013). Kodály's emphasis on the role of music in holistic development aligns with modern neuroscientific findings on the cognitive and linguistic benefits of musical training. Additionally, this idea is also justified by Gardner's (1993) Theory of Multiple Intelligences, which proposes that intelligence is more complex and versatile than what an IQ test can capture, including a variety of skills. According to Gardner (1993), musical intelligence can provide an advantage in other areas of intelligence. He also highlights that musical intelligence appears to be particularly

connected to linguistic and mathematical intelligence. Further research on the influence of musical abilities on other cognitive skills could offer deeper insight into the transfer effects of music, presenting an intriguing area for future investigation.

Further studies in the field of language education suggested that integrating music into the ESL classroom can be beneficial for ESL learners in several ways (Bokiev et al., 2018; Failoni, 1993; Grimm, 2020; Khaghaninejad & Fahandejsaadi, 2016; Lems, 2001, 2005). Krashen's (1982) Affective Filter Hypothesis considers the learners' emotional well-being in the context of language learning. According to Krashen (1982), factors such as motivation, self-confidence, and anxiety significantly influence the success of language learning. Research on the role of music in the language learning classroom has demonstrated that music is an effective tool for motivating learners and creating a supportive and comforting atmosphere in the classroom (Bokiev et al., 2018; Grimm, 2020; Khaghaninejad & Fahandejsaadi, 2016; Lems, 2005). Providing a classroom where learners feel welcomed might contribute to successful language learning. As Trevarthen (1999) and Malloch and Trevarthen (2018) discussed, musicality is an inherent feature of human beings, with a natural drive to react to music. This biological trait can be facilitated in the ESL classroom to enhance communication and foster cultural bonding. Music is often referred to as a universal language humans share (Bokiev et al., 2018; Grimm, 2020). Bokiev et al. (2018) and Lems (2005) support this view, suggesting that music from different cultures can help form connections, while exercises such as singing together can promote social bonding. Additionally, music can serve as an authentic source of the target language, supporting language learners in acquiring new vocabulary, improving pronunciation, and enhancing memory (Bokiev et al., 2018; Grimm, 2020; Lems, 2005). Educators such as Bokiev et al. (2018), Grimm (2020), and Lems (2001, 2005) have highlighted that popular music provides an approachable method for adults to acquire a language. Its simple and straightforward

lyrics can provide new vocabulary, while its conversational tone aids learners in becoming familiar with the syntax and word order of the target language. In addition, exposure to L2 music might also offer insight into the culture associated with the language and can help immerse oneself in the culture of the target language (Lems, 2001, 2005). Besides language learners, teachers can also benefit from the use of music in the L2 classroom. Music not only comforts students, but teachers as well, making language teaching less stressful (Lems, 2001, 2005). The formation of connections is not limited to students alone; it can also foster closer relationships between students and the teacher (Bokiev et al., 2018). While the use of music in the ESL classroom has been explored, further investigation into the relationship between musical abilities and verbal skills development could enhance L2 education and support the inclusion of music programs in public education systems.

The findings discussed in this thesis are particularly important in the context of general and language education. The results provide evidence for the positive transfer effects of music on L2 verbal skills and cognitive mechanisms, while some studies suggest music has a positive effect on other intelligences as well. The advantages of musical training on L2 verbal skills could be facilitated in L2 education, especially among those who face challenges in learning a foreign language or have difficulty with pronunciation. As studies suggest, musical training can especially benefit late learners—individuals who started learning a language after the period that is believed to be critical according to the CPH—and help them acquire a more native-like pronunciation (Lems, 2005; Slevc & Miyake, 2006). All the advantages of music on L2 skills and the language learning environment advocate for further research on music as an intelligence, and the inclusion of music in general and language education as well.

These findings may also hold relevance for musicians, as they highlight the cognitive benefits associated with musical training. Musicians' enhanced phonemic awareness and

language processing abilities may facilitate more fluent and accurate pronunciation in a foreign language. These advantages may not only encourage them to pursue foreign language learning but also enable them to apply these skills to other cognitive domains.

