Musical aptitude, phonological awareness and reading fluency: the reading process in adult migrants learning Spanish

Aptitud musical, conciencia fonológica y fluidez lectora: el proceso lector en adultos migrantes que aprenden español

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Abstract:

Previous studies on the reading process in additional languages (AL) have provided interesting data on the relationship between musical aptitude and reading skills, with phonological awareness being a predictor of fluency and comprehension. Most research has focused on literate readers learning an AL, while knowledge about the reading process in adults with low literacy levels in a migration context remains scarce. This study, in which 74 adult migrants participated, aims to explore the interaction between musical aptitude, phonological awareness, and oral reading fluency. To this end, linguistic and non-linguistic tests were administered to obtain data that would allow a relationship to be established between musical aptitude, operationalized as the ability to perceive non-linguistic rhythm, phonological awareness, and oral reading fluency. The results indicated a significant correlation between musical rhythm perception and phonological awareness, but not between rhythm and reading fluency in adults with low literacy levels, as reported in previous literature on literate reader profiles. However, further studies are needed on how these variables behave in order to propose a valid model for understanding the reading process in adults with low literacy levels who are learning Spanish as an additional language.

Keywords:

Additional Spanish language, musical aptitude, migrant adults, oral reading fluency, phonological awareness.

Resumen:

Estudios previos sobre el proceso lector en lenguas adicionales (LA) han aportado datos interesantes sobre la relación entre la aptitud musical y las habilidades lectoras, siendo la conciencia fonológica un elemento predictor de la fluidez y de la comprensión. La mayor parte de la investigación se ha centrado en perfiles lectores alfabetizados que aprenden una LA, mientras que el conocimiento sobre el proceso lector en adultos con bajo nivel de alfabetización en un contexto de migración continúa siendo escaso. Este estudio, en el que participaron 74 adultos migrantes, tiene por objetivo explorar la interacción entre la aptitud musical, conciencia fonológica y fluidez lectora oral. Para ello, se administraron test lingüísticos y no lingüísticos, a fin de obtener datos que permitieran establecer una relación entre la aptitud musical operativizada como capacidad de percibir el ritmo no lingüístico, la conciencia fonológica y la fluidez lectora oral. Los resultados indicaron la existencia de una correlación significativa entre percepción del ritmo musical y conciencia fonológica, pero no entre ritmo y la fluidez lectora de personas adultas con bajo nivel de alfabetización, tal y como se recoge en la literatura previa referida a perfiles lectores alfabetizados. No obstante, se requieren más estudios sobre cómo se comportan estas variables para llegar a plantear un modelo válido sobre la comprensión del proceso lector en adultos con bajo nivel de alfabetización que aprenden español como lengua adicional.

Palabras claves:

Adultos migrantes, aptitud musical, conciencia fonológica, fluidez lectora oral, lengua adicional al español.

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1. Introduction

Although learning to read involves the visual processing of written language, successful acquisition of general reading skills is also associated with the development of oral pre-reading abilities such as phonological awareness. Reading thus requires abilities such as hearing and associating the acoustic features of speech (phonemes) with the graphic symbols of writing (graphemes). In second or additional language (L2/AL) contexts, reading becomes even more complex due to phonological interference from the first language (L1), limited exposure to oral input in the AL, and variability in previous educational experiences (Koda, 2007). Among adult migrant populations, these challenges are intensified by socio-affective conditions such as acculturative stress or the prioritisation of oral over written communication, all of which may delay the acquisition of literacy in the AL (Tarone et al., 2009; LASLLIAM, 2022).

The acoustic dimension of reading has also gained prominence through recent research suggesting that musical aptitude—defined as sensitivity to musical features such as rhythm and melodic structure—may act as a cognitive facilitator in the development of phonological awareness and, by extension, reading fluency (Patel, 2011; Foncubierta et al., 2020; Sousa et al., 2022). Neurolinguistic studies have shown that musical and linguistic processing share neural networks, particularly in areas associated with the segmentation of sound units and auditory memory (Koelsch et al., 2019). This overlap raises a critical question: might musical aptitude help to mitigate phonological difficulties in adult migrants learning to read in Spanish as an additional language, thereby accelerating their transition from grapheme–phoneme decoding to the automatisation of oral reading fluency?

