LINKING SINGING SKILL DEVELOPMENT TO LIFE SATISFACTION: EVIDENCE FROM BOYS' CHOIRS

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Although singing has been shown to affect life satisfaction, little is known about children's choir contexts. This study examines the interplay between the development of singing skills and the level of life satisfaction in children and adolescents, with a particular focus on the context of boys' choirs. Collective music-making, including singing in choirs, is a multifaceted activity that simultaneously involves musical, cognitive, emotional, and social competencies, contributing significantly to the personal development and quality of life of children and youth. Although a substantial body of research addresses the impact of singing on adults' emotional well-being, the relationship between singing skills and life satisfaction among children and adolescents especially in the choral context remains underexplored.

Highlighting the relevance of this study, it must be noted that regular and structured participation in school choirs not only fosters vocal and musical skills but also promotes emotional balance, social integration, and the enhancement of cognitive functions. Thus, singing may serve as an important psychosocial and pedagogical instrument in the lives of students, helping to reveal how musical activities influence young people's subjective well-being and life satisfaction.

To achieve the aims of the study, an adapted online testing platform, *LongGold Latvia*, was employed. This platform integrates standardized and customized instruments to assess singing skills, musical perception, and levels of life satisfaction. Such an approach provides comprehensive and quantitatively comparable data, enabling the analysis of the associations between singing and musical abilities and the life satisfaction of children and adolescents. The study thereby offers valuable contributions to both the field of music pedagogy and the exploration of youth psychological well-being. Findings indicate that choir participants demonstrated higher rhythmic singing ability than non-participants, while no significant differences were observed in life satisfaction between the two groups. This suggests that structured choral singing may support musical development, although its direct relationship with well-being requires further investigation.

Keywords: singing, singing skills, boys' choir, life satisfaction, collective music-making

INTRODUCTION

Singing, particularly collective music-making in various types of choirs, such as boys', mixed, and other choral groups, constitutes one of the oldest and most universal forms of human musical expression. It encompasses several interrelated components, including vocal skills, musicality, as well as emotional, cognitive, and social competences.

The experience of collective music-making in childhood and adolescence not only fosters the development of technical singing abilities but also affects emotional well-being, social interaction skills, and self-esteem (Clift & Hancox, 2010; Welch, 2011). Previous research has demonstrated that regular singing enhances emotional self-regulation, reduces stress, and promotes a more positive outlook on life (Kreutz et al., 2004; Gick, 2011; Pearce et al., 2016). However, these findings have predominantly been derived from studies with adults and older populations, while the context of children's and adolescents' choirs remains largely underexplored.

In view of this research gap, the Latvian boys' choir tradition provides a unique opportunity to analyze the impact of collective singing on the development of children and adolescents within a pedagogical and cultural environment. This tradition, which has long been closely connected with the national Song Festival movement, remains a vital part of Latvia's cultural identity and music education system. As such, it represents not only an artistic practice but also a pedagogical and social institution that shapes children's musical, emotional, and social development. These choirs represent a significant pedagogical, social, and emotional context for students, making it possible to systematically assess both the development of singing skills and students' life satisfaction, particularly when employing contemporary quantitative assessment methods. Such research is essential for better understanding how music, and collective singing in particular, influences students' emotional well-being, social integration, and cognitive development.

The starting point of this study lies in the need to systematically investigate the interrelations between the development of singing skills and subjective well-being during childhood and adolescence. By focusing on boys' choirs, the research offers the possibility to analyze the multidimensional effects of collective singing (i.e., vocal, musical, social, cultural, pedagogical, and psychological aspects) in a real educational context, while also expanding the academic literature that has thus far primarily addressed either musical development or emotional well-being in isolation. Understanding these interactions is crucial in both music pedagogy and child and adolescent psychology, as it enables the development of more effective educational and musical activities that foster both vocal skills and students' subjective well-being.

Characterizing collective music-making, for example in boys' choirs, it must be emphasized that this is a complex process in which all the aforementioned dimensions of singing (vocal, musical, emotional, cognitive, social, and pedagogical – interact dynamically and contribute to the overall artistic and developmental outcomes) can be developed and reinforced. Research indicates that regular singing improves emotional self-regulation, reduces stress levels, and supports the development of positive self-esteem (Milošević, 2024). The social dimension is particularly significant during adolescence, a developmental stage in which identity formation and the sense of belonging to a group are critical. Collective music-making strengthens cooperation skills, responsibility, and social integration, all of which are directly correlated with life satisfaction and subjective well-being (Shen & Yang, 2025).

In addition to its emotional and social dimensions, singing stimulates cognitive development. Systematic and regular music-making enhances concentration, musical memory, and learning efficiency (Moreno et al., 2009; Schellenberg, 2004; Schlaug et al., 2005; Hyde et al., 2009). These factors, in turn, influence self-esteem and overall quality of life, creating a multi-layered positive effect on individual well-being.

The present research builds upon a previous study examining stress and its management, particularly the extent to which such competencies are incorporated into higher education and the practical strategies applied to cope with stress (Maurītis, 2022). This article expands the thematic scope by examining the development of singing skills and their correlation with life satisfaction within the real pedagogical setting of general education. The study focuses on how processes of musical and emotional development that occur through collective singing influence the subjective well-being of children and adolescents, particularly their level of life satisfaction. In this way, the research continues previous inquiries in a more specific educational context and age group.

The development of singing skills in boys' choirs is not solely a musical phenomenon, but also a psychosocial and cognitive one. Its investigation provides a significant contribution to both music pedagogy and the study of youth psychological well-being, offering theoretical and empirical insights into the correlation between musical skill development and life satisfaction. This perspective forms the basis of the study's relevance particularly in Latvia, where the relationship between singing skills and life satisfaction in the boys' choir context has thus far received little scholarly attention. The article is grounded in the methodological framework of the international *LongGold* project and the author's practical experience. At the same time, the study contributes to the broader international discourse, as the *LongGold* project will be expanded with new research and Latvian data, thereby enabling cross-national comparisons and enriching the global understanding of this research problem.

In the following sections, the author presents evidence indicating that singing skills may be positively associated with students' overall life satisfaction. Previous research by other authors has highlighted that regular engagement in musical activities, such as choir singing, contributes significantly to emotional well-being, social cohesion, and cognitive development. Building on these findings, growing attention has been directed toward understanding how singing abilities develop during childhood and adolescence, as well as the potential benefits that structured collective music-making experiences in school settings may provide. The present study aims to examine the associations between students' life satisfaction and their musical skills, with a specific focus on the development of singing abilities throughout childhood and adolescence. Furthermore, it investigates whether boys who regularly and systematically participate in school choir activities demonstrate higher levels of life satisfaction and enhanced musical skill development compared to peers who do not engage in choir singing. To address these objectives, three central research questions were formulated:

(1) Are singing skills in school-aged children positively related to indicators of life satisfaction?