5. Conclusion

Music and language are universal to all humans, serving as a mode of communication and expression. Their connection lies in their auditory aspects (Khaghaninejad & Fahandejsaadi, 2016; Moreno, 2009), as both rely on similar features, such as pitch, rhythm, volume, stress, and pause. Additionally, both are governed by structured rules and based on syntactic hierarchical structures that determine their organisation and meaning (Patel, 2003). Musicians require a set of skills to perceive and comprehend music, including sound analysis, pitch processing, and sense of rhythm. As a result of these auditory abilities, musicians exhibited more advanced auditory discrimination abilities and phonological competence than non-musicians (Christiner & Reiterer, 2013; Milovanov et al., 2010; Pastuszek-Lipinska, 2008; Slevc & Miyake, 2006).

Beyond shared auditory and structural features, neuroimaging data have shown that music and language are also linked on a neurological level, operating through overlapping cognitive and neural mechanisms (Moreno, 2009; Patel, 2003, 2008). The processing of musical sequences appears to originate in brain areas typically associated with language, as brain activation was found in Broca's area, Wernicke's area, and BA 47 when examining the cognitive processes involved in music processing (Besson et al, 2011; Levitin & Menon, 2003; Patel, 2003). Interestingly, the ability to detect subtle sound changes is not limited to music and L2 for musicians but is extended to foreign languages as well (Marques et al., 2007). Musicians outperformed non-musicians in most phonemic discrimination tasks, highlighting their heightened auditory perception and discrimination skills (Slevc & Miyake, 2006). However, some studies (Milovanov et al., 2009) have found no significant correlation

between musical skills and phonemic discrimination ability, suggesting that music might not influence this aspect of phonological skills. The structural parallels between sentences and musical sequences also contribute to musicians' heightened verbal processing abilities. Taken together, the evidence indicates that musical training may, to varying degrees, have a positive transfer effect on auditory discrimination and verbal processing abilities of L2 learners.

The reviewed studies provide strong evidence that musical training can enhance various aspects of L2 pronunciation, particularly in pitch discrimination, speech imitation, and phonological competence. Individuals with prior musical education demonstrated greater phonological competence than non-musicians, achieving more native-like pronunciation in their L2. However, a distinction between vocalists and instrumentalists appears to be a relevant factor in assessing linguistic advantages. The specific skills associated with each may influence phonological abilities differently, and because singing and speaking both involve vocal mechanisms, there might be a closer relation between the two (Christiner & Reiterer, 2013). This highlights the need for a more focused comparison between the two groups and suggests a promising direction for further research in music and language education. In conclusion, studies show that musicians benefited from their musical education in the context of L2 verbal skills, especially in acquiring native-like pronunciation.

The neurological findings synthesised in this thesis provide evidence of a relationship between music and language, as they appear to engage overlapping neural resources and activate similar brain areas. Additionally, differences in brain activation of musicians and non-musicians were observed. These findings provide evidence for the transfer effects of music on cognitive processes. Although music clearly influences L2 skills and the brain mechanisms associated with them to some extent, its effects seem to be primarily limited to verbal skills and phonological competence. The limited research done on the integration of

music into the ESL classroom highlights the need for further investigation. Longitudinal studies could help determine how music can be effectively integrated into language learning classrooms to facilitate its benefits for learners. Beyond language education, music seems to offer other potential cognitive benefits. Gardner's (1993) Theory of Multiple Intelligences and Kodály's philosophies on music as a developmental tool offer new perspectives on the role of musical education within general education. A potential area for future exploration is the influence of music on other intelligences, such as mathematics, as well as its application in therapy for language deficits. Ultimately, the relationship between music and language is complex and versatile, as they share cognitive, neurological, and structural similarities. These findings provide evidence for the positive influence of musical abilities on ESL learners' verbal skills, particularly in the areas of language processing and phonological competence.

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