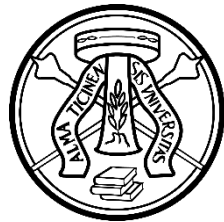


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Adaptation and evaluation of the eBMRQ for children: individual differences in musical reward sensitivity during development

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Abstract

Musical reward sensitivity refers to individual differences in the rewarding experiences elicited by music and encompasses several dimensions, including emotion, mood regulation, social interaction, sensory-motor experiences, and absorption. The present study aimed to provide an initial validation of the Italian adaptation of the extended Barcelona Music Reward Questionnaire for children (eBMRQc), developed to assess these individual differences in younger populations. Adult participants completed the adult eBMRQ, the Italian eBMRQc, and a brief questionnaire assessing demographic and musical background characteristics. Descriptive statistics and Pearson correlations were conducted using JASP. The eBMRQc total score showed a strong positive correlation with the eBMRQ total score, while significant positive associations were found between all corresponding subscales, providing preliminary evidence of convergent validity. Musical expertise was positively associated with both questionnaire versions, whereas years of musical training was associated with the eBMRQ but not the eBMRQc. Overall, these findings provide initial support for the Italian adaptation and suggest that the eBMRQc captures individual differences in musical reward in a manner consistent with the multidimensional framework of the adult measure. Further research involving children and additional psychometric analyses will be necessary to establish the instrument's reliability and validity in its intended population.

Keywords: musical reward, individual differences, children, questionnaire adaptation

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1. Introduction

The individual ability to experience reward through music is a fundamental aspect of human experience and shows considerable interindividual variability. In recent years, several studies have delved into the psychological and neural mechanisms underlying music reward, contributing to outline an articulated theoretical framework that integrates emotional, cognitive and motivational components. Previous studies highlighted how individual differences in pleasure responses to music can be traced back to different subdomains of music reward, such as an individual's music-related research and discovery, how much music evokes emotional responses in the individual, an individual's tendency to use music to change or maintain their emotional state, how much pleasure an individual gets from bonding with others through music, and an individual's tendency to experience automatic physical and bodily responses to music (Carraturo et al., 2025; Fullone et al., 2026; Mas-Herrero et al., 2013). This work led to the development of the Barcelona Music Reward Questionnaire (BMRQ), which served as a benchmark for psychometric evaluation of music-related reward experiences. It is a tool that allows us to characterise the so-called musical hedonia, meaning individual differences in a person's sensitivity to the rewarding and pleasurable effects of music, with some individuals being anhedonics, and some individuals being hyperhedonics, aside from the majority of the population scoring in the average range (Cardona et al., 2020). In fact, there are individuals that derive no pleasure or reward from music, despite having fully functional perceptual abilities and adequate responses to rewarding stimuli in other domains, these people are referred to as *musical anhedonics*. In contrast, individuals characterised by an unusually high sensitivity to the rewarding and emotional effects of music are referred to as *musical hyperhedonics* (Martínez-Molina et al., 2016; Mas-Herrero et al., 2018).

More recently, Cardona et al. developed the extended version of the BMRQ (eBMRQ), which includes an additional dimension: musical absorption (Absorption in Music), a construct which proved to be central to the reward experience (Cardona et al., 2022). The eBMRQ currently represents one of the most comprehensive tools for assessing musical reward in adults and has a validated Italian version (Carraturo et al., 2025).

Neuroimaging studies further clarified the importance of individual differences. Neural correlates of specific musical anhedonia have been identified, showing that some people exhibit atypical responses in the music reward circuit even though maintaining normal operation for other rewarding stimuli, such as monetary incentives or artistic experiences. These results have highlighted the need for sensitive tools capable of detecting individual differences in the system of reward, even in non-clinical populations (Martínez-Molina et al., 2016; Mas-Herrero et al., 2026).

In general, research has been conducted on musical hedonia in adults, but more recent literature has begun to explore music reward in developmental age. Kragness et al. showed that differences in sensitivity to music as a reward emerge as early as in school-age children, suggesting that such differences appear early and can be influenced by both intrinsic factors and family context (Kragness et al., 2024). On this line there is also the work of Kathios et al., who investigated the home musical environment retrospectively, emphasising how musical exposure during childhood helps shape reward experiences in subsequent years (Kathios et al., 2024). Overall, musical hedonia in children remains relatively underexplored in the literature, with existing research relying predominantly on parent-reported measures.

This project aimed to develop the Italian version for children of the eBMRQ, inspired by the French version currently being validated by Cantoni et al. (2026), adapting content and language to the comprehension skills of 7–8 year olds. The main goal is to obtain a reliable and

culturally appropriate tool for evaluation of individual differences in developmental music reward experiences. This could also promote, if necessary, the development of more effective clinical treatment modalities depending on the individual characteristics of each child.

The first chapter introduces the topic by reviewing the existing scientific literature. The subsequent chapters describe in detail the development of the questionnaire and present a discussion of the findings obtained from the collected data on adults.

1.1. What is musical reward?

Musical reward can be understood as the rewarding value that individuals derive from music, encompassing both the pleasurable and motivational aspects of the musical experience. More generally, reward is not considered a unitary construct but rather a multidimensional process involving distinct psychological components. In particular, Berridge (2019) distinguishes between *liking* and *wanting*, which represent two related but dissociable aspects of reward. *Liking* refers to the hedonic impact of a reward, that is, the pleasure experienced in response to a rewarding stimulus, whereas *wanting* refers to the motivational component of reward, whereby rewarding stimuli acquire incentive salience and promote approach and engagement. Although liking and wanting typically occur together, they can also be dissociated, suggesting that the experience of pleasure and the motivation to pursue a reward do not necessarily depend on one another (Berridge, 2019).

Applied to music, musical reward therefore encompasses both the pleasure elicited by musical experiences and the motivation to seek out and engage with music. The hedonic component may be reflected in the positive affect and pleasure experienced while listening to music, whereas the motivational component may manifest in the tendency to seek out music, listen to it repeatedly, or engage in musical activities. Thus, musical reward is not limited to the

subjective enjoyment of music but also involves the motivational value that music holds for an individual.

Importantly, individuals differ considerably in the extent to which they experience music as rewarding. As previously mentioned, while some individuals derive intense pleasure from music and are strongly motivated to engage with it, others may experience comparatively little pleasure or motivation in response to musical experiences. Investigating these individual differences is therefore essential for understanding the mechanisms underlying musical reward and the factors that contribute to variability in people's responses to music.

The rewarding nature of music is likely due to its power to move us and make us feel a certain way that can vary interpersonally (Zatorre, 2015). Music plays an important role in emotion evocation and is considered one of the most pleasurable stimuli, even though it doesn't offer any biological advantage, such as food or sex (Mas-Herrero et al., 2013).

Indeed, several studies have demonstrated that music can elicit emotional responses accompanied by measurable physiological changes, including alterations in heart rate, blood pressure, respiration, skin conductance, and peripheral temperature (Altenmüller et al., 2002; Baumgartner et al., 2006; Krumhansl, 1997; Salimpoor et al., 2009; Sammler et al., 2007; Sloboda & Juslin, 2001)

For example, Krumhansl (1997) found that different musical emotions were associated with distinct patterns of cardiovascular, respiratory, electrodermal, and vascular responses, with sad excerpts producing particularly pronounced changes in heart rate, blood pressure, skin conductance, and finger temperature, whereas happy excerpts were associated with greater changes in respiration. Similarly, Altenmüller et al. (2002) reported greater skin conductance responses during more highly arousing musical emotions, such as happiness and fear. Importantly, physiological responses have also been associated with the subjective experience

of musical pleasure: Salimpoor et al. (2009) found a positive relationship between the intensity of pleasure experienced while listening to music and sympathetic nervous system activity, particularly during intensely pleasurable moments associated with musical “chills.”

Additionally, a substantial body of neuroimaging research has demonstrated that pleasurable music listening engages neural systems involved in emotion and reward processing. In particular, activity has been observed in components of the mesolimbic reward system, such as the ventral striatum, including the nucleus accumbens, and the ventral tegmental area, alongside emotion-related regions such as the amygdala, orbitofrontal cortex, anterior cingulate cortex, and insula (Blood & Zatorre, 2001; Brown et al., 2004; Koelsch, 2010; Koelsch et al., 2006; Menon & Levitin, 2005; Mitterschiffthaler et al., 2007)

One important aspect, though, is that the strength of the impact that music has can vary between individuals according to personal and cultural preference, meaning that music can be experienced in ways that differ vastly for each individual (Mas-Herrero et al., 2013).

This evidence would lead us to further explore in depth how musical reward is experienced on a neuropsychological and behavioural level.

1.1.1. Neural correlates of musical reward

Music has the ability to produce many emotions, and due to this, it is a rewarding and valued aspect of people’s lives (Zatorre, 2015). For this reason, it’s interesting to explore how musical reward functions from a neuroscientific perspective. There is a large number of studies focusing on a network of brain regions that may form a core reward system. The structures composing this reward network include the dopaminergic brainstem nuclei, especially the ventral tegmental area, the ventromedial and orbitofrontal cortices, the amygdala, the insula, and the striatum (Berridge & Kringelbach, 2013; Schultz, 2006).