(2) Does participation in school choir singing, as a structured and regular form of collective music-making, influence students' life satisfaction?

(3) Do boys who participate in school choirs differ significantly from their non-singing peers in both singing skills and life satisfaction?

1. MUSIC-MAKING AT SCHOOL AND IN BOYS' CHOIRS: HISTORICAL, PEDAGOGICAL AND PSYCHOSOCIAL CONTEXTS

Music-making in schools is a multifaceted activity that encompasses educational, creative, social, personal development, and cultural dimensions. It not only provides musical experience, but also fosters children's and adolescents' personal growth, emotional balance, social skills, and a sense of belonging to the collective, the school, and the broader culture (Hallam, 2010; Welch & McPherson, 2018; Rickard et al., 2013). The school environment serves as a key setting in which singing acquires both pedagogical and cultural value, integrating music education with the goals of emotional and social development.

From a historical perspective, the evolution of singing in Ancient Egypt, Greece, and Rome demonstrates its multifunctional role in society, where it was purposefully employed in religious, educational, and social communication contexts (Ma, 2024). Over time, singing has manifested in diverse forms and stylistic traditions, maintaining ties with traditional values while expanding opportunities for creative expression (Batovska et al., 2022). Collective music-making enables children to express their thoughts, build relationships, and enhance emotional well-being (Van Der Sandt, 2025).

Children's choirs have long been an essential part of music education, particularly in school settings, and this tradition continues today. In Latvia, various types of choirs exist – boys', girls', and mixed – each with their own pedagogical particularities. Boys' choirs possess a rich cultural history closely connected with schools and the work of national educators. Choral singing holds an important place in Latvia's musical heritage, developing alongside the formation of national culture and continuing through traditions such as the General Song and Dance Celebrations and the School Youth Song and Dance Festivals (Daugavietis, 2015; Latvian National Centre for Culture, 2018; UNESCO, 2003).

Even today, boys' choirs provide a unique environment that combines artistic expression, discipline, and a sense of community, while simultaneously offering social and emotional support. Within this environment, students develop a sense of belonging, responsibility, self-confidence, and collaboration skills. Unlike mixed or girls' choirs, boys' choirs face specific challenges related to upbringing, motivation, and

voice development, which require tailored pedagogical approaches and individualized work with singers (Periodika.lv, n.d., *Rīgā un visā Latvijā – pasaules zēnu balsis*[1]).

This multidimensional perspective, encompassing historical, pedagogical, and psychosocial factors, provides a framework for understanding how school-based singing not only offers music education but also promotes the emotional, social, and cognitive development of young people. Such a context is particularly relevant for analyzing the development of singing skills and life satisfaction, as it demonstrates how collective music-making creates an integrated pedagogical and psychosocial experience for students.

2. THE DEVELOPMENT OF SINGING SKILLS IN SCHOOLS AND BOYS' CHOIRS AND THE SIGNIFICANCE OF STUDYING SUBJECTIVE WELL-BEING IN THE SCHOOL CHOIR CONTEXT

Singing is one of the oldest and most universal forms of musical expression, centered on the human voice. It combines intonation, rhythm, articulation, emotional expression, and communication skills, which develop gradually and are closely linked to physiological, cognitive, emotional, and social factors (Welch, 2005; Welch, 2006). Within general and cultural education, singing serves not only as a foundation of aesthetic and creative education but also as an important driver of personal development and social interaction (Wicks, 2014).

In Latvia, singing skills are systematically acquired in general education schools, where music classes provide both practical music-making and theoretical knowledge (*Metodiskie ieteikumi skolotājiem mācību satura īstenošanai mūzikā 1.–9. klasei*, n.d.[2]). This process is characterized by systematicity, continuity, concentric progression, and practical application. Regular singing enhances students' musical hearing, sense of rhythm, and vocal technique, while also fostering emotional, intellectual, and social competences (Cuadrado & Rusinek, 2016). Beyond formal education, extracurricular music activities, particularly choir participation, provide broader opportunities for creative self-expression and social engagement (Platpere, 2020).

Choral singing for children and adolescents serves as a comprehensive educational medium that fosters the development of vocal, musical, cognitive, and social skills, including posture, breathing technique, clear diction, melodic and harmonic hearing, emotional expressiveness, and creative thinking (Rucsanda, 2021; Vītols, 2016; Batņa, 2020). Special attention must be given to boys' choirs, considering the physiological characteristics of voice transition and the importance of age-appropriate pedagogical

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[1] Periodika.lv. (n.d.). Rīgā un visā Latvijā – pasaules zēnu balsis. Retrieved May 20, 2025, from https://periodika.lv/periodika2-viewer/?lang=fr#panel:pa|issue:418148|article:DIVL3321|query:koru%20attīstībai%20Zēnu%20zēnu

[2] Metodiski ieteikumi skolotājiem mācību satura īstenošanai mūzikā 1.–9. klasei. (n.d.). Kompetenču pieeja mācību saturā. Retrieved May 26, 2025, from https://mape.gov.lv/api/files/8FE15403-DD41-43B8-BB32-EC6F022E48F0/download

approaches (Asztalos, 2022). In both school and boys' choir settings, systematic warm-up routines – encompassing relaxation, breathing, articulation, and vocal exercises – play a central role (Batņa, 2020).

Such structured approaches improve vocal quality, refine musical hearing, enhance musical thinking, and cultivate a positive attitude toward singing as a collective and artistic practice (Cuadrado & Rusinek, 2016; Wicks, 2014). The development of singing skills in schools and choirs is closely connected to students' emotional well-being and personal growth (Clift et al., 2010; Welch, 2011; Rickard et al., 2013; Saarikallio, 2019).

Existing studies highlight the positive influence of choir singing on emotional well-being, social relationships, and a sense of belonging, although the majority of such studies have been conducted with adults or seniors (Clift & Hancox, 2010; Livesey et al., 2012; Gick, 2011; Pearce et al., 2016). While regular singing may enhance subjective well-being and life satisfaction, research on children and adolescents in this regard remains limited, particularly concerning the relationship between singing skills, emotional well-being, and life satisfaction.