Although efficient word recognition is the cornerstone of the reading process, the ability to read fluently also depends on the reader's capacity to group words into notional or phonological chunks, in much the same way that musical notes are grouped into melodies or rhythms. Thus, music may involve transferable skills relevant to AL reading, such as the anticipation of syntactic patterns or the grouping of lexical units (Fonseca-Mora et al., 2015). Despite these promising findings, there is still a lack of studies examining this relationship in adult migrant populations—a group that presents specific needs and linguistic, educational, and motivational heterogeneity.

This article seeks to address this gap in the scientific literature (Young-Scholten et al., 2015) by analysing how musical aptitude relates to phonological awareness and reading fluency in low-literate adult migrants. It is hypothesised that greater musical sensitivity should correlate positively with more accurate performance in phonological awareness tasks and with better outcomes in reading fluency measures. The results could help to redefine pedagogical strategies for AL teaching in migration contexts, through the integration of sound–musical resources as cognitive bridges towards functional literacy

2. Theoretical Framework

2.1. Importance of Phonological Awareness in the Reading Process in L1 and AL

There is broad consensus within the scientific community regarding the predictive role of phonological awareness in the acquisition of reading skills, both in children and adults, despite differences in orthographic systems (Goswami, 2009) and within multilingual contexts (Kittle et al., 2024). This predictive nature is further reinforced by the close relationship between phono-

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logical awareness, fluency, and reading comprehension (Goswami & Bryan, 2007; Defior et al., 2011; Fonseca-Mora & Fernández-Corbacho, 2017).

The relationship between spoken and written language is parasitic or dependent in nature, as the natural state of language is orality. Languages emerged to be spoken, and some languages do not even have a written system. Reading therefore requires the ability to hear and then translate written code back into orality. Thus, if oral language experience impacts the development of phonological awareness, it is plausible that other auditory experiences—such as music—could also be linked to this development. According to the systematic review by Prados López and Foncubierta (2024), there is substantial evidence pointing to the specific importance of musical rhythm as a factor potentially shaping readers' phonological awareness and other reading skills.

Currently, there is little debate regarding the predictive role of phonological awareness in the development of reading skills in both L1 and AL. Being a skill that supports literacy development, phonological manipulation is in turn influenced by that very development (Ehri, 2014). While some studies suggest a similar learning trajectory between children and adult migrants (Filimban, 2019; Sosinski et al., 2020), data on the relationship between phonological awareness and reading skills in AL among low-literate adults remain scarce.

2.2. Importance of Reading Fluency in the Reading Process in L1 and AL

Reading fluency can be considered a key skill and an indicator of reading proficiency, as it acts as a bridge between decoding abilities and text comprehension (Pikulski & Chard, 2005), and is thus a reliable measure of reading comprehension (Horowitz-Kraus, 2023). Fluency and comprehension often operate in tandem: greater fluency leads to greater comprehension (Foncubierta, 2022).

Despite the lack of a universally accepted definition, reading fluency is generally understood as the ability to read with appropriate cadence and accuracy (NICHD, 2000: 3). Fluent reading is not possible without efficient speech sound decoding. Deficits in phonological awareness are often at the root of reading difficulties. From a phonological perspective, the sharper the categorisation of sound, the greater the accuracy in phoneme–grapheme correspondence, which enhances word recognition and, by extension, overall fluency in reading written texts.

However, the relationship between fluency and comprehension is not as straightforward when reading in an additional language (Lems, 2003; Grabe & Stoller, 2011). AL readers operate across two interacting linguistic systems (Koda, 2005). Consequently, differences in the nature of these systems impact the acquisition of reading in an AL—not only in terms of the efficiency with which learners grasp letter–sound correspondences but also in terms of overall reading performance (Rau et al., 2015).