The matter is whether this reward network is only responsible for the processing of biologically relevant stimuli, such as food or sex, which are primary rewards, or also for secondary rewards, such as money, which have a learned element based on associations with a primary reward. Recently, a meta-analysis was developed regarding functional imaging studies using food rewards, erotic stimuli, or monetary rewards, and the results strongly supported the conclusion that a common reward network underlies both primary and secondary rewards, including all the above regions (Sescousse et al., 2013).

Music, on the other hand, is neither a primary reward, as it gives no biological advantage for survival, nor a secondary reward, for it has no association with a primary reward either. Music stands as a reward in itself, and that is why it is interesting to explore how the cognitive systems responsible for the processing of music interact with the reward network (Zatorre, 2015).

Neuroimaging data highlights the activation of this reward network when pleasant musical stimuli are presented (Koelsch, 2014). For example, Salimpoor et al. (2011) used ligand-based positron emission tomography (PET), where a radioactive tracer specific to dopamine receptors is used to show regional uptake of dopamine. The results confirmed that dopamine is indeed released with music considered to be pleasant in both ventral and dorsal components of the striatum; additionally, the magnitude of the response was positively associated to the reported degree of pleasure experienced, even during time periods when listeners did not report chills (Salimpoor et al., 2011).

Furthermore, when examined with fMRI, the findings showed that the dorsal striatum would activate before the participants experienced peak pleasure, while the ventral striatum would activate during the moment of peak pleasure. This suggests that the two areas play two distinct roles, the dorsal striatum an anticipatory one, while the ventral striatum is more specifically implicated in hedonic processing.

One possible limitation of this study is related to the fact that musical stimuli were familiar to the participants, thus making the pleasure and familiarity processes partially overlapped. To overcome this issue, Salimpoor et al. (2013) developed a new study that presented participants with unfamiliar musical pieces, and asked them how much they were willing to bid in an auction (Becker et al., 1964) for a recording of the musical piece. The findings showed that striatal areas activated the most with musical stimuli that were valued as more rewarding, based on the higher monetary bids. The nucleus accumbens specifically has been associated with reward prediction error, meaning the discrepancy between expectation and outcome (O'Doherty, 2004), so this finding supports the concept that temporal predictions are fundamental for experiencing pleasure from musical stimuli (Hallam et al., 2009).

Another important finding from this study was the increased functional connectivity found in auditory cortices with the striatum during the processing of musical pieces with high reward value compared to low reward value. Auditory cortices are also involved in temporal prediction (Vuust et al., 2009), so increased functional connectivity between the striatum and auditory cortices, as there is an increase in reward value, leads to the idea that predictions are linked with the processing of the stimuli in auditory areas. These processes could also include internal representations of sound patterns coming from past experiences, used to predict future events. These could also partly explain individual differences in musical preference, as each person has a different experience that can lead to the creation of different internal representations of sound patterns.

Furthermore, the findings showed similar interactions with the reward system and other brain areas, such as orbital, ventromedial, and inferior frontal cortical areas, and the amygdala. The frontal lobes are notoriously involved in several executive functions, such as maintaining information in working memory, temporal sequencing, planning actions to obtain rewards and anticipating outcomes (Mai & Paxinos, 2011; Stuss & Knight, 2013). The authors of the study

came to the conclusion that the cortical system has the ability to process tonal or rhythmic relationships found in music, enabling the generation of expectations, while the emotional aspect associated with these predictions emerges through the interactions with the striatal dopaminergic system (Salimpoor et al., 2013).

Further evidence for the involvement of the dopaminergic system in musical reward comes from Ferreri et al. (2019), who directly manipulated dopaminergic transmission using a pharmacological approach. The authors found that increasing dopamine availability through levodopa enhanced both the hedonic experience of music and motivation to engage with it, whereas reducing dopaminergic activity through the dopamine antagonist risperidone produced the opposite effect. These findings provide causal evidence for the role of dopamine in musical reward and suggest that dopaminergic transmission contributes to both the pleasurable and motivational components of the musical experience (Ferreri et al., 2019).

1.1.2. Individual differences in musical reward sensitivity

All the studies discussed thus far have investigated neural activity associated with music-induced pleasure and therefore recruited participants who reported experiencing strong pleasure in response to music as part of the initial screening process. This means that this type of studies excluded from the discussion the possible individual differences that people experiment in musical pleasure sensitivity in everyday life. On this subject, Mas-Herrero et al. (2013) developed a psychometric tool to investigate sensitivity to music reward, the Barcelona Music Reward Questionnaire (BMRQ). They collected data from around 1600 participants and identified five factors that are most relevant to individual differences in music reward experiences: *Musical Seeking*, which refers to the motivation and tendency to actively seek out musical experiences, such as discovering new music, attending concerts, playing an instrument, or learning more about music, *Emotion Evocation*, which captures the emotional responses elicited by music, including the extent to which listening to music can evoke strong or intense

emotions, *Mood Regulation*, which refers to the use of music to influence or regulate one's emotional state, for example, to relax, relieve stress, improve one's mood or cope with negative emotions, *Sensorimotor*, which concerns the tendency for music to elicit spontaneous bodily responses synchronised with its rhythm, such as nodding, moving, humming, or dancing along to music, and *Social Reward*, which refers to the social and interpersonal rewards derived from music, particularly its capacity to facilitate social connection, bonding, and a sense of cohesion with other people (Figure 1), which resulted being in accordance with prior studies (Werner et al., 2006).

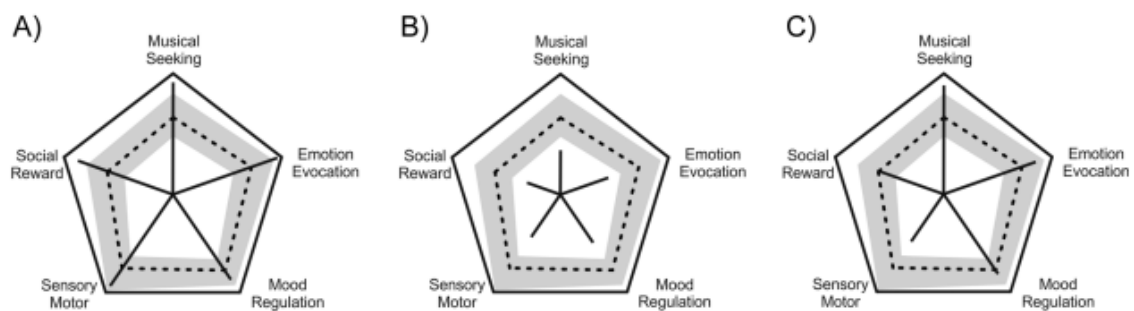


Fig. 1: Graphical representation of the factor scores of three participants in the present study (the score for each factor is represented as a solid line departing from the center and creating the impression of a star). The dotted line in the middle of the pentagon indicates the mean value of each factor for the general population (Study 4, $n = 857$ participants), while the surrounding grey area represents one standard deviation above and below the mean value (mean $\pm$ SD; mean $-$ SD) for each particular factor. In A, we represent a prototypical highly music-hedonic participant, while in B, a music-anhedonic participant is depicted. The participant represented in C shows normal values in Emotion Evocation, Mood Regulation, and Social Reward and extreme values in Musical Seeking and the Sensory-Motor factors. From Mas-Herrero et al., (2013).

Another interesting aspect of people's musical experiences, though, is absorption or transcendence, meaning the complete immersion in the musical experience, to the point of momentary loss of self-consciousness or time-space disorientation, and this is what Cardona et al. (2022) investigated and identified in the development of the Extended Barcelona Music Reward Questionnaire (eBMRQ).

1.2. The Extended Barcelona Musical Reward Questionnaire

As previously mentioned, the BMRQ was originally structured around five dimensions of musical reward. However, due to its ability to move us, music can also be the cause of extraordinary absorption or transcendent states, that were not considered in the original BMRQ scale and led Cardona et al. (2022) to further investigate this aspect, later integrating it into the eBMRQ.

1.2.1. Development of the original BMRQ scale

Mas-Herrero et al. (2013) developed the BMRQ to better understand and investigate the factors that make music reward experiences so different between people. One component would be the *emotional impact* that music can induce in people, which can significantly influence the pleasure a person feels during the musical experience (Jones & Holleran, 1992; Juslin & Sloboda, 2001, 2011; Juslin & Västfjäll, 2008; Wells & Hakanen, 1991).

Another important factor which can influence the pleasure one feels during music listening is their use of music as a *mood regulator*. There is evidence showing that music can be used with the purpose to change emotions, to relieve stress, or to comfort (Deliege & Sloboda, 2004; Juslin & Laukka, 2003; Panksepp & Bernatzky, 2002; Pelletier, 2004; Sloboda & O'Neill, 2001; Zillmann & Gan, 1997), but also to improve mood in patients who suffered a stroke and are taking part in motor neurorehabilitation programs with intensive music listening or music performance training (Bradt et al., 2010; Rodriguez-Fornells et al., 2012; Särkämö et al., 2008).

A third factor that can shape the experience of music as a reward is each individual's ability to *move* their body and *synchronise* its movements with the music, which is important because these activities involve somatosensory and motor brain areas (Zatorre et al., 2007).

A fourth factor essential for musical pleasure is the ability of music to help us *bond* with other people and create *social connections* (Cross, 2001; Freeman et al., 2000; Mithen, 2006; Panksepp & Bernatzky, 2002), indeed this might represent an important aspect of music from an evolutionary standpoint as well, its ability to promote social contact.