The concept of subjective well-being was introduced by Ed Diener (Diener, 1984), emphasizing individuals' evaluations of their own lives. Unlike the more ambiguous concept of "happiness," subjective well-being offers a more precise psychological framework encompassing both the balance of positive and negative emotions (the affective dimension) and life satisfaction (the cognitive dimension) (Proctor, 2014; Das et al., 2020). This approach enables a deeper understanding of how individuals experience and evaluate their lives, highlighting the importance of emotional well-being alongside rational satisfaction (Radočaj-Jerković, 2022). It is important to note that life satisfaction and subjective well-being are not synonymous. Subjective well-being is a broader construct that includes both cognitive life evaluations and emotional experiences (Diener et al., 1985; Diener et al., 1999; Diener et al., 2018).

Life satisfaction is regarded as the cognitive component of subjective well-being – an individual's overall evaluation of their life (Diener et al.1999) – while subjective well-being also encompasses affective aspects, namely the balance of positive and negative emotions (Diener et al., 2018). OECD guidelines similarly emphasize that subjective well-being consists of three components: life evaluation (including life satisfaction), affective experience, and eudaimonic well-being, or a sense of meaning (OECD, 2013[3]).

In the context of school choirs, singing represents a powerful means not only for the development of musical skills but also for promoting students' emotional, psychological, and social well-being, provided that it is implemented in a positive, supportive, and structured environment (Davies et al., 2023). Collective music-making strengthens communication, emotional development, and the sense of belonging to a group, thus forming the basis for a positive school environment and supporting students' emotional health (Rucsanda, 2021; Platpere, 2020). For these reasons, it is important to study both

[3] Organisation for Economic Co-operation and Development. **(2013).** OECD guidelines on measuring subjective well-being. OECD Publishing. https://doi.org/10.1787/9789264191655-en

the acquisition of singing skills and students' subjective well-being, as this allows for an evaluation of the impact of music education on students' emotional well-being and quality of life. The findings of such research may provide practical recommendations for educators and choir conductors, helping to create inclusive, emotionally safe, and creatively stimulating environments in which students can experience the joy of music-making, emotional fulfillment, and harmonious collaboration (Asztalos, 2022; Batņa, 2020).

3. METHODOLOGY AND INSTRUMENTS

3.1. Participants

Although the initial plan was to include 60 respondents – 30 boys actively participating in boys' choirs (attending more than 60% of rehearsals during the past six months) and 30 boys not involved in choir activities (the control group) – the actual number of participants varied across different parts of the study. These differences were primarily related to practical constraints of data collection, participant availability, and the voluntary nature of involvement.

In total, **39 participants completed the individual singing ability test**. Meanwhile, **20 choir members and 27 participants from the control group** took part in the online assessments, reflecting differences in motivation and interest. Such variations are typical for school-based research, where data collection occurs within real educational contexts and depends on students' and teachers' schedules, workload, and willingness to participate.

Openly reporting these differences ensures methodological transparency and allows for a more accurate interpretation of the results, while maintaining the internal coherence and quality of the study.

To ensure that respondents in the control group were not participating in other choirs, ensembles, or collective music-making activities, their extracurricular musical involvement was assessed through an online questionnaire, which recorded type, frequency, and duration of such activities. This procedure ensured that the control group accurately reflected students not regularly engaged in musical activities, allowing for valid comparisons with choir participants.

All participants were students in general education schools (ages 8–13; grades 2–7), none of whom received specialized music training as part of their general education. Although a sample of 60 may appear modest, this size was sufficient to provide statistical power for examining correlations between singing skills and life satisfaction, while maintaining the reliability of the findings. Furthermore, the formation of two balanced groups – with equivalent age ranges and socio-demographic profiles – enabled not only correlational analysis but also comparative statistical testing between groups. To further refine comparability, respondents were subdivided into two age groups: 8–10 years (grades 2–4), prior to voice change, and 11–13 years (grades 5–7), during

the onset of voice transition. This subdivision allowed for examination of both developmental differences in vocal abilities and potential variations in emotional well-being and self-esteem across age stages.

3.2. Measures

Data collection employed the LongGold adapted online test battery, including Ed Diener's Satisfaction with Life Scale (SWLS), adjusted for children (Diener, 1985; Gadermann et al., 2009), to measure life satisfaction. This five-item self-report scale uses a 5-point Likert response format (1 = strongly disagree to 5 = strongly agree), yielding total scores ranging from 5 to 25, with higher scores reflecting greater life satisfaction.

Singing skills were assessed with the Singing Ability Assessment (SAA) test (Silas et al., 2023), designed to quantitatively evaluate vocal ability and melodic memory. The Singing Ability Assessment was culturally adapted with Latvian folk songs, ensuring ecological validity. The test was comprised of three components: sustained note production, rhythmic melody imitation, and melodic (non-rhythmic) reproduction. For cultural adaptation to the Latvian context, original melodic fragments were replaced with 20 Latvian folk song excerpts varying in rhythmic and melodic complexity. This ensured cultural relevance and age-appropriateness while preserving quantitative comparability.

3.2.1. Testing Procedure and Content Validity of the Singing Test

The online testing procedure included the use of computers with high-quality headphones and microphones in quiet environments. Each participant received a unique ID code ensuring anonymity. The testing sequence began with equipment calibration (microphone, volume, noise reduction) and a practice trial, followed by the main test sections. This setup enabled evaluation not only of performance accuracy but also of memory capacity, attention, and melodic perception.

The validation of the Singing Ability Assessment test emphasized whether the tasks and indicators reliably measured singing skills (including melody and rhythm components). Content validity was ensured by selecting Latvian folk song fragments with distinct rhythmic and melodic features, aligning with the music education curriculum.

3.2.2. Validation Analyses

In this study, an **exploratory factor analysis (EFA)** was conducted to reduce the dimensionality of the dataset by identifying underlying factors representing related musical structure variables. The sample consisted of N = [insert sample size] participants and included both rhythmic and melodic stimuli. Sampling adequacy was confirmed with a **Kaiser–Meyer–Olkin (KMO)** measure of **.600** and **Bartlett's test of sphericity** was significant ($\chi^2(153)$ **= 17,624,** $p < .001$), indicating that the data were suitable for factor analysis (see *Table 1* and *Table 2*).

Assumption Checks

Table 1

KMO Measure of Sampling Adequacy

	MSA
Overall	0.600
i.entropy	0.252
mean_information_content	0.680
tonalness	0.540
tonal.clarity	0.495
tonal.spike	0.474
step.cont.glob.dir	0.535
step.cont.glob.var	0.833
step.cont.loc.var	0.372
mean_int_size	0.667
int_range	0.830
dir_change	0.795
mean_dir_change	0.317
int_variety	0.424
pitch_variety	0.714
mean_run_length	0.717
d.entropy	0.521
d.eq.trans	0.559
mean_duration	0.905

Table 2

Bartlett's Test of Sphericity

χ^2	df	p
17624	153	<.001

Factor extraction was performed using the Principal Axis Factoring method. Based on eigenvalues greater than 1, scree plot inspection, and parallel analysis, a three-factor solution was retained, explaining **47.6%** of the total variance (**see Table 3**). The scree plot further supported a three-factor structure (**see Figure 1**).