In AL reading acquisition, learners often develop phonological processing skills through their literacy experience in L1 (Fonseca-Mora & Fernández-Corbacho, 2017; Carreño-Sepúlveda & Arancibia-Gutiérrez, 2024). However, in migrant contexts, there is a lack of research exploring how phonological awareness influences the development of reading fluency in adults with low literacy levels.

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2.3. Importance of Musical Aptitude in Reading Fluency in L1 and AL

In recent years, the role of music in additional language learning has garnered increasing attention, as research has demonstrated that music, speech perception, and reading skills share similar mechanisms of auditory temporal processing (Patel, 2011; Besson et al., 2017; Fonseca-Mora et al., 2021). For this reason, musical aptitude has been linked to reading fluency in a specific component of the reading process: phonological awareness. This refers to the ability to identify and efficiently manipulate phonological information (such as syllables, phonemes, and stress), which in turn enables the reader to access the rhythmic patterns inherent in written discourse through these oral language features.

Accurate categorisation of acoustic signals thus appears to be a prerequisite for effective phonological encoding of speech units (Prados-López & Foncubierta, 2024). Moreover, studies involving adult populations with reading difficulties have shown that rhythmic musical training improves phonological awareness—an element that can sometimes serve as a mediating factor between reading skills and musical aptitude (Sousa et al., 2022), and in some cases has a more direct relationship (Bonacina et al., 2020; 2021), potentially leading to improved reading acquisition.

In AL contexts involving adults who are literate in their L1, there is evidence suggesting that musical aptitude influences the acquisition of reading ability as much as, or even more than, phonological awareness (Foncubierta et al., 2020; Fonseca-Mora, 2021). This has also been observed in adult multilingual learners (Legaz-Torregrosa et al., 2022), indicating that musical aptitude—specifically rhythmic perception—may be a facilitating factor in reading acquisition in both L1 and AL. Nevertheless, some research indicates that the relationship between musical rhythm and language is complex and dependent on other variables (Schellenberg et al., 2023).

The present study focuses on the relationship between musical aptitude—operationalized as rhythm perception and production—and the linguistic variables of phonological awareness and oral reading fluency among adult readers with low levels of literacy in an AL. To this end, the following research questions were posed:

(RQ1): Is there a relationship between phonemic awareness and oral reading fluency in an additional language?

(RQ2): Is there a relationship between phonemic awareness and musical rhythm?

(RQ3): Is there a relationship between musical rhythm and oral reading fluency in an additional language?

3. Methods

3.1. Participants

This study involved 74 adult learners aged between 18 and 72 years, all of whom were learning Spanish at various community centres in the city of Huelva (Spain). All assessments were conducted anonymously, and participants were asked only to provide an identification code formed by the first three letters of their surname, the first three letters of their country of origin, and the last two digits of their age. Informed consent was obtained in writing from all par-

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ticipants, in accordance with the European General Data Protection Regulation (GDPR) (EU) 2016/679.

3.2. Instruments

Rhythm perception and production task

The selected task was the Stambak Rhythm Reproduction Scale (1984), originally developed to identify dyslexic readers. It consists of a repetition/production exercise in which participants use a pencil to tap on a desk in order to replicate the rhythm patterns previously played in an audio recording. These sequences comprise rhythms with short (••) or long (• •) intervals—corresponding to one quarter of a second or one second, respectively. The complexity of the sequences increases progressively as the test proceeds. The scale contains 21 items, of which the last four were taken from the PROMS (Profile of Music Perception Skills, Universität Innsbruck) test due to the simplicity of its format. Responses scored two points if correct on the first attempt and one point if correct on the second attempt. The maximum and minimum possible scores were both 24, with scores below 24 indicating difficulty in rhythm reproduction. The task was discontinued after four failed attempts at both trials, although participants were required to reach at least item 12.