The last important factor that can influence the music reward experience of each person is the way people *seek* and *research information* about the music they listen to, and this can be extended to simply knowing more about music, even through the attendance of musical events or dedicating time specifically to music-related activities, such as listening to it or learning to play an instrument.

In its first version Mas-Herrero et al. created a questionnaire consisting of 112 items, which could be categorised in six broad categories: music seeking activities, mood regulation, emotion evocation, sensory-motor behavior, social rewarding experiences, and musical memory. However, the final version of the BMRQ is composed of the five factors mentioned above: Musical Seeking, Emotion Evocation, Mood Regulation, Sensorimotor, and Social Reward. They tested it on a first Spanish sample, after which they carried out an exploratory factorial analysis to select the items that would compose the final version of the BMRQ. They later administered this new version to another Spanish sample and finally translated the questionnaire into English and administered it to an international sample online. The items composing the final version, both originally in Spanish and translated to English, can be found in Figure 2.

Facet	Spanish items	English items
Emotional Evocation ^{1,2}	1. Algunas canciones me ponen los pelos de punta. 2. Me emociono escuchando ciertas canciones. 3. Puedo llorar cuando escucho algunas melodías que me gustan mucho. 4. Siento escalofríos cuando escucho una melodía que me gusta.	1. I like to listen music that contains emotion. 2. I get emotional listening to certain pieces of music. 3. I can become tearful or cry when I listen to a melody that I like very much. 4. I sometimes feel chills when I hear a melody that I like.
Sensory-Motor ^{1,2}	1. No me apetece bailar ni con la música que más me gusta. 2. La música me hace bailar. 3. No puedo evitar tararear las canciones que me gustan cuando las escucho. 4. Cuando escucho una melodía que me gusta mucho no puedo evitar mover el cuerpo.	1. I don't like to dance, not even with music I like 2. Music often makes me dance 3. I can't help humming or singing along to music that I like 4. When I hear a tune I like a lot I can't help tapping or moving to its beat.
Mood Regulation ^{1,2}	1. La música me hace compañía cuando estoy solo. 2. La música me tranquiliza y me relaja. 3. La música me ayuda a desconectar. 4. Con la música me puedo desahogar.	1. Music keeps me company when I'm alone. 2. Music calms and relaxes me 3. Music helps me chill out 4. Music comforts me
Musical Seeking ^{1,2}	1. En mi tiempo libre apenas escucho música. 2. Me informo sobre la música que me gusta. 3. Busco novedades musicales continuamente. 4. Me gasto bastante dinero en música y cosas relacionadas con la música.	1. In my free time I hardly listen to music. 2. I inform myself about music I like. 3. I'm always looking for new music 4. I spend quite a bit of money on music and related items.
Social Reward ²	1. Cuando comparto música con alguien siento una complicidad especial con aquella persona. 2. La música me hace conectar con la gente. 3. Me gusta cantar o tocar un instrumento con más gente. 4. En los conciertos me siento en sintonía con los artistas y el público.	1. When I share music with someone I feel a special connection with that person. 2. Music makes me bond with other people. 3. I like to sing or play an instrument with other people. 4. At a concert I feel connected to the performers and the audience

Notes. ¹ Extracted from the first sample / ² Extracted from the second sample

Fig. 2: Items Included in the Spanish and English versions Evaluated for the BMRQ. From Mas-Herrero et al., (2013).

1.2.2. The sixth dimension of musical reward in the eBMRQ

As stated earlier, the original version of the BMRQ was composed of five factors encompassing different dimensions of musical reward. Cardona et al. (2022) wanted to further take into consideration the concept of Music Absorption, which is a peak emotional experience that can rarely take place for a person as they listen to a musical piece. Absorption can be described as a situation where attention becomes tightly focused on the experience, to the point where awareness of internal and external conditions lessens (Eisen & Lynn, 2001), but during this the person could also feel increasingly connected to something bigger than themselves (Yaden et al., 2017). In fact, Maslow (A. Maslow, 1962; A. H. Maslow, 1969) theorised that music is a simple way to feel these peak emotional experiences, that are characterised by a loss of

inhibition, fear, anxiety, and a total absorption by the phenomenon. These experiences are also associated to *flow* states (Cziksentmihalyi, 1990), which seem to be facilitated by musical activities (Chirico et al., 2015; Vroegh et al., 2021).

These powerful emotional experiences are usually coupled with behavioural reactions, for instance pleasure, psychophysiological reactions, such as heart rate and skin conductance changes associated with chills, and neural mesolimbic dopaminergic reward activations (Gottfried, 2011; Grewe et al., 2007; Juslin & Sloboda, 2011; Koelsch, 2014; Salimpoor et al., 2011).

As previously mentioned, through the BMRQ (Mas-Herrero et al., 2013) there is evidence of individual differences in how people experience music as a reward. Cardona et al. wanted to explore whether these differences could also be found in the Absorption in Music factor, which was lacking from the original BMRQ. Hence, the authors decided to administer the Absorption in Music Scale (AIMS) (Sandstrom & Russo, 2013) and the BMRQ to a sample of participants. The AIMS is a validated tool with good psychometric properties, used to measure individual differences in music absorption. 370 participants responded to both the BMRQ and the AIMS with the purpose of selecting four items from the AIMS to add to the BMRQ to form the new version, called Extended Barcelona Music Reward Questionnaire (eBMRQ).

The four items selected from the AIMS were the following:

- item 3: I sometimes feel like I am “one” with the music.
- item 13: While listening to music, I may become so involved that I may forget about myself and my surroundings.
- item 15: It is sometimes possible for me to be completely immersed in music and to feel as if my whole state of consciousness has been temporarily altered.

- item 29: When listening to great music I sometimes feel as if I am being lifted into the air.

Subsequently, 550 participants responded to the eBMRQ, which was composed of 24 items. Further details regarding the questionnaire items are provided in the Methods section.

1.3. Musical reward through development

So far, we have only talked about musical experiences in adulthood, but what about childhood? How much can the environment that an individual is raised in, influence the way they experience music throughout all their life?

We know that environmental experiences have the ability to shape our brain and our behaviour, especially so during the developmental age where plasticity is highest (McLaughlin & Gabard-Durnam, 2022; Werker & Hensch, 2015). For example, we know children have an heightened sensitivity to the sounds they hear in the environment, that allows them to have a proficiency in the phonology of their native language, that will last for their whole lifetime (Kuhl et al., 2006; Ortiz-Mantilla et al., 2016; Werker & Tees, 2002).

As for music, previous studies show that it is an important aspect of childhood, in fact children often partake in musical activities such as playing with musical toys, singing or being sung to (Custodero & Johnson-Green, 2003; Fancourt & Perkins, 2018; Ilari, 2005; Mendoza & Fausey, 2021; Yan et al., 2021; Young, 2008). Hence, it is interesting to know how exposure to music during middle childhood influences the individual throughout their life, which is what Kathios et al. (2024) investigated in their Music@Home – Retrospective Scale (Kathios et al., 2024).

1.3.1. Parental mediation and early musical exposure's influence beyond childhood

Previous research has provided evidence that musical training during childhood may have enduring effects on behavioural outcomes in adulthood, such as the LongGold project

(<https://longgold.org/>) (Müllensiefen et al., 2015, 2022) which proposes that musical training can improve cognitive abilities throughout middle childhood and adolescence (for a meta-analysis, see (Román-Caballero et al., 2022)).

In particular, musical training during this age has been proven to produce improvements in inhibitory control (Hennessy et al., 2019) and working memory (Lippolis et al., 2022). Further evidence also showed that musical training can lead to a greater activation of brain regions involved in inhibition (Sachs et al., 2017) and brain structure volumes of auditory and motor areas (Hyde et al., 2009). Furthermore, previous research has demonstrated that early musical training has an association with improved adult working memory (Bailey & Penhune, 2010; Tierney et al., 2015) and white matter volume in adulthood (Bailey et al., 2014; Steele et al., 2013). This evidence supports the idea that the associations that exist between formal musical training and behaviour could also extend to musical behaviours in children's home environments. However, while musical training has an influence on childhood, even beyond it the simple exposure to music is important for behavioural outcomes. In fact, there is evidence showing that musical engagement at home during development can benefit language (Papadimitriou et al., 2021), and auditory perception (for a review, see (Putkinen et al., 2013)). Musical engagement at home can be defined as the range of informal musical activities, interactions, and experiences that take place within the home environment and involve or are accessible to children. This encompasses both active forms of engagement, such as singing, dancing, playing musical instruments, and making music with parents or caregivers, and more passive forms of musical exposure, such as listening to recorded music. In addition, the home musical environment may reflect parental involvement and beliefs regarding music, as well as children's own active participation in musical activities (Politimou et al., 2018; Steinberg et al., 2021). What has yet to be investigated is how informal music environment influences on cognitive abilities can persist into adulthood as well.

The home musical environment can be understood as the broader context in which children encounter and participate in music, encompassing both their exposure to music and the musical activities and interactions facilitated by caregivers. For example, the Music@Home framework conceptualises the home musical environment as comprising multiple dimensions, including parental musical behaviours and beliefs, children's musical exposure, and children's active engagement with music (Politimou et al., 2018). Importantly, musical engagement represents a more specific behavioural dimension within this broader environment, thus, although the two concepts are closely related, the musical environment refers to the context and opportunities for musical experience, whereas musical engagement refers more specifically to the individual's involvement in those experiences.