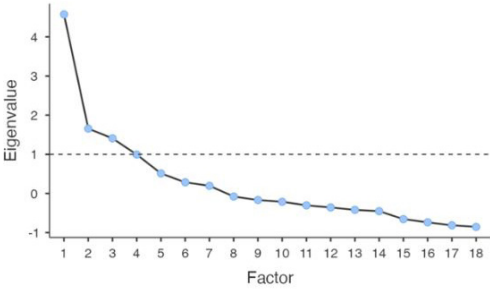
Factor extraction and variance

Table 3

Summary

Factor	SS Loadings	% of Variance	Cumulative %
1	3.91	21.7	21.7
2	2.74	15.2	37.0
3	1.92	10.7	47.6

Figure 1



To clarify the factor structure, an oblique (Oblimin) rotation was applied. Factor loadings below .30 were excluded from interpretation. Communalities ranged from .28 to .76 (**see Table 4**).

Table 4. ***Pattern matrix.***

Factor Loadings

	Factor			
	1	2	3	Uniqueness
dir_change	0.945			0.136
mean_run_length	0.929			0.171
pitch_variety	-0.784	0.304		0.170
mean_information_content	-0.696	0.321		0.299
i.entropy	0.462			0.796
mean_dir_change	0.332			0.840
step.cont.glob.dir				0.964
int_range		0.812		0.307
mean_int_size		0.805		0.161
step.cont.loc.var	0.440	0.720		0.393
step.cont.glob.var		0.574		0.489
int_variety	-0.312	0.342		0.649
tonalness				0.912
d.eq.trans			-0.797	0.369
d.entropy			0.779	0.383
mean_duration	-0.316		0.538	0.534
tonal.spike			0.318	0.897
tonal.clarity				0.957

Note. 'Principal axis factoring' extraction method was used in combination with a 'oblimin' rotation

The extracted factors showed small to moderate inter-correlations, supporting the use of an oblique rotation (see Table 5)

Table 5. ***Factor correlations.***

Inter-Factor Correlations

	1	2	3
1	—	-0.264	-0.0834
2		—	0.0176
3			—

Factor 1 was labeled *Rhythmic Complexity*, as it included items related to rhythmic entropy, duration variability, and interval direction change.

Factor 2 was labeled *Melodic–Tonal Clarity*, consisting of variables associated with tonalness, tonal clarity, and tonal stability.

Factor 3 was labeled *Information Content Variability*, reflecting measures of informational unpredictability (mean information content and entropy).

3.2.3. Reliability Analysis

Test reliability was examined using Cronbach's alpha (α). Cronbach's α and McDonald's Omega (ω) are reported with 95% confidence intervals (CI), which indicate the range within which the true reliability values are likely to fall. This provides a measure of the precision and stability of the reliability estimates (see Table 6).

When analyzing all ten parameters together (rhythm parameters: *mean_int_size, int_range, dir_change, mean_dir_change, int_variety*; melody parameters: *pitch_variety, mean_run_length, d.entropy, d.eq.trans, mean_duration*), Cronbach's α was only 0.24, indicating weak internal consistency and confirming that rhythm and melody indicators should not be combined into a single scale. For rhythm parameters, Cronbach's α initially was 0.25, but after removing the problematic indicator *dir_change*, it improved to 0.57. When the remaining indicators were standardized (converted to z-scores), Cronbach's α increased to 0.739, and McDonald's ω reached 0.766, indicating good reliability and a stable assessment of rhythmic ability.

In contrast, melody parameters did not form a coherent scale. Even after excluding individual indicators, Cronbach's α remained negative. Thus, within this test, the melody should be interpreted as a set of separate indicators that contribute to understanding singing ability but do not constitute a unified construct.

Table 6. ***Cronbach's alpha, McDonald's omega, p-values, and 95% confidence intervals for different parameter combinations.***

Scale	Cronbach's α	95% CI	McDonald's ω	p-value	Interpretation
All 10 parameters	0.24	[0.20; 0.28]	0.31	<0.001	Very weak consistency: parameters do not form a unified scale
Rhythm parameters (all)	0.25	[0.20; 0.29]	1.05*	<0.001	Weak reliability; inconsistency driven by problematic influence of dir_change
Rhythm parameters (without *dir_change*)	0.57	[0.55; 0.59]	1.22*	<0.001	Moderate reliability; stable construct after exclusion of dir_change
Rhythm parameters (standardized)	0.74	–	0.77	<0.001	Good reliability: standardized measures provide a coherent and robust scale
Melody parameters	-1.73	[-2.01; -1.48]	–	1.000	Negative reliability: items fail to cohere and capture contradictory tendencies

* McDonald's ω values greater than 1 are not practically interpretable and indicate limitations of the one-factor model.

Overall, the validation process confirms that the test is appropriate as a two-dimensional instrument that reliably evaluates singing ability by separately analyzing rhythmic and melodic components. The reliability analyses demonstrate that rhythm and melody cannot be treated as a single unified construct of singing ability. When all ten parameters were combined, Cronbach's α was only 0.24, confirming very weak internal consistency. In contrast, rhythm parameters showed a clear improvement: after excluding the problematic indicator *dir_change* and standardizing the remaining items, reliability reached acceptable levels (Cronbach's $\alpha = 0.74$; McDonald's $\omega = 0.77$), supporting rhythm as a coherent and stable construct. Melody parameters, however, consistently failed to form a reliable scale, with negative α values even after exclusions, indicating that melody should be interpreted through separate indicators rather than as a single dimension. These findings validate the test as a two-dimensional instrument, where rhythm can be analyzed as a unified ability, while melody must be assessed through distinct measures. This has important implications for future research, suggesting that collapsing rhythm and melody into a single "singing skill index" would obscure meaningful differences and that a differentiated approach better captures the multifaceted nature of singing ability.

3.3. Online Test Battery

In addition to the Singing Ability Assessment, the study employed several established tests of musical perception and skills. The **Mistuning Perception Test (MPT)** (Larrouy et al., 2019) evaluates the ability to detect whether a singer performs with accurate intonation. In each trial, participants hear pairs of short vocal excerpts – one sung in tune and one containing a controlled degree of mistuning – and must decide which version is out of tune. This test captures fine-grained auditory discrimination abilities and is particularly sensitive to individual differences in pitch accuracy perception.