Phonemic awareness

This task was adapted from the *Early Grade Reading Assessment (EGRA)*. Among the phonological awareness tests, the chosen measure was the *initial sound identification task*, which involves recognising the first phonological segment and distinguishing it within sets of three words. In this linguistic task, participants listened to audio recordings of three-word groups, two of which began with the same sound and one that did not. They were required to identify the word beginning with the different sound. All words were bisyllabic. Participants received one point for each correct response.

Oral reading fluency

This task was developed ad hoc for the study. It consisted of a 259-word adapted text on a topic relevant to migration contexts. Participants were asked to read the text aloud for one minute. The score was determined by the number of words read correctly within the time frame. All readings were audio recorded (participants were informed of this beforehand).

3.3. Data Analysis

Data were analysed using the SPSS statistical software package. Initially, normality tests were conducted, followed by correlational analyses of the target variables. Descriptive statistics were also included.

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4. Results

Table 1 presents the main descriptive statistics for the variables under study: phonemic awareness, reading fluency, and musical rhythm perception. Phonemic awareness had a mean score of 8.22 (SD = 2.08), with scores ranging from 2 to 10. Reading fluency yielded a mean of 74.94 correctly read words per minute (SD = 31.39), with a range between 0 and 161. As for musical rhythm perception, the mean score was 23.57 (SD = 9.18), with values ranging from 2 to 40.

Table 1

Descriptive Statistics

	N	Min	Max	Mean	Std. Deviation	Variance
Phonemic awareness	74	2	10	8,22	2,076	4,309
Reading fluency	62	0	161	74,94	31,386	985,078
Musical rhythm	60	2	40	23,57	9,179	84,250

Normality tests (Kolmogorov–Smirnov and Shapiro–Wilk) were conducted to assess the distribution of the variables. Results indicated that phonemic awareness did not follow a normal distribution ($p < .001$ for both tests). In contrast, reading fluency and musical rhythm perception showed distributions compatible with normality according to the Shapiro–Wilk test ($p = .901$ and $p = .199$, respectively).

Table 2

Normality Tests

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Estadístico	gl	Sig.	Estadístico	gl	Sig.
Phonemic awareness	,245	51	,000	,804	51	,000
Reading fluency	,074	51	,200*	,989	51	,901
Musical rhythm	,115	51	,089	,969	51	,199
*. This is a lower bound of the true significance level.						
a. Lilliefors significance correction						

Finally, correlations between variables were analysed using Spearman's rho coefficient.

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Table 3

Correlations

			Musical Rhythm	Reading Fluency (AL)	Phonemic Awareness
Rho de Spearman	Musical Rhythm	Correlation coefficient	1,000	,234	,479**
		Sig. (2-tailed)	.	,098	,000
		N	60	51	60
	Reading Fluency (AL)	Correlation coefficient	,234	1,000	,376**
		Sig. (2-tailed)	,098	.	,003
		N	51	62	62
	Phonemic awareness	Correlation coefficient	,479**	,376**	1,000
		Sig. (2-tailed)	,000	,003	.
		N	60	62	74
*. The correlation is significant at the 0.01 level (two-tailed).					

Significant positive correlations were found between phonemic awareness and musical rhythm perception ($\rho = .479$, $p < .001$), as well as between phonemic awareness and reading fluency ($\rho = .376$, $p = .003$). A positive but non-significant correlation was observed between reading fluency and musical rhythm perception ($\rho = .234$, $p = .098$).

5. Discussion

This study focused on the relationship between musical aptitude—operationalised as rhythm perception and production—and the linguistic variables of phonological awareness and oral reading fluency among adult readers with low literacy levels in an additional language (AL). More specifically, we aimed to determine whether musical rhythm affects oral reading fluency. The analysis carried out provides the following answers to the research questions.

(RQ1): Is there a relationship between phonemic awareness and oral reading fluency in an additional language?

The results indicate a moderate correlation between phonemic awareness (PA) and oral reading fluency (ORF) in an AL, suggesting that phoneme mastery contributes to, although does not solely determine, the effectiveness of oral decoding in reading (Fonseca-Mora & Fernández-Corbacho, 2017). This finding aligns with a surprisingly limited body of literature (Young-Scholten et al., 2015; LASLLIAM, 2022) that similarly identifies a comparable trajectory in the reading acquisition process between children and low-literate adults (Filimban, 2019; Sosinski et al., 2020). The moderate correlation found in this study mirrors the findings of Carreño-Sepúlveda and Arancibia-Gutiérrez (2024), who observed that increased phonemic proficiency in children was associated with better performance in various aspects of oral reading fluency. Participants in that study had only minimal oral language competence and thus limited reading skills.

The predictive nature of phonological awareness in the acquisition of reading skills in both L1 and AL has been extensively documented. Although PA is not the sole predictor of ORF in AL, its facilitating role is empirically supported, with clear implications for language teaching (Sousa et al., 2022).

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(RQ2): Is there a relationship between musical rhythm and phonemic awareness?

Regarding the second research question, the results show a moderate relationship between musical rhythm and phonemic awareness. This finding is consistent with the majority of previous studies (Prados López & Foncubierta, 2024), although the strength of this association may depend on variables such as the type of phonological task, participants' age, or level of oral proficiency (Patel, 2011; Besson et al., 2017; Foncubierta et al., 2020; Fonseca-Mora et al., 2021).

Given that adequate phonemic awareness implies a degree of auditory sensitivity, the relationship between musical rhythm and PA suggests that having a good ear—or the capacity to mentally represent the acoustic features of language—facilitates reading acquisition. Some studies have highlighted that higher correlations are found between phonological awareness and melodic tasks, while rhythmic tasks show more moderate associations in certain contexts. Anvari et al. (2002) and Lamb and Gregory (1993) found that rhythm and melody skills in early childhood were linked to better performance in phonemic awareness tasks. In the study by Foncubierta et al. (2020) with adult Italian learners of Spanish, a high correlation was reported between stress (a rhythmic feature) and phonemic awareness (accent: $\rho = 0.641$). The moderate correlation found in the present study may be explained by participants' limited oral proficiency in Spanish. This supports the idea that effective categorisation of acoustic signals may be a prerequisite for efficient phonological encoding of speech units (Prados López & Foncubierta, 2024). Moreover, studies involving adults with reading difficulties have shown that musical rhythm training enhances phonological awareness, which sometimes serves as a mediating factor between musical aptitude and reading skills (Sousa et al., 2022), and in other cases shows a more direct link (Bonacina et al., 2020; 2021), with potential implications for reading development.

(RQ3): Is there a relationship between musical rhythm and oral reading fluency in an additional language?

The results of this study show no statistically significant correlation between musical rhythm and oral reading fluency, which contrasts with some of the existing literature, although it is supported by more recent findings.

Several studies have documented a positive relationship between rhythmic skills and the development of reading abilities, particularly in the context of additional language learning. For instance, Fonseca-Mora et al. (2021) and Legaz-Torregrosa et al. (2022) found that musical aptitude—and rhythm perception in particular—is associated with the development of phonological awareness and other reading skills, suggesting that musical rhythm may facilitate the acquisition of a language's sound structure and, consequently, influence reading fluency. The meta-analysis conducted by Ozernov-Palchik and Patel (2018), as well as the precise auditory timing hypothesis proposed by Tierney and Kraus (2014), argue that musical rhythm contributes to reading development primarily through its impact on phonological awareness, which in turn affects fluency. Nevertheless, some studies have reported divergent results. Schellenberg et al. (2023) conclude that the relationship between musical rhythm and language is unreliable or contingent on factors such as age and literacy level, which aligns with the findings of the present study. It is likely that both musical rhythm and oral reading fluency require a certain level of literacy in both L1 and an additional language.

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6. Conclusions

The primary objective of this study was to explore the relationship between musical aptitude, phonological awareness, and oral reading fluency in adults learning Spanish within a migratory context in the city of Huelva.