This distinction is particularly relevant when considering the potential socioemotional implications of musical experiences during childhood. Research has shown that shared musical engagement, particularly between children and their peers or caregivers, may be associated with positive social behaviours. For instance, joint music-making has been linked to increased prosocial behaviour towards other children (Kirschner & Tomasello, 2010; Schellenberg et al., 2015). Moreover, music may serve an affective function during childhood, contributing to emotion regulation and the regulation of the self (Williams et al., 2015; Winsler et al., 2011). Taken together, these findings suggest that the social and affective functions of music may represent important pathways through which children's musical experiences within the home environment could contribute to later socioemotional development.

A tool to measure the link between the childhood home musical environment and long-term outcomes, such as adult behaviour, had yet to be created, and this is what Kathios et al., (2024) set out to do, creating the Music@Home-Retrospective scale, an adult self-report measure of individual's home musical environment during middle childhood.

After testing the first sample of participants, they initially found five factors with 20 items retained: Caregiver Beliefs (e.g., “My caregivers believed that music was part of a well-rounded education.”), Caregiver initiation of Singing (e.g., “My caregivers sang in playful contexts to/with me often.”), Child Engagement in Music (e.g., “I enjoyed making sounds/interacting with musical instruments (including toy ones).”), Social Listening Contexts (e.g., “I associate music I heard as a child with social contexts (listening with caregivers, siblings, friends).”), and Attitude Toward Childhood Home Musical Environment (e.g., “I do not like the music my caregivers played in the home when I was a child.”, reverse coded item).

At a later stage, they tested a second sample on the Music@Home-Retrospective scale, but also on the Musical Ear Test (MET; (Wallentin et al., 2010)) for rhythmic and melodic music perception, and to associate childhood home musical environment to music use in adulthood and current mental health, they employed the Healthy-Unhealthy Music Scale (HUMS; (Saarikallio et al., 2015) validated in adolescents but still commonly used in adult samples) to assess music usage, the State-Trait Anxiety Inventory (STAI; (Spielberger, 1970)) to assess trait anxiety, and the Connor–Davidson Resilience Scale (CD-RISC-10; (Campbell-Sills & Stein, 2007)) to assess resiliency. Additionally, considering that this second sample had participated in other online surveys in their lab, Kathios et al. also included their scores in the Goldsmiths Musical Sophistication Index (Gold-MSI; (Müllensiefen et al., 2014)), the Barcelona Music Reward Questionnaire (BMRQ; Mas-Herrero et al., 2013), and the Absorption in Music scale (Sandstrom & Russo, 2013).

As for the associations between Music@Home–Retrospective scale and the MET, The findings indicated that greater perceived caregiver endorsement of the importance of music and greater musical engagement during childhood were associated with superior music perception abilities in adulthood. Furthermore, all Music@Home–Retrospective subscales showed significant

positive associations with Gold-MSI scores, except for the Attitude Toward Childhood Music Environment subscale.

Importantly, significant positive associations were found between the Music@Home–Retrospective General scale score and all dimensions of the eBMRQ, suggesting a relationship between the childhood home musical environment and individual differences in musical reward sensitivity in adulthood. Among the specific dimensions of the Music@Home–Retrospective, Social Listening Contexts showed particularly consistent associations with adult Social Reward, Emotion Evocation, and Absorption. These findings suggest that shared and socially embedded musical experiences during childhood may be relevant to how individuals experience and derive reward from music in adulthood.

Furthermore, the study suggests that the childhood home musical environment may also be associated with more adaptive patterns of music use and broader psychological functioning in adulthood. In particular, a richer home musical environment was associated with healthier patterns of music use, lower trait anxiety, and greater resilience, with social musical contexts emerging as a particularly relevant dimension. Together, these findings suggest that the musical experiences and contexts available during childhood may have implications extending beyond musical behaviour itself, potentially relating to broader aspects of psychological functioning later in life. However, while suggesting that the musical activities and exposure we experience during childhood are important in shaping our musical abilities and preferences, the measures considered so far have not specifically assessed children's affective musical experiences.

1.3.2 Musical reward in childhood

It is known that musical pleasure results from the interaction of social, emotional, and cognitive factors, and that in adults there are significant individual differences in the way people

experience musical reward. What we know little of, is how musical reward is experienced in children.

If we take into consideration the eBMRQ, the main factors assessed by it also appear to characterize musical experiences during childhood.

Emotion Evocation and Mood Regulation refer to the ability of music to induce emotions and to be used as a tool to regulate mood, respectively. Caregivers use music with the purpose of emotional regulation in children from very early on, in fact infant-directed singing is a common activity. Infant-directed singing is cross cultural and very common, with most North American parents, for example, reporting singing daily to their infants (Yan et al., 2021). Caregiver singing has also been shown to reduce infant distress more successfully than speech, notably when the song is familiar to the infant (Cirelli et al., 2020; Corbeil et al., 2016). Infants react differently, both physiologically and behaviourally, to a lullaby than to a play song (Bainbridge et al., 2021; Cirelli et al., 2020; Rock et al., 1999). In particular, musical features characteristic of play songs, such as faster tempi, have been found to elicit more positive affect in infants than those typically associated with lullabies (Kragness, Anderson, et al., 2023; Kragness et al., 2022). This differentiation between song types appears to emerge early in development, as children as young as four years of age are able to distinguish songs intended for sleep from those intended for dancing (Hilton et al., 2023). Moreover, children's emotional responsiveness to music has been identified as a potentially important motivational mechanism underlying the effectiveness of music-based interventions (e.g., (Lense & Camarata, 2020)).

Similarly, emerging evidence suggests that the sensorimotor dimension of musical reward is present early in development, reflecting the capacity of music to elicit and motivate motor responses. For instance, approximately 90% of North American parents report observing their children dancing to music by their 1st birthday (Kim & Schachner, 2023), and infants exhibit

more rhythmic movements in response to music than to non-musical auditory stimuli (Zentner & Eerola, 2010). Research examining children's motor and affective responses to music further suggests an association between movement and reward; in both infants and children, the amount of time spent moving to music is positively associated with the amount of time spent smiling in response to it (Cirelli & Trehub, 2019; Kragness et al., 2022; Kragness, Hannon, et al., 2023; Zentner & Eerola, 2010). Although the direction of causality remains unclear, these findings collectively point to a close association between movement elicited by music and positive affective responses.

Social reward, referring to the capacity of musical experiences to facilitate and strengthen social bonds, is also evident early in development. Infants and children alike exhibit more prosocial behaviours towards individuals with whom they have engaged in synchronous, rather than asynchronous movement (Cirelli et al., 2014; Kirschner & Tomasello, 2010; Rabinowitch & Meltzoff, 2017), and synchronous activities are also associated with increased smiling between interaction partners (Tunçgenç & Cohen, 2018). Although music is not essential for eliciting the prosocial effects of synchrony in children, its regular and predictable temporal structure may facilitate coordinated movement and, consequently, social bonding. Interestingly, music has also been shown to increase infants' compliance, further supporting its potential role in regulating affective and behavioural states (Cirelli et al., 2017). Consistent with these findings, participation in group music training has been associated with enhanced social abilities among third- and fourth-grade children compared with passive control conditions (Schellenberg et al., 2015). Moreover, children may use familiar songs as social cues, which can influence their interactions with and evaluations of unfamiliar individuals (Cirelli & Trehub, 2018; Soley & Spelke, 2016).

The fifth subscale, Musical Seeking, encompasses behaviours such as choosing to listen to, spend money on, and become more informed about appreciated music. Compared with the

previous four dimensions, fewer direct parallels can be identified in the developmental literature, as children generally have limited opportunities to engage in the forms of musical seeking assessed by the eBMRQ. Nevertheless, even young children are capable of actively selecting and requesting preferred music. By their 1st birthday, infants demonstrate preferences for highly familiar over unfamiliar songs (Kragness et al., 2022), as well as for music featuring culturally familiar rather than unfamiliar metrical structures (Soley & Hannon, 2010), when given control over the listening experience. However, it remains unclear whether such preferences reflect reward-related mechanisms or alternative processes, such as an avoidance of novelty. Although empirical evidence concerning the frequency of children's requests for music remains limited, anecdotal evidence, including widely circulated videos of toddlers repeatedly requesting favourite songs such as *Baby Shark* through smart speakers, suggests that such behaviours may be relatively common.

The final subscale, Music Absorption, refers to the tendency to become deeply immersed in music, with attention becoming strongly focused on the musical experience and, in some cases, involving a reduced awareness of oneself or of the surrounding environment. In the context of musical reward, absorption has been described as a form of music-driven transcendence involving states of complete immersion and, potentially, temporary alterations in self-consciousness and the perception of time or space (Cardona et al., 2022). Although this dimension was only incorporated into the eBMRQ more recently, there is evidence that highly focused and immersive musical experiences can also occur during childhood. Studies of young children's musical activities have identified focused attention and intense involvement as observable components of flow-like states during music making, suggesting that children can become deeply engaged in musical experiences from an early age (Addessi, 2020; Chirico et al., 2015; Custodero, 2005). Moreover, children's use of music can involve intense emotional and imaginative experiences; for example, research with 3- to 8-year-old children identified

“fantasy imagery” as one of the functions served by music, with parents describing children engaging in fantasy play and becoming strongly involved in the experiences evoked by music (Saarikallio, 2009). These findings suggest that the capacity to become deeply immersed in music is present during childhood, although the extent to which individual differences in such experiences constitute a distinct dimension of musical reward during development remains relatively underexplored.