The **Beat Perception Test (BAT)** (Harrison & Müllensiefen, 2018) assesses rhythmic perception skills, including pulse detection and sensitivity to metrical accents. During the task, participants listen to instrumental excerpts in which the underlying beat structure remains constant while specific rhythmic events or accent shifts are manipulated. They are asked to judge whether the beat feels aligned or displaced. This measure reflects core temporal processing skills that support rhythmic entrainment, marching, dancing, and ensemble coordination.

The **Melody Discrimination Test (MDT)** (Harrison et al., 2017) measures the ability to identify melodic changes across different tonalities. Each item consists of two short melodic sequences presented in succession. In some trials, the second melody contains a subtle modification – typically an altered pitch or interval. Participants must indicate whether the melodies are the same or different. The test captures melodic pattern recognition, short-term musical memory, and the ability to track sequential pitch structures, all of which are central to musical learning and performance.

Together, these perception-based measures offer a detailed profile of participants' auditory abilities, ranging from fine pitch discrimination and rhythmic timing to melodic memory. Their inclusion allows for a comprehensive assessment of the cognitive components that underlie broader musical development.

3.4. Questionnaires

Alongside quantitative tests, several self-report questionnaires were used to explore musical habits, environment, and beliefs. The **Concurrent Musical Activities Questionnaire (CMA)** collects information about respondents participation in everyday musical activities, such as choir, orchestra, or individual lessons. *For example, respondent indicated whether they had "played in an orchestra" or "received individual lessons on an instrument or voice" during the last three months.*

The **Musical Home Environment Questionnaire (MHE)** evaluates the musical environment in the family, parental involvement, and support for the respondents musical development and education. *Typical items ask whether parents sing in a choir or play an instrument, and how often they encourage the repondent to practise music (e.g., "Encourage me to practice music").*

The **Theory of Musicality Questionnaire (TOM)** assesses respondents beliefs about the development of musical abilities – whether they are perceived as innate or cultivated through regular long-term practice. *For instance, respondent rate statements such as "You have a certain level of musical ability and you cannot change it very much" and "You will always get better at music if you study and work hard."*

The **Goldsmiths Musical Sophistication Index (GMSI)** (Müllensiefen, 2014) provides a comprehensive overview of individual musical skills and engagement, covering listening, analysis, technical, and everyday musical abilities. *Example items include "I spend a lot of my free time doing music-related activities" from the Active Engagement scale, and "I can tell when people sing or play out of tune" from the Perceptual Abilities scale.*

This combination of diverse tests and questionnaires provided the opportunity to comprehensively evaluate students' life satisfaction, singing skills, musical perception, and additional factors such as the home musical environment and everyday involvement in music. Such an approach ensures the collection of precise, comparable, and reliable data, as well as insights into potential relationships between life satisfaction and musical skills, thereby laying the foundation for further analysis of the impact of subjective well-being on the development of singing ability in children and adolescents.

3.5. Testing procedure

The study was conducted in general education schools, within environments familiar to the students, to ensure maximum naturalness and participant comfort. Testing sessions for the two groups (choir participants and the control group) were carried out

separately at times coordinated with school administration and parents. All participants and their legal guardians received both oral and written information about the study procedure and data confidentiality, and formal parental consent was obtained.

Testing took place in acoustically isolated rooms using a computer with headphones and a microphone to ensure appropriate sound quality. Each participant was assigned a unique identification code to maintain anonymity. Participants then completed the tasks from the adapted LongGold Latvia test battery. Afterwards, choir participants individually completed the newly developed Singing Ability Assessment test, which evaluates singing ability and musical memory.

The total duration of each testing session was approximately 60–90 minutes, which, for some students, risked causing fatigue – particularly during the final sections of the tasks. To minimize this risk, students were allowed to complete the tasks at their own pace. Upon completion, the data were automatically transmitted to the LongGold database for further processing and statistical analysis. In addition, students completed a short survey about their testing experience, indicating whether they enjoyed the process and how they perceived the test items and tasks. This information helps evaluate not only the methodological quality of the tests but also the participants' motivation and attitude, which are crucial for ensuring the reliability of the results.

RESULTS

Descriptive statistics for all variables included in the analysis – life satisfaction (SWL.general), rhythmic ability (BAT.ability), melodic ability (MDT.ability), and the self-reported musical skills assessed by the GMS scales – are summarised in Table 7 (see Table 7). On average, participants reported moderately high life satisfaction (M = 3.58, SD = 0.96). Rhythmic and melodic abilities showed negative mean values (BAT: M = –1.64; MDT: M = –1.56), reflecting standardised scores relative to international norms. Self-reported singing abilities (M = 3.80, SD = 0.83), musical training (M = 3.01, SD = 1.19), and perceptual abilities (M = 4.09, SD = 0.71) demonstrated meaningful variability, suggesting the presence of different levels of musical background and experience among participants.

Table 7. ***Descriptives analyze.***

Descriptives

	SWL.general	BAT.ability	MDT.ability	GMS.singing_abilities	GMS.musical_training	GMS.perceptual_abilities
Mean	3.58	-1.64	-1.56	3.80	3.01	4.09
Median	3.60	-1.60	-1.95	3.86	2.93	4.06
Standard deviation	0.957	1.48	1.14	0.829	1.19	0.706
Minimum	1.40	-4.00	-3.65	1.71	1.00	2.67
Maximum	5.00	1.88	0.826	5.57	5.71	5.44

To examine the relationships between life satisfaction and musical abilities, Pearson correlations were calculated for all variables. All correlations – including non-significant ones – are reported and interpreted, and the full correlation matrix appears in Table 8 (see Table 8).

Table 8. ***Correlation Matrix***

		SWL.general	BAT.ability	MDT.ability	GMS.singing_abilities	GMS.musical_training	GMS.perceptual_abilities
SWL.general	Pearson's r	—					
	df	—					
	p-value	—					
BAT.ability	Pearson's r	-0.097	—				
	df	43	—				
	p-value	0.525	—				
MDT.ability	Pearson's r	0.044	0.358*	—			
	df	43	43	—			
	p-value	0.773	0.016	—			
GMS.singing_abilities	Pearson's r	0.115	0.306*	0.271	—		
	df	44	43	43	—		
	p-value	0.446	0.041	0.072	—		
GMS.musical_training	Pearson's r	0.137	0.336*	0.450**	0.314*	—	
	df	44	43	43	44	—	
	p-value	0.365	0.024	0.002	0.033	—	
GMS.perceptual_abilities	Pearson's r	-0.198	0.447**	0.310*	0.469**	0.258	—
	df	44	43	43	44	44	—
	p-value	0.187	0.002	0.038	0.001	0.083	—

Note. * p < .05, ** p < .01, *** p < .001

Life satisfaction did **not** correlate significantly with rhythmic (r = –.097, p = .525) or melodic ability (r = .044, p = .773). These results indicate that children's objective rhythmic and melodic discrimination skills were not associated with their reported life satisfaction. Similarly, life satisfaction was not significantly related to self-reported singing ability (r = .115, p = .446*), musical training (r = .137, p = .365*), or perceptual musical skills (r = –.198, p = .187*). Although the directions of the associations suggested small positive tendencies for singing ability and training, these effects were minor and statistically non-significant.

In contrast, several **significant correlations** emerged among the musical ability measures themselves. Rhythmic and melodic abilities were positively related (r = .358, p = .016*). Rhythmic ability also correlated with self-reported singing ability (r = .306, p = .041*), musical training (r = .336, p = .024*), and perceptual abilities (r = .447, p = .002*). Melodic ability showed significant relationships with musical training (r = .450, p = .002*) and perceptual skills (r = .310, p = .038*). Furthermore, the GMS scales were positively interrelated: singing abilities correlated with musical training (r = .314, p = .033*) and perceptual abilities (r = .469, p = .001*). These internal associations confirm that the musical measures used in the study function coherently and capture meaningful differences in participants' musical experience and competencies.

To ensure full compliance with ethical standards, the study received prior approval from the Research Ethics Committee of Rīga Stradiņš University (Decision No. 2-PĒK-4/195/2023), thereby affirming adherence to internationally recognized research ethics principles and safeguarding the rights, dignity, and interests of all participants.

The results obtained can contribute meaningfully to the fields of pedagogy, psychology, and general education as well as cultural education. Although the present study did not identify direct statistical associations between musical abilities and life satisfaction, the findings – together with the broader body of research – offer several important implications for practice and future development.

In school choir pedagogy, the results support the view that collective music-making remains an important educational space. Even though musical aptitude itself was not linked to well-being in this sample, extensive previous research indicates that choir participation promotes emotional growth, social cohesion, and meaningful peer connections. Therefore, the present findings may be used as part of a broader scientific justification for strengthening, preserving, and developing traditions of collective singing across regions.

In the context of psychology, these results can inform the design of support programs where music and artistic self-expression are considered valuable resources for promoting emotional balance, self-esteem, and social connection in children and adolescents. While our quantitative data did not reveal direct correlations, the theoretical pathways identified in the literature – including social integration, self-esteem, and stress regulation – remain relevant for psychological practice.

In educational policy, the data contribute to the growing evidence base highlighting the broader significance of arts and music education. Combined with existing empirical research, the present findings can be used to support arguments for sustained funding of choral education, cultural initiatives, and music-based youth programs, emphasising their potential role in fostering social integration, cultural identity, and community well-being.

DISCUSSION

The results of this study suggest that the direct relationship between singing skills and children's well-being is less straightforward than often assumed. In our data, neither rhythmic nor melodic ability showed a significant correlation with life satisfaction, indicating that singing skills may not function as a direct predictor of subjective well-being. Nevertheless, the broader literature points to the possibility that singing-related benefits are mediated by psychosocial mechanisms rather than emerging from musical ability itself. In this sense, singing skills may contribute indirectly to children's emotional balance, self-esteem, and general well-being through the contexts and experiences that surround musical activity, rather than through technical competence alone.

For young people, the most plausible pathway from choir participation to well-being appears to be social belonging rather than stress reduction. Although our results did not show a significant link between musical ability and life satisfaction, the theoretical framework and previous research consistently highlight choirs as unique communities of support. Collective musical engagement has been found to foster rapid social bonding, strengthen peer relationships, and activate physiological systems associated with social connection (Pearce et al., 2015; Weinstein et al., 2016). These mechanisms may explain why choir participation can enhance well-being even when individual musical aptitude does not directly correlate with life satisfaction.

The findings of this study therefore shed light on the potential mechanisms linking singing to well-being and suggest that these associations are likely mediated by several psychosocial factors rather than being linear or unidimensional. Recent literature highlights three central components – social integration, self-esteem, and stress regulation – that together provide a coherent explanatory model.

The first component, social integration, is especially relevant for children and adolescents. Group singing serves as a powerful social tool that accelerates the formation of interpersonal bonds and enhances feelings of belonging. Empirical work shows that collective music-making facilitates faster social cohesion and is associated with neurochemical processes that promote affiliation (Pearce et al., 2015; Weinstein et al., 2016). This aligns with the idea that social belonging may be a key mediator between singing activities and subjective well-being.

A second potential mediator is self-esteem. Participation in choirs, including rehearsals and performances, can promote feelings of achievement and competence, which are well-established predictors of psychological well-being. Singers themselves often report improvements in relaxation, confidence, and social connectedness as key benefits of participation (Clift & Hancox, 2010). Although these relationships did not manifest strongly in our quantitative correlations, they remain theoretically plausible pathways through which choir participation could support well-being.

A third component concerns stress regulation. Physiological studies indicate that singing can have a calming effect in low-stress contexts, reducing cortisol and cortisone levels, while higher-stress performance situations may evoke different hormonal responses (Fancourt et al., 2015). This suggests that the link between singing and stress regulation is context-dependent and may not be captured through cross-sectional correlations such as those used in the present study.

Recent scholarship further strengthens the argument that group singing supports well-being across multiple dimensions. Research with youth choirs highlights that the experience of well-being depends strongly on the social context of participation (Blagojević, Habe, & Bajec, 2025). Empirical work with children shows that group singing can enhance positive affect and perceived social belonging (Davies, Bentham, & Duah, 2023), and early childhood research indicates that singing contributes to health and developmental well-being (Welch & Baxter, 2025). More broadly, music education has

been linked to psychological well-being via self-efficacy and self-esteem, underscoring the importance of perceived competence in music learning (Jiang, 2024). Physiological studies of group chanting similarly show reductions in stress and increases in social connectedness (Perry, Polito, & Thompson, 2024).

Taken together, these findings point to a mediation model in which singing influences subjective well-being **indirectly** – through mechanisms of social integration, self-esteem, and stress regulation – rather than through musical ability itself. This model helps explain why the present study did not find direct correlations between musical skills and life satisfaction, while substantial evidence from broader literature continues to support the psychosocial value of group singing. Future research should empirically test these mediating relationships using larger samples, longitudinal designs, and multi-method assessments of both musical engagement and well-being.

BIBLIOGRAPHY

Asztalos, Andrea. 2022. *The Theory and Practice of Singing Voice Production of Children*. https://www.researchgate.net/publication/366646537_THE_THEORY_AND_PRACTICE_OF_SINGING_VOICE_PRODUCTION_OF_CHILDREN.

Batņa, Liene. 2020. *Skolas kora darba metodika*. Rīga: Musica Baltica.

Batovska, Oksana, Nataliia Grebenuk, Nataliia Byelik-Zolotaryova, Yuliia Ivanova, Tetiana Sukhomlinova, Jovana Blagojević, Katarina Habe, and Bojan. Bajec. 2025. "Differences in Experiencing Well-Being in Youth Choir Singers Regarding (In) Formal Participation." *Behavioral Sciences* 15 (10): 1337. https://doi.org/10.3390/bs15101337.

Clift, Stephen and Grenville Hancox. 2010. "The Significance of Choral Singing for Sustaining Psychological Wellbeing: Findings from a Survey of Choristers in England, Australia and Germany." *Music Performance Research* 3 (1): 79–96.

Clift, Stephen, Grenville Hancox, Ian Morrison, Brbel Hess, Don Stewart, and Gunter Kreutz. 2010. "Choral Singing and Psychological Wellbeing: Quantitative and Qualitative Findings from English Choirs in a Cross-National Survey." *Journal of Applied Arts and Health* 1 (1): 19–34. https://doi.org/10.1386/jaah.1.1.19/1.

Clift, Stephen and Grenville Hancox. 2010. "The Perceived Benefits of Singing: Findings from Preliminary Surveys of a University College Choral Society." *The Journal of the Royal Society for the Promotion of Health* 128 (3): 153–160. https://doi.org/10.1177/1466424007088361.

Cuadrado, Albina and Gabriel Rusinek. 2016. "Singing and Vocal Instruction in Primary Schools: An Analysis from Six Case Studies in Spain." *British Journal of Music Education* 33 (1): 101–115. https://doi.org/10.1017/s0265051715000273.

Daugavietis, Jānis. 2015. *Amatiermāksla Latvijā: kopienas attīstība un kultūrpolitika*. Promocijas darbs. https://doi.org/10.13140/rg.2.2.34862.77126.

Davies, Jessica, Susan Bentham, and Francis Duah. 2023. "The Impact of Group Singing on Children's Subjective Well-Being: Mixed Methods Research." *Children & Society* 37 (4): 1252–1273. https://doi.org/10.1111/chso.12727.

Diener, Ed (Edwin). 1984. "Subjective Well-Being." *Psychological Bulletin* 95 (3): 542–575. https://doi.org/10.1037/0033-2909.95.3.542.

Diener, Ed, Emmons Robert, Randy J. Larsen, and Sharon Griffin. 1985. "The Satisfaction with Life Scale." *Journal of Personality Assessment* 49 (1): 71–75. https://doi.org/10.1207/s15327752jpa4901_13.

Diener, Ed, Shigehiro Oishi, and Louis Tay. 2018. "Advances in Subjective Well-Being Research." *Nature Human Behaviour* 2 (4): 253–260. https://doi.org/10.1038/s41562-018-0307-6.

Diener, Ed, Eunkook M. Suh, Richard E. Lucas, and Heidi L. Smith. 1999. "Subjective Well-Being: Three Decades of Progress." *Psychological Bulletin* 125 (2): 276–302. https://doi.org/10.1037/0033-2909.125.2.276.

Fancourt, Daisy, Leanne Aufegger, and Aron Williamon. 2015. "Low-Stress and High-Stress Singing Have Contrasting Effects on Glucocorticoid Response." *Frontiers in Psychology* 6: 1242. https://doi.org/10.3389/fpsyg.2015.01242.

Gick, Marion L. 2011. "Singing, Health and Well-Being: A Health Psychologist's Review." *Psychomusicology: Music, Mind & Brain* 21 (1–2): 176–207. https://doi.org/10.1037/h0094011.

Hallam, Susan. 2010. "The Power of Music: Its Impact on the Intellectual, Social and Personal Development of Children and Young People." *International Journal of Music Education* 28 (3): 269–289. https://doi.org/10.1177/0255761410370658.

Harrison, Peter M. C. and Daniel Müllensiefen. 2018. "Development and Validation of the Computerised Adaptive Beat Alignment Test (CA-BAT)." *Scientific Reports* 8 (1). https://doi.org/10.1038/s41598-018-30318-8.

Harrison, Peter M. C., Tom Collins, and Daniel Müllensiefen. 2017. "Applying Modern Psychometric Techniques to Melodic Discrimination Testing." *Scientific Reports* 7 (1). https://doi.org/10.1038/s41598-017-03586-z.

Hyde, Krista L., Jason Lerch, Andrea Norton, Marie Forgeard, Ellen Winner, Alan C. Evans, and Gottfried Schlaug, 2009. "Musical Training Shapes Structural Brain Development." *Journal of Neuroscience* 29 (10): 3019–3025. https://doi.org/10.1523/JNEUROSCI.5118-08.2009.

Jiang, Jiajia. 2024. "Impact of Music Learning on Students' Psychological Development with Mediating Role of Self-Efficacy and Self-Esteem." *PLOS ONE* 19 (9): e0309601. https://doi.org/10.1371/journal.pone.0309601.

Kreutz, Gunter, Stefan Bongard, Sonja Rohrmann, Volker Hodapp, and Dietrich Grebe. 2004. "Effects of Choir Singing or Listening on Immunoglobulin A, Cortisol and Emotional State." *Journal of Behavioral Medicine* 27 (6): 623–635. https://doi.org/10.1007/s10865-004-0006-9.

Larrouy-Maestri, Philippe, Peter M. C. Harrison, and Daniel Müllensiefen. 2019. "The Mistuning Perception Test." *Behavior Research Methods* 51 (2): 663–675. https://doi.org/10.3758/s13428-019-01225-1.

Latvian National Centre for Culture. 2018. *The Latvian Song and Dance Celebration Tradition*. Rīga: LNKC.

Livesey, Linda, Ian Morrison, Stephen Clift, and Paul M. Camic. 2012. "Benefits of Choral Singing for Social and Mental Wellbeing." *Journal of Public Mental Health* 11 (1): 10–26. https://doi.org/10.1108/17465721211207275.

Ma, Hao. 2024. "The Historical Evolution of the Art of Singing." *International Journal of Education and Humanities* 15 (2): 346–352. https://doi.org/10.54097/wxbjkh09.

Maurītis, Reinis. 2022. *Uzstāšanās stresa vadības paņēmieni mūziķiem*. https://kopkatalogs.lv.

Milošević, Jelena. 2024. "Choral Singing as a Means of Increasing Wellbeing in Youth and Adults: PRISMA Review." *Glasbenopedagoški Zbornik Akademije Za Glasbo* 20 (1): 125–151. https://doi.org/10.26493/2712-3987.20(40)125-151.

Moreno, Sylvain, Carla Marques, Andreia Santos, Marta Santos, Sao Luis Castro, and Mireille Besson. 2009. "Musical Training Influences Linguistic Abilities in Children." *Cerebral Cortex* 19 (3): 712–723. https://doi.org/10.1093/cercor/bhn120.

Müllensiefen, Daniel, Bruno Gingras, Jakub Musil, and Lauren Stewart. 2014. "Measuring the Facets of Musicality: The Gold-MSI." *Personality and Individual Differences* 60: S35. https://doi.org/10.1016/j.paid.2013.07.081.

Pearce, Eiluned, Jacques Launay, and Robin I. M. Dunbar. 2015. "The Ice-Breaker Effect: Singing Mediates Fast Social Bonding." *Royal Society Open Science* 2 (10): 150221. https://doi.org/10.1098/rsos.150221.

Perry, Gavin, Vincenzo Polito, and William Forde Thompson. 2024. "The Physiological and Psychological Effects of Group Chanting." *Journal of Religion and Health* 63 (6): 4793–4815. https://doi.org/10.1007/s10943-023-01967-5.

Platpere, Rita. 2020. *Metodiskie ieteikumi kora interešu izglītības programmas veidošanai un īstenošanai*. Valsts izglītības satura centrs.

Proctor, Catherine. 2014. "Subjective Well-Being (SWB)." In *Springer eBooks*, 6437–6441. https://doi.org/10.1007/978-94-007-0753-5_2905.

Rickard, Nikki S., Paul Appelman, Richard James, Felicity Murphy, Adele Gill, and Catherine Bambrick, 2013. "Orchestrating Life Skills." *International Journal of Music Education* 31 (3): 292–309. https://doi.org/10.1177/0255761411434824.

Saarikallio, Suvi. 2019. “Music as Emotional Self-Regulation Throughout Adulthood.” *Psychology of Music* 47 (5): 589–606. https://doi.org/10.1177/0305735618765349.

Schellenberg, Glenn E. 2004. “Music Lessons Enhance IQ.” *Psychological Science* 15 (8): 511–514. https://doi.org/10.1111/j.0956-7976.2004.00711.x.

Schlaug, Gottfried, Andrea Norton, Katie Overy, and Ellen Winner. 2005. “Effects of Music Training on the Child’s Brain and Cognitive Development.” *Annals of the New York Academy of Sciences* 1060: 219–230. https://doi.org/10.1196/annals.1360.015.

Shen, Lei and Wei Yang. 2025. “The Intervention of Music Education on Adolescents’ Subjective Well-Being.” *Frontiers in Psychology* 16. https://doi.org/10.3389/fpsyg.2025.1617097.

Silas, Sebastian, Daniel Müllensiefen, and Reinhard Kopiez. 2023. “Singing Ability Assessment: Development and Validation of a Singing Test.” *Behavior Research Methods* 56 (5): 4358–4384. https://doi.org/10.3758/s13428-023-02188-0.

UNESCO. 2003. *The Baltic Song and Dance Celebrations*. UNESCO Intangible Cultural Heritage Lists.

Van Der Sandt, Johannes. 2025. “Singing in Music Education as a Tool for Developing Children’s Communication Skills.” *Literacy, Preliteracy and Education Journal* 8 (3). https://doi.org/10.14712/25337890.4848.

Vītols, Edgars. 2016. “Personality Qualities Development Opportunities in Extended Choir Activities.” *Arts and Music in Cultural Discourse* 87. https://doi.org/10.17770/amcd2016.2215.

Welch, Graham F. 2005. “Singing as Communication.” In *Oxford University Press eBooks*, 239–260. https://doi.org/10.1093/acprof:oso/9780198529361.003.0011.

Welch, Graham F. 2006. “Singing and Vocal Development.” In *Oxford University Press eBooks*, 311–330. https://doi.org/10.1093/acprof:oso/9780198530329.003.0016.

Welch, Graham F. 2011. “Singing and Vocal Development.” In *The Oxford Handbook of Music Education*, edited by G. E. McPherson and G. F. Welch, vol. 1, 695–710. Oxford University Press.

Welch, Graham F. and Hannah Baxter. 2025. “Singing, Health and Wellbeing in Young Children.” *Frontiers in Psychology* 16: 1595834. https://doi.org/10.3389/fpsyg.2025.1595834.

Welch, Graham F. and Gary E. McPherson. 2018. “Music Education and the Role of Music in People’s Lives.” In *Music and Music Education in People’s Lives*, vol. 1, 3–20. Oxford University Press.

Weinstein, David, Jacques Launay, Eiluned Pearce, Robin I. M. Dunbar, and Larue Stewart, 2016. “Singing and Social Bonding: Changes in Connectivity and Pain Threshold as a Function of Group Size.” *Evolution and Human Behavior* 37 (2): 152–158. https://doi.org/10.1016/j.evolhumbehav.2015.10.002.

Wicks, Daniel. 2014. *Voices of Learning: Teacher Knowledge, Skill and Development in Secondary School Singing*. https://www.academia.edu/64518679/Voices_of_learning_teacher_knowledge_skill_and_development_in_secondary_school_singing.

Welch, G. F., and H. Baxter. 2025. "Singing, Health and Wellbeing in Young Children." *Frontiers in Psychology* 16: 1595834. https://doi.org/10.3389/fpsyg.2025.1595834.

Welch, G. F., and G. E. McPherson. 2018. "Music Education and the Role of Music in People's Lives." In *Music and Music Education in People's Lives*, vol. 1, 3–20. Oxford University Press.

Weinstein, D., J. Launay, E. Pearce, R. I. M. Dunbar, and L. Stewart. 2016. "Singing and Social Bonding: Changes in Connectivity and Pain Threshold as a Function of Group Size." *Evolution and Human Behavior* 37 (2): 152–158. https://doi.org/10.1016/j.evolhumbehav.2015.10.002.

Wicks, D. 2014. *Voices of Learning: Teacher Knowledge, Skill and Development in Secondary School Singing*. https://www.academia.edu/64518679/Voices_of_learning_teacher_knowledge_skill_and_development_in_secondary_school_singing.