The study of reading skills, such as fluency and phonological awareness, and their relationship with other auditory experiences such as musicality in readers with prior schooling is well documented (Fonseca-Mora et al., 2021; Foncubierta et al., 2020; Legaz-Torregosa, 2022; Kittle et al., 2024). This is also the case for novice readers in monolingual contexts (Soussa et al., 2022; Bonacina et al., 2021; Steinbrink et al., 2019). However, in the case of adult migrants with low levels of literacy, the way in which these variables might interact remained unknown.

The study of oral reading fluency in an additional language is of particular importance, as it allows for the identification of reader profiles and the description of potential reading difficulties, which is especially relevant within the migrant population. Given the heterogeneity and living conditions of individuals who migrate under vulnerable circumstances, investigating the reading process, as well as other literacy-related skills, presents a considerable challenge for research (Foncubierta, 2022).

This correlational study has evidenced a moderate relationship between phonological awareness—a predictive element in reading acquisition—and musical rhythm, one of the dimensions of musical aptitude. This supports previous findings that music and phonological processing are interrelated systems. Moreover, the relationship between oral reading fluency and musical rhythm was also explored, revealing a positive yet weak correlation. This may be attributed to the participants' low levels of literacy and reading proficiency. On average, participants read fewer than 70 words per minute, an indicator of limited reading fluency.

In light of these findings, the results concerning the oral dimension (phonological awareness) of reading ability (fluency) in an additional language among adults in migratory contexts, although not all hypotheses could be confirmed, contribute to a better understanding of reading profiles in this specific population

One of the main limitations of this study lies in the size and representativeness of the sample. Although 74 participants may appear to be sufficient, the sample size remains limited for generalising the findings to the broader population of migrants with low levels of literacy. Additionally, factors such as literacy levels in the participants' first language were not considered, and these may have influenced the results.

For future research, it would be worthwhile to consider that, in this study, reading fluency was measured solely in terms of reading rate—that is, the number of words correctly read within one minute. It would be relevant to take prosodic patterns of reading into account, as this may be where the correlation between musical rhythm and oral reading fluency could be more clearly observed.

7. References

Anvari, S. H., Trainor, L. J., Woodside, J., & Levy, B. A. (2002). Relations among musical skills, phonological processing, and early reading ability in preschool children. Journal of Experimental Child Psychology, 83(2), 111-130. https://doi.org/10.1016/s0022-0965(02)00124-8

Besson, M., Chobert, J., & Marie, C. (2011). Transfer of training between music and speech: common processing, attention, and memory. Frontiers in psychology, 2, 94. https://doi.org/10.3389/fpsyg.2011.00094

Bonacina, S., Huang, S., White-Schwoch, T., Krizman, J., Nicol, T., & Kraus, N. (2021). Rhythm, reading, and sound processing in the brain in preschool children. NPJ Science of Learning, 6(1), 20. https://doi.org/10.1038/s41539-021-00097-5

Bonacina, S., Krizman, J., White-Schwoch, T., Nicol, T., & Kraus, N. (2020). Distinct rhythmic abilities align with phonological awareness and rapid naming in school-age children. Cognitive Processing, 21(4), 575–581. https://doi.org/10.1007/s10339-020-00984-6

Carreño-Sepúlveda, F., & Arancibia-Gutiérrez, B. (2024). Conciencia Fonológica y Fluidez Lectora en Escolares con y sin Trastorno del Desarrollo del Lenguaje de Segundo, Tercero y Cuarto año de enseñanza básica. Revista Chilena De Fonoaudiología, 23, 1–11. https://doi.org/10.5354/0719-4692.2024.66839

Council of Europe (2022). *Reference Guide on Literacy and Second Language Learning for the Linguistic Integration of Adult Migrants (LASLLIAM).* Education Department.

Defior, S., & Serrano, F. (2011). La conciencia fonémica, aliada de la adquisición del lenguaje escrito. *Revista de logopedia, foniatría y audiología*, *31*(1), 2-13. https://doi.org/10.1016/S0214-4603(11)70165-6

Ehri, L. (2014). Orthographic mapping in the acquisition of sight word reading, spelling memory, and vocabulary learning. *Scientific Studies of Reading*, 18(1), 5-21. https://doi.org/10.1080/10888438.2013.819356

Filimban, E. (2019). *The Effectiveness of a Computer Software for Developing Phonemic Awareness and Decoding Skills for Low-literate adult learners learning English*. ((Doctoral dissertation, University of Newcastle). University of Newcastle. http://theses.ncl.ac.uk/jspui/handle/10443/4873

Foncubierta, J. M. (2022). Medir la fluidez lectora oral en adultos inmigrantes o refugiados que aprenden español como L2: dificultades y retos. *Revista Nebrija de Lingüística Aplicada a la Enseñanza de Lenguas, 16*(33), 65–83. https://doi.org/10.26378/rnlael1633502

Foncubierta, J. M., Machancoses, F. H., Buyse, K., & Fonseca-Mora, M. C. (2020). The Acoustic Dimension of Reading: Does Musical Aptitude Affect Silent Reading Fluency? *Frontiers in Neuroscience, 14*, 399. https://doi.org/10.3389/fnins.2020.00399

Fonseca-Mora, M. C., & Fernández-Corbacho, A. (2017). Procesamiento fonológico y aprendizaje de la lectura en lengua extranjera. *Revista Española de Lingüística Aplicada/Spanish Journal of Applied Linguistics*, *30*(1), 166-187 https://doi.org/10.1075/resla.30.1.07fon

Fonseca-Mora, M. C., Jara-Jiménez, P., & Gómez-Domínguez, M. (2015). Musical plus phonological input for young foreign language readers. *Frontiers in psychology*, *6*, 286.

Fonseca-Mora, M. C., Machancoses, F. H., Gryb, O., Reiterer, S., & Pourhosein Gilakjani, A. (2021). Musical aptitude, working memory, general intelligence and plurilingualism: When adults learn to read fluently in a foreign language. *Cogent Education, 8*(1). https://doi.org/10.1080/2331186X.2021.1936371

Fonseca-Mora, M.C., Jara-Jiménez, P., Gómez-Domínguez, M. (2015). Musical plus phonological input for young foreign language readers. *Frontiers in Psycholo*gy, 6, 286. http://dx.doi.org/10.3389/fpsyg.2015.00286

Goswami, U. (2009). Mind, brain, and literacy: Biomarkers as usable knowledge for education. *Mind, Brain, and Education*, *3*(3), 176-184. https://doi.org/10.1111/j.1751-228X.2009.01068.x

Goswami, U., & Bryant, P. (2007). Children's cognitive development and learning. https://tinyurl.com/c9dmdaxm

Grabe, W., & Stoller, F. (2011). *Teaching and researching reading*. Pearson Longman.

Horowitz-Kraus, T. (2023). The Role of Executive Functions in Fluent Reading: Lessons from Reading Acquisition and Remediation. *Mind, Brain, and Education*, 17, 373-382.https://doi.org/10.1111/mbe.12357

Kittle, J. M., Amendum, S. J., & Budde, C. M. (2024). What Does Research Say About the Science of Reading for K-5 Multilingual Learners? A Systematic Review of Systematic Reviews. *Educational Psychology Review*, *36*(4), 108. https://doi.org/10.1007/s10648-024-09942-6

Koda, K. (2005). *Insights into Second Language Reading: A Cross-Linguistic Approach*. Cambridge University Press.

Koda, K. (2007). Reading and language learning: Crosslinguistic constraints on second language reading development. *Language Learning*, 57(s1), 1–44. https://doi.org/10.1111/0023-8333.101997010-i1

Koelsch, S., Vuust, P., & Friston, K. (2019). Predictive processes and the peculiar case of music. Trends in cognitive sciences, 23(1), 63-77. https://tinyurl.com/mps9jjmh

Legaz-Torregrosa, H., Machancoses, F. H., Buyse, K., & Fonseca-Mora, M. C. (2022). Musical aptitude and silent reading fluency in adult multilingual learners of Spanish: An explora-tory study. International Journal of Multilingualism, 21(1), 78–91. https://doi.org/10.1080/14790718.2021.2025242

Lems, K. (2003). Adult ESL oral reading fluency and silent Reading comprehension. National- Louis University. https://tinyurl.com/2zhsf8mc

National Institute of Child Health and Human Development (2000). Report of the National Reading Panel: Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction (NIH Publication No. 00-4769). U.S. Government Printing. https://tinyurl.com/4m4rk8kx

Ozernov-Palchik, O., & Patel, A. D. (2018). Musical rhythm and reading development: Does beat processing matter? Annals of the New York Academy of Sciences, 1423(1), 166–175. https://doi.org/10.1111/nyas.13853

Patel, A.D. (2011). Why would musical training benefit the neural encoding of speech? The OPERA hypothesis. Frontiers in Psychology, 2, Article 142. https://doi.org/10.3389/fpsyg.2011.00142

Pikulski, J.J. & Chard, D.J. (2005). Fluency: Bridge between decoding and reading comprehension. The Reading Teacher, 58(6), 510–519. https://doi.org/10.1598/RT.58.6.2

Prados López, M., & Foncubierta, J. M. (2024). Ritmo musical en las habilidades lectoras de adultos migrantes: hipótesis e implicaciones basadas en una revisión sistemática. Bellaterra Journal of Teaching & Learning Language & Literature, 17(4), e1401. https://doi.org/10.5565/rev/jtl3.1401

Rau, A. K., Moll, K., Snowling, M. J., & Landerl, K. (2015). Effects of orthographic consistency on eye movement behavior: German and English children and adults process the same words differently. Journal of experimental child psychology, 130, 92-105. http://dx.doi.org/10.1016/j.jecp.2014.09.012

Schellenberg, E. G., Correia, A. I., & Lima, C. F. (2023). Is musical expertise associated with self-reported foreign-language ability? Journal of experimental psychology. Human perception and performance, 49(7), 1083–1089. https://doi.org/10.1037/xhp0001116

Sosinski, M., Young-Scholten, M., & Naeb, R. (2020). Notas sobre la enseñanza de alfabetización a inmigrantes adultos. Foro De Profesores De E/LE, (16), 354-374. https://ojs3.uv.es/index.php/foroele/article/view/17811/170

Sousa, J., Martins, M., Torres, N., Castro, S. L., & Silva, S. (2022). Rhythm but not melody processing helps reading viaphonological awareness and phonological memory. Scientific Reports, 12(1), 13224.

Steinbrink, C., Knigge, J., Mannhaupt, G., Sallat, S., & Werkle, A. (2019). Are Temporal and Tonal Musical Skills Related to Phonological Awareness and Literacy Skills? - Evidence from Two Cross-Sectional Studies with Children from Different Age Groups. Frontiers in Psychology, 10, 805. https://doi.org/10.3389/fpsyg.2019.00805

Tarone, E., Bigelow, M., & Hansen, K. (2009). Literacy and Second Language Oracy. Oxford University Press.

Young-Scholten, M., Peyton, J. K., Sosinski, M., & Cabeza, A. M. (2015, May). LESLLA teachers' views of the knowledge and skills they need: An international study. In LESLLA Symposium Proceedings, 10 (1), 165-185. https://doi.org/10.5281/zenodo.8024410

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MP: Conceptualization; Data curation; Data collection, cleaning, and organization; Formal analysis; Funding acquisition; Investigation; Methodology; Project administration; Project supervision and coordination; Resources; Software; Validation; Visualization; Writing – original draft; Writing – review & editing.

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JMF: Conceptualization; Formal analysis; Funding acquisition; Investigation; Methodology; Project administration; Project supervision and coordination; Resources; Software; Supervision and coordination of the project; Validation; Visualization; Writing – original draft; Writing – review & editing.

Data Availability

The data underlying this study are available upon request to the corresponding author.

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Conflict of Interest

The authors declare no conflict of interest.