All these findings support the idea that music can be experienced as a reward even starting from early on during development, across the six factors composing the eBMRQ. Despite this, there is some evidence showing how the way music is experienced during childhood is inevitably different from adulthood. For example, sensorimotor and social aspects of reward related to music could be influenced by the fact that children are poor beat synchronisers into middle childhood (McAuley et al., 2006). Prediction-based reward mechanisms may also remain relatively immature during childhood given that adult-like expectations regarding musical sequences develop gradually across childhood (Corrigall & Trainor, 2009, 2010; Kragness & Trainor, 2018). Similarly, although music is capable of eliciting emotional responses from an early age, children's ability to recognize and interpret musical emotions in an adult-like manner continues to develop throughout childhood (Dalla Bella et al., 2001). Taken together, these findings highlight the need to further investigate whether and how musical reward is experienced during childhood.

For this reason, Kragness et al. (2024) set out to investigate whether musical reward in children is experienced differently from adults. They decided to do so by questioning parents on their perceptions of musical reward in their children. To do this, they adapted the BMRQ to a version more fitting for children, the cBMRQ, that the parents would respond to, from their perspective of their children's behaviours, and also administered parents with the Children's Behavior Questionnaire—Very Short Form, concerning their 3- to 7-year-old children. The findings of

this study suggest that there are large individual differences in musical reward already from early on, the current limitation consists in the fact that parents are filling in the questionnaire for their children. Thus, a child-friendly adaptation of the questionnaire is needed to allow researchers to systematically and directly assess individual differences in musical reward during development.

1.4 The present study

The present project aims to adapt the adult version of the eBMRQ for Italian primary school children by introducing linguistic and content-related modifications appropriate for the developmental level of children aged 7–8 years. The validation of the resulting child version, the eBMRQc, is intended to proceed in two phases. An initial administration to adults, alongside the original eBMRQ, is conducted to assess the correlation between the two versions and to provide preliminary evidence for the validity of the adaptation. The questionnaire is then intended to be administered to children within the target age range to further evaluate its applicability to the intended population. As the present thesis focuses on the adult phase of this validation process, the following sections will report exclusively the methodology and findings obtained from the adult sample; the child administration and its results are therefore beyond the scope of the present work.

1.4.1 Research questions and hypotheses

The present study aims to investigate how individual differences in musical reward sensitivity can be assessed during development. Although musical reward has been extensively studied in adults, there is currently a lack of instruments specifically designed to measure this construct in children. Therefore, the main objective of this study is to develop a reliable and culturally appropriate instrument capable of assessing individual differences in music reward experiences during developmental age.

Specifically, the project aims to:

- a) create an instrument that could allow us to obtain information to quantify individual differences in musical reward in developmental age
- b) check the correlation between the adult version of the eBMRQ and the new version for children proposed in the study

Based on these research questions, the following hypotheses were formulated:

- i. Scores obtained with the child version of the questionnaire will show a positive correlation with scores obtained from the adult version of the eBMRQ, supporting the convergent validity of the adapted instrument.
- ii. As previously shown in literature for the adult version of the BMRQ (ex. Mas-Herrero et al., 2013), we expect to find a positive relationship between eBMRQc and participants' musical training.

2. Methods

2.1. Participants

A total of 92 adults participated to the study. One participant was excluded from the analyses due to inconsistent response patterns, suggesting that the questionnaires had not been completed reliably. Analyses were then conducted on a final sample of 91 participants. Participants ranged in age from 18 to 70 years old ($M = 34.26$, $SD = 14.04$). The sample included 60 women (65.9%), 29 men (31.9%), and 2 non-binary participants (2.2%). The individuals who participated in the study reported an average of 1.78 years of musical training ($SD = 4.28$).

All participants provided written informed consent in accordance with procedures approved by the University of Pavia Ethics Committee.

2.2. Instruments

For the realisation of this project we employed different behavioural testing tools, the eBMRQc (Italian version) at the core of the study, a demographic and background questionnaire, and the eBMRQ.

2.2.1. eBMRQc

The Italian version of the eBMRQc is based on the translation of its French version (Cantoni et al., 2026) originally developed within the Laboratoire d'Étude de l'Apprentissage et du Développement (LEAD) at Université Bourgogne Europe (Dijon, France).

It consists of 6 items, to which the participants can respond with a score ranging from 1 (Not at all) to 5 (Very much).

These items were created and selected for each subscale using the ones from the eBMRQ. Specifically, the items used were the following:

Social Reward

- 1. When I share music with someone I feel a special connection with that person.
- 15. I like to sing or play an instrument with other people.

Musical Seeking

- 13. I'm always looking for new music.

Emotional Evocation

- 9. I get emotional listening to certain pieces of music.
- 14. I can become tearful or cry when I listen to a melody that I like very much.
- 21. I sometimes feel chills when I hear a melody that I like.

Mood Regulation

- 10. Music calms and relaxes me.
- 16. Music helps me chill out.
- 22. Music comforts me.

Sensory-Motor

- 11. Music often makes me dance.
- 23. When I hear a tune I like a lot I can't help tapping or moving to its beat.

Absorption in Music

- 6. I sometimes feel like I am "one" with the music.
- 12. While listening to music, I may become so involved that I forget about myself and my surroundings.

<i>Q.</i>	<i>Subscale</i>	<i>French version</i>	<i>Italian version</i>	<i>English translation</i> (unvalidated)
1.	<i>Social Reward</i>	<i>Est-ce que tu aimes écouter de la musique, chanter ou faire de la musique avec d'autres, comme avec ta famille ou tes ami(e)s?</i>	<i>Ti piace ascoltare musica, cantare o fare musica con altre persone, come la tua famiglia o i tuoi amici/amiche?</i>	<i>Do you enjoy listening to music, singing or making music with other people, such as your family or friends?</i>
2.	<i>Musical Seeking</i>	<i>Est-ce que tu aimes découvrir de la nouvelle musique, par exemple écouter des chansons que tu ne connaissais pas avant?</i>	<i>Ti piace scoprire musica nuova, ad esempio ascoltare canzoni che prima non conoscevi?</i>	<i>Do you like discovering new music, such as listening to songs you didn't know before?</i>
3.	<i>Emotional Evocation</i>	<i>Quand tu écoutes une musique que tu aimes bien, est-ce que tu ressens des émotions, comme te sentir joyeux ou triste, ou même avoir parfois des frissons?</i>	<i>Quando ascolti una musica che ti piace, provi delle emozioni, come sentirsi felice o triste, o anche avere a volte dei brividi?</i>	<i>When you listen to music you like, do you feel emotions, like feeling happy or sad, or even sometimes having chills?</i>
4.	<i>Mood Regulation</i>	<i>Est-ce que la musique t'aide à te sentir mieux ou à te calmer, par</i>	<i>La musica ti aiuta a sentirti meglio o a calmarti, ad esempio</i>	<i>Does music help you feel better or calm</i>

		<i>exemple quand tu es triste ou en colère?</i>	<i>quando sei triste o arrabbiato/a?</i>	<i>down, such as when you are sad or angry?</i>
5.	Sensory-Motor	<i>Parfois, quand tu écoutes une chanson que tu aimes bien, est-ce que tu as envie de danser ou de bouger, par exemple en tapant des mains ou des pieds au rythme de la musique?</i>	<i>A volte, quando ascolti una canzone che ti piace, ti viene voglia di ballare o muoverti, per esempio battendo le mani o i piedi a ritmo con la musica?</i>	<i>Sometimes, when you listen to a song you like, do you want to dance or move, for example by clapping your hands or feet to the beat with the music?</i>
6.	Absorption in Music	<i>Quand tu écoutes de la musique, est-ce que parfois tu te sens plongé dans la musique, comme dans un rêve, et tu oublies ce qu'il y a autour de toi?</i>	<i>Quando ascolti della musica, a volte ti senti così immerso/a nella musica da dimenticare ciò che ti circonda, come in un sogno?</i>	<i>When you listen to music, do you sometimes feel so immersed in the music that you forget your surroundings, like in a dream?</i>

Table 1: The 6 Items of the eBMRQc, in the French version (Cantoni et al., 2026), in the Italian version, and an English translation of the items is provided for reference; this translation has not been formally validated.

The procedure and instructions for the French version of the questionnaire is represented in figure 3 below.



Fig. 3: First page of the questionnaire procedure used in the French version of the study. An English translation of the procedure is provided for reference; this translation has not been formally validated: “Now I’m going to ask you a few questions and you’re going to answer me with these stars – they go from “not at all” (pointing to the smallest) to “very much” (pointing to the largest)–. (Be careful! DO NOT SAY THE NAMES OF INTERMEDIATE STARS). For example, I ask you: “Do you like to run on the grass?” You can choose a star to answer me. You can choose the smallest star to say: “I don’t like it at all”, a slightly larger star to say “I like it a little”, and then more and more until the biggest star to say: “I really like it a lot.” So, can you answer to this first question? “Do you like to run on the grass?”

(Wait for the child to point to a star.) Ok, did you understand how to use the stars? So, I'm going to ask you a few questions, and then we'll be done!"

Using this version, we proceeded with a back-translation approach to obtain an Italian equivalent. The translation for the procedure is represented in figure 4.

6 sottoscale
1 item per ogni sottoscala
5 opzioni di risposta
Dando i 2 estremi (oralmente) + Scala Visiva: stelle
Target: bambini/e in età scolare (dai 6 anni in su)
Lo/la sperimentatore/trice legge le domande al/alla bambino/a, operando con un/una solo/a bambino/a alla volta
Il/la bambino/a vede solamente la scala visiva di risposta.

Per niente Molto



Istruzioni:
Ora ti farò qualche domanda e tu mi risponderai con queste stelle - vanno da "per niente" (indicare la più piccola) a "molto" (indicare la più grande) -
(Attenzione! NON DIRE IL NOME DELLE STELLE INTERMEDIE)
Per esempio, ti chiedo: "Ti piace correre sull'erba?" Puoi scegliere una stella per rispondermi. Puoi mostrare la stella più piccola per dire: "Non mi piace per niente", una stella un po' più grande per dire "Mi piace un po'", e poi sempre di più fino alla stella più grande per dire: "Mi piace davvero molto." Quindi, puoi rispondermi a questa prima domanda?
"Ti piace correre sull'erba?"
(Attendere che il/la bambino/a indichi una stella.)
Ok, hai capito come usare le stelle? Dunque, ti farò qualche domanda e poi avremo finito!

Fig. 4: First page of the questionnaire procedure in the Italian translated version.

2.2.2. Demographic and musical background questionnaire

We included a demographic and background questionnaire to gather information about our participants, such as age, gender, education level, their native language and whether they spoke other languages, and also a few questions to learn more about their musical background, including the following questions:

- “Have you taken or are currently taking a music training course (for example at a conservatory, in a music school) for one or more instruments or for singing?”
- “If so, indicate which instrument (or singing) and the duration of the training, specifying in figures the age at which you started and the age at which you finished.”
- “If you have undergone or are undergoing musical training, please indicate the duration of your weekly or daily musical practice (in hours).”
- “Have you ever taken dance lessons?”
- “If so, indicate which type of dance and the duration of the training, specifying in figures the age at which you started and the age at which you finished.”
- “What kind of music do you listen to most often?”
- “How often do you listen to music carefully?”
- “How would you describe yourself as a musician (or non-musician)?” with the following options:
 - Professional musician (you work with music and have a high level of expertise)
 - Advanced musician (you play regularly at a high technical level, but it isn’t your main activity)
 - Amateur musician (you play for pleasure, without a professional goal)
 - Beginner (you started taking instrument or singing lessons recently)

- Non-musician but passionate about music (you have no musical training, but you listen to a lot of music, go to concerts, etc.)
- Non-musician

2.2.3. eBMRQ

Lastly, we administered the validated Italian version of the eBMRQ (Carraturo et al., 2025). It consists of 24 items, illustrated in table 2 below, to which the participants can respond with a score ranging from 1 (Not at all) to 5 (Very much).

<i>Q.</i>	<i>English Version</i>	<i>Italian Version</i>
1.	<i>When I share music with someone I feel a special connection with that person.</i>	<i>Quando condivido della musica con qualcuno, sento una complicità speciale con quella persona.</i>
2.	<i>In my free time I hardly listen to music.</i>	<i>Nel mio tempo libero ascolto poco la musica.</i>
3.	<i>I like listen to music that contains emotion.</i>	<i>Alcune canzoni mi fanno emozionare.</i>
4.	<i>Music keeps me company when I'm alone.</i>	<i>La musica mi tiene compagnia quando sono solo.</i>
5.	<i>I don't like to dance, not even with the music I like.</i>	<i>Non mi piace ballare, neanche con la musica che mi piace.</i>
6.	<i>I sometimes feel like I am "one" with the music.</i>	<i>A volte mi sento come se fossi un "tutt'uno" con la musica.</i>
7.	<i>Music makes me bond with other people.</i>	<i>La musica mi fa interagire con altre persone.</i>
8.	<i>I inform myself about music I like.</i>	<i>Cerco informazioni sulla musica che mi piace.</i>

9.	<i>I get emotional listening to certain pieces of music.</i>	<i>Mi emozionano ascoltando certe canzoni.</i>
10.	<i>Music calms and relaxes me.</i>	<i>La musica mi tranquillizza e rilassa.</i>
11.	<i>Music often makes me dance.</i>	<i>La musica mi spinge a ballare.</i>
12.	<i>While listening to music, I may become so involved that I forget about myself and my surroundings.</i>	<i>Quando ascolto la musica, posso essere così coinvolto da dimenticare me stesso e ciò che mi circonda.</i>
13.	<i>I'm always looking for new music.</i>	<i>Cerco continuamente novità musicali.</i>
14.	<i>I can become tearful or cry when I listen to a melody that I like very much.</i>	<i>Posso piangere quando ascolto melodie che mi piacciono molto.</i>
15.	<i>I like to sing or play an instrument with other people.</i>	<i>Mi piace cantare e suonare uno strumento con altre persone.</i>
16.	<i>Music helps me chill out.</i>	<i>La musica mi aiuta a rilassarmi.</i>
17.	<i>I can't help humming or singing along to music that I like.</i>	<i>Non posso fare a meno di canticchiare le canzoni che mi piacciono molto quando le ascolto.</i>
18.	<i>It is sometimes possible for me to be completely immersed in music and to feel as if my whole state of consciousness has been temporarily altered.</i>	<i>Posso sentirmi completamente immerso nella musica, come se il mio stato di coscienza fosse temporaneamente alterato.</i>
19.	<i>At a concert I feel connected to the performers and the audience.</i>	<i>Ai concerti mi sento in sintonia con gli artisti ed il pubblico.</i>
20.	<i>I spend quite a bit of money on music and related items.</i>	<i>Spendo parecchi soldi per la musica e per cose relazionate alla musica.</i>

21.	<i>I sometimes feel chills when I hear a melody that I like.</i>	<i>Mi vengono i brividi quando ascolto una musica che mi piace.</i>
22.	<i>Music comforts me.</i>	<i>La musica mi dà conforto.</i>
23.	<i>When I hear a tune I like a lot I can't help tapping or moving to its beat.</i>	<i>Quando ascolto una melodia che mi piace molto non posso a fare a meno di muovermi.</i>
24.	<i>When listening to great music I sometimes feel as if I am being lifted into the air.</i>	<i>Quando ascolto della buona musica a volte ho la sensazione di fluttuare nell'aria.</i>

Table 2: The 24 Items of the eBMRQ in English Version (Cardona et al., 2022), and in the Italian Version (Carraturo et al., 2025)

2.3. Procedure

The questionnaires were administered to the sample of participants online, using Google Forms. All the participants had to agree to the informed consent beforehand, and then complete the three questionnaires in the following order: the eBMRQc, the demographic and musical background questionnaire, and finally the eBMRQ. The order of administration was not counterbalanced, as the primary aim was to assess the newly developed eBMRQc without potential influence from prior exposure to the original eBMRQ. The inclusion of the intervening questions was intended to minimise potential carryover effects between the two questionnaire versions. The entire testing procedure took approximately 10 minutes.

2.4. Analysis

All statistical analyses were conducted using JASP 0.98.1. Descriptive statistics were computed for the demographic variables, the musical background measures, and the scores obtained on both the eBMRQc and the eBMRQ. For each questionnaire, descriptive statistics were calculated for the total score as well as for each of the six subscales.

To evaluate the convergent validity of the eBMRQc with the eBMRQ, Pearson's correlation coefficients were computed between the total scores of the eBMRQc and the adult version of the questionnaire (eBMRQ). Furthermore, correlational analyses were conducted between the corresponding subscale scores of the two questionnaires to assess the degree of association across the different dimensions of musical reward sensitivity.

Finally, to evaluate relationships with musical expertise, additional Pearson's correlation analyses were performed between total scores for both questionnaires and the musical background measures collected.

3. Results

3.1 Descriptive Statistics

Descriptive statistics were calculated for the total scores and subscale scores of both the eBMRQ and the eBMRQc. The means, standard deviations, and observed score ranges are presented in Table 3 and Table 4 below.

For the eBMRQ, the mean total score was 95.52 ($SD = 13.39$), with observed scores ranging from 57 to 116. For the eBMRQc, the mean total score was 26.14 ($SD = 3.418$), with scores ranging from 18 to 30. At the subscale level, the highest mean score was observed for Emotion Evocation in both questionnaire versions. In the eBMRQ, Emotion Evocation had a mean score of 17.49 ($SD = 2.405$), whereas in the eBMRQc the corresponding mean was 4.648 ($SD = 0.584$). The lowest mean score was observed for Musical Seeking in the eBMRQ ($M = 14.29$, $SD = 3.096$) and for Absorption in Music in the eBMRQc ($M = 3.934$, $SD = 1.009$).

	MS (2, 8, 13, 20)	EE (3, 9, 14, 21)	MR (4, 10, 16, 22)	SR (1, 7, 15, 19)	SM (5, 11, 17, 23)	AM (6, 12, 18, 24)	eBMRQ SUM
Valid	91	91	91	91	91	91	91
Missing	0	0	0	0	0	0	0
Mean (arithmetic)	14.29	17.49	17.31	15.11	16.44	14.88	95.52
Standard Deviation	3.096	2.405	2.589	2.923	3.067	3.373	13.39
Minimum	6	9	6	5	6	7	57

Maximum	20	20	20	20	20	20	116
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Table 3: Descriptive Statistics for eBMRQ Total and Subscale scores

	eBMRQc 1 (SR)	eBMRQc 2 (MS)	eBMRQc 3 (EE)	eBMRQc 4 (MR)	eBMRQc 5 (SM)	eBMRQc 6 (AM)	eBMRQc SUM
Valid	91	91	91	91	91	91	91
Missing	0	0	0	0	0	0	0
Mean (arithmetic)	4.560	4.297	4.648	4.308	4.396	3.934	26.14
Standard Deviation	0.819	0.913	0.584	0.985	0.828	1.009	3.418
Minimum	2	1	3	1	2	1	18
Maximum	5	5	5	5	5	5	30

Table 4: Descriptive Statistics for eBMRQc Total and Subscale scores

The distributions of the eBMRQ and eBMRQc total scores are illustrated in figure 5. The eBMRQ scores were distributed across the observed range of 57–116, with most scores concentrated between approximately 80 and 116. The eBMRQc scores showed a narrower distribution, with most scores concentrated between 24 and 30, corresponding to the upper portion of the observed range.

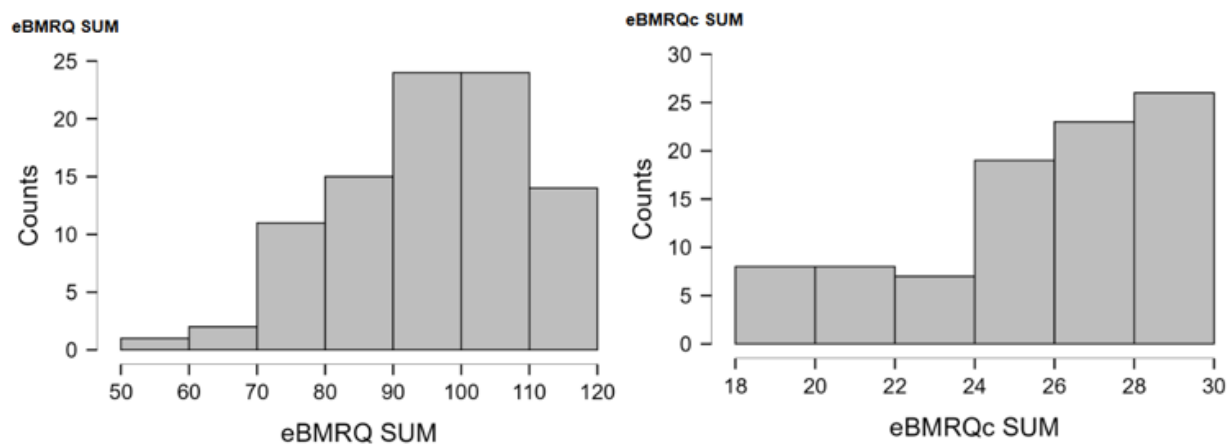


Fig. 5: Distributions of *eBMRQ* and *eBMRQc* Total Scores

3.2 Association between the eBMRQ and eBMRQc

To examine the association between the adult version of the questionnaire and the newly developed child version, Pearson's correlation coefficients were calculated between the total scores of the eBMRQ and eBMRQc.

A strong positive correlation was observed between the eBMRQ and eBMRQc total scores, $r = .772$, $p < .001$. The scatterplot illustrating this association is presented in figure 6.

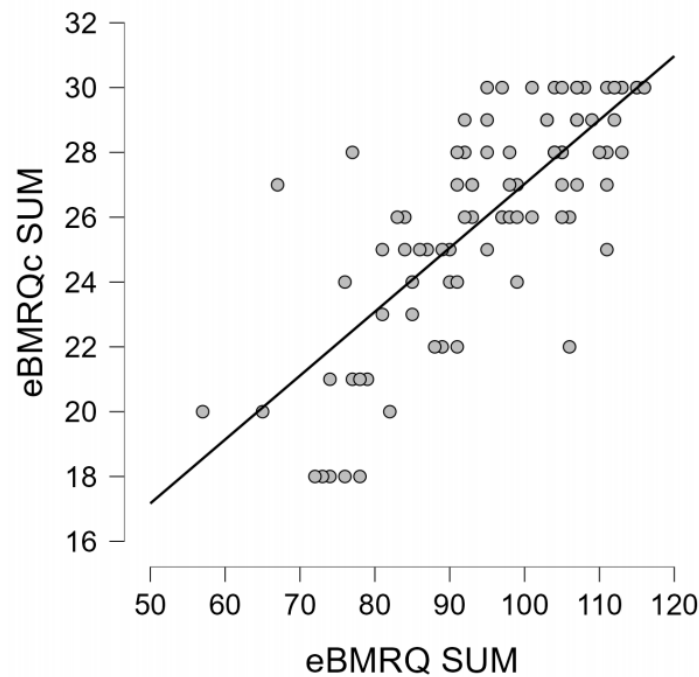


Fig. 6: Association Between eBMRQ and eBMRQc Total Scores

Correlations were also calculated between corresponding subscales of the two questionnaire versions. All correlations were positive and statistically significant (all $p < .001$). The correlations ranged from $r = .433$ to $r = .705$. The strongest association was observed for the Sensory-Motor subscale, $r = .705$, followed by Absorption in Music, $r = .696$. The weakest association was observed for Emotion Evocation, $r = .433$, although this correlation remained

statistically significant. The remaining correlations observed were for Musical Seeking, $r = .544$, Mood Regulation, $r = .542$, and Social Reward, $r = .494$. The correlations between corresponding subscales are presented in table 5.

Subscale	r	p
Musical Seeking	0.544	< .001
Mood Regulation	0.542	< .001
Sensory-Motor	0.705	< .001
Emotion Evocation	0.433	< .001
Social Reward	0.494	< .001
Absorption in Music	0.696	< .001

Table 5: Pearson Correlations Between Corresponding eBMRQ and eBMRQc Subscale Scores.

Note. Bonferroni correction was applied to the six subscale comparisons, resulting in an adjusted significance threshold of $\alpha = .0083$. All correlations remained statistically significant after correction.

3.3 Associations between eBMRQ/eBMRQc and musical background

To examine the relationship between musical background and musical reward sensitivity, Pearson's correlations were calculated between the total scores of both the eBMRQ and the eBMRQc and measures of musical background.

Years of musical training showed a significant positive correlation with the eBMRQ total score, $r = .272, p = .010$ (Figure 7a). In contrast, the association between years of musical training and the eBMRQc total score was not statistically significant, $r = .123, p = .248$ (Figure 7b).

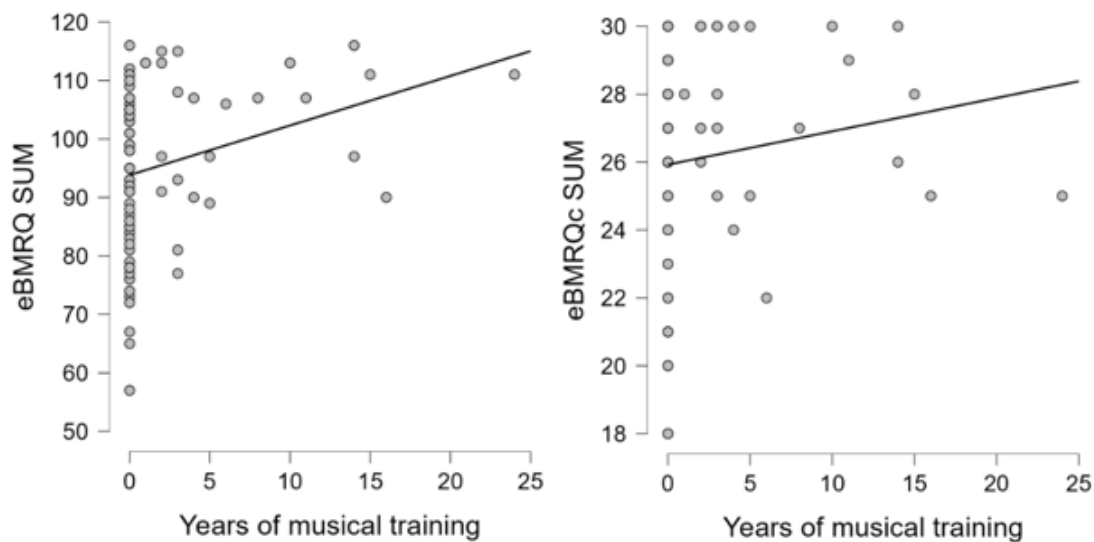


Fig. 7a (on the left): Association Between eBMRQ Total Scores and Years of Musical Training

Fig. 7b (on the right): Association Between eBMRQc Total Scores and Years of Musical Training

Self-reported musical expertise was significantly and positively associated with both questionnaire versions. Specifically, self-reported musical expertise was positively correlated with the eBMQR total score, $r = .333$, $p = .001$ (Figure 8a), as well as with the eBMQRc total score, $r = .290$, $p = .005$ (Figure 8b).

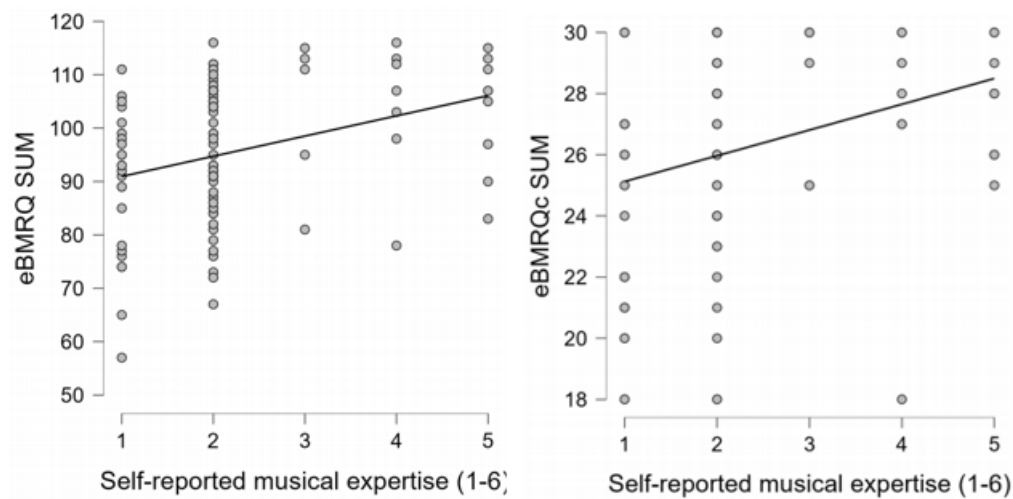


Fig. 8a (on the left): Association Between eBMQR Total Scores and Self-Reported Musical Expertise.

Fig. 8b (on the right): Association Between eBMQRc Total Scores and Self-Reported Musical Expertise

4. Discussion

The present study aimed to develop and provide an Italian adaptation of the eBMRQc, a psychometric instrument designed to assess individual differences in musical reward sensitivity in children. Originally developed in French by Cantoni et al. (2026), the instrument was adapted into Italian, and its psychometric properties were subsequently evaluated in an adult sample. Specifically, the study investigated whether scores on the adapted instrument were associated with those obtained on the adult version of the questionnaire (eBMRQ), as well as with measures of participants' musical background, thereby providing an initial assessment of its validity. Overall, the findings provide encouraging preliminary support for the Italian adaptation, suggesting that the eBMRQc retains the conceptual structure of the original instrument while employing language that is more accessible to younger respondents.

The strongest evidence supporting the adaptation was the high positive correlation observed between the total scores of the eBMRQ and the eBMRQc. This finding suggests that the child-adapted version captures individual differences in musical reward sensitivity in a manner broadly consistent with the adult questionnaire, providing preliminary evidence of convergent validity. This correspondence is particularly relevant given that individual differences in the experience of musical reward represent an important area of research in music psychology. The relevance of assessing individual differences in musical reward lies in the fact that, although music is generally experienced as pleasurable, individuals vary substantially in the extent to which they derive pleasure from and engage with music. Musical reward sensitivity has therefore been conceptualised as an individual-difference characteristic rather than as a uniform response to music, making its reliable assessment important for investigating why music is experienced as highly rewarding by some individuals but less so by others. The eBMRQ was

developed precisely to capture these multidimensional differences in musical reward sensitivity (Cardona et al., 2022; Mas-Herrero et al., 2013).

Extending this investigation to childhood is particularly relevant from a developmental perspective. Relatively little was known about individual differences in musical reward during childhood until recent research began to address this gap. Kragness et al. (2024), for example, investigated musical reward in 3- to 7-year-old children using a parent-report adaptation of the BMRQ and found substantial individual variability in musical reward. Their findings further suggested that a profile resembling musical anhedonia may already be observable during early childhood, indicating that differences in the rewarding value attributed to music may emerge relatively early in development. These findings raise broader questions concerning the developmental origins of musical reward sensitivity, including when individual differences first emerge, how they change across development, and which individual and environmental factors may contribute to them. However, addressing such questions requires reliable and developmentally appropriate instruments for assessing musical reward in children.

There is also evidence that further highlights the importance of addressing these questions. Recent research by Fasano et al. (2026) examined musical reward sensitivity in 7- to 9-year-old children using a child-adapted version of the BMRQ and found that musical reward sensitivity was positively associated with empathy and, to a lesser extent, musical engagement, whereas it was not associated with objective musical ability. These findings suggest that individual differences in musical reward during middle childhood may be related more closely to socio-emotional dispositions and everyday engagement with music than to musical perceptual abilities (Fasano et al., 2026). Such findings broaden the relevance of musical reward beyond the experience of pleasure itself and suggest that its assessment may contribute to understanding individual differences in children's social, emotional, and musical development.

In this context, the present findings provide an initial step toward extending the assessment of musical reward to younger populations. The strong correspondence between the eBMRQ and eBMRQc suggests that adapting the wording and content of the original questionnaire to make it accessible to children did not substantially alter the construct being assessed. This is consistent with the rationale underlying the development of the French eBMRQc (Cantoni et al., 2026), which aimed to preserve the multidimensional conceptualisation of musical reward while adapting the instrument to a younger population. The present results therefore support the feasibility of using the adapted measure as a basis for further investigation of musical reward during development, while the findings should be interpreted as preliminary given that the current validation was conducted in an adult sample.

The availability of an age-appropriate measure may ultimately allow future research to investigate how musical reward sensitivity relates to children's broader musical experiences and developmental characteristics. This is particularly relevant given evidence that children encounter music extensively within their everyday environments, including through singing, musical play, listening, and interactions with parents and caregivers (Politimou et al., 2018). A validated measure of children's musical reward sensitivity could therefore contribute to examining whether individual differences in the rewarding value attributed to music are associated with children's patterns of musical engagement, their social and emotional development, and the musical environment in which they grow. More broadly, establishing when and how individual differences in musical reward emerge may contribute to a better understanding of the role that music plays in children's development.

A validated measure of children's musical reward sensitivity could nevertheless facilitate future research into the factors that contribute to individual differences in this domain. One potentially relevant factor is the child's musical environment, particularly the frequency and nature of musical interactions within the home. Politimou et al. (2018) demonstrated that the home

musical environment encompasses multiple dimensions of children's everyday musical experiences, including parental musical behaviours, musical exposure, and children's active engagement with music. However, the extent to which variation in these experiences contributes to individual differences in children's musical reward remains insufficiently understood. Future research could therefore investigate whether differences in children's musical environments are associated with their sensitivity to musical reward, as well as whether such associations change across development.

The analyses also revealed significant positive correlations between all corresponding subscales of the two questionnaires. This finding suggests that each of the six dimensions of musical reward identified in the adult literature—Musical Seeking, Emotion Evocation, Mood Regulation, Social Reward, Sensory-Motor, and Absorption in Music—was successfully represented in the child-adapted version. Together, these findings support the multidimensional nature of musical reward proposed by Mas-Herrero et al. (2013) and further expanded by Cardona et al. (2022) through the inclusion of the Absorption in Music dimension.

Among the subscales, Sensory-Motor and Absorption in Music showed the strongest associations between questionnaire versions. One possible explanation is that these dimensions may reflect particularly salient aspects of musical reward that are readily experienced and reported across different developmental stages. In contrast, Emotion Evocation showed the weakest, although still statistically significant, association. Emotional responses to music may be influenced by developmental factors, including differences in emotional vocabulary, introspective abilities, and emotional regulation, which may make this dimension more challenging to assess using child-oriented language. Alternatively, the lower correlation may reflect subtle differences introduced during the adaptation process rather than genuine differences in the underlying construct.

The associations with musical background measures provide additional insights into the construct assessed by the eBMRQc. Self-reported musical expertise was positively associated with scores on both questionnaire versions, suggesting that individuals who perceive themselves as more musically skilled also tend to report greater sensitivity to musical reward. This finding is consistent with previous evidence indicating a relationship between musical experience and individual differences in musical reward. In the original development of the BMRQ, Mas-Herrero et al. (2013) reported positive associations between musical expertise and several dimensions of musical reward, particularly those related to Musical Seeking, Emotion Evocation, and Social Reward. These findings suggest that greater involvement and experience with music may be associated with a stronger tendency to derive reward from musical experiences, although the relationship may differ across specific dimensions of musical reward. More recent evidence further suggests that the association between musical reward and musical abilities may extend beyond the amount of musical experience or expertise reported by individuals. Fullone et al. (2026), for example, found that individual sensitivity to musical reward was positively related to rhythmic processing abilities, indicating that individuals who experience greater hedonic responses to music may also demonstrate enhanced abilities in processing rhythmic information, despite having less than 3 years of musical training. This finding suggests that musical reward sensitivity may be related not only to the extent to which individuals engage with music, but also to how efficiently they process specific features of musical stimuli. Taken together, these findings provide converging evidence for an association between musical reward and different aspects of musical experience and ability (Fullone et al., 2026). The present results extend this literature by showing that self-perceived musical expertise is also positively associated with the child-adapted version of the questionnaire. The fact that a similar pattern was observed for both the eBMRQ and the eBMRQc suggests that the association between musical expertise and musical reward sensitivity was not substantially

altered by the adaptation of the instrument. At the same time, the correlational nature of the present findings does not allow for conclusions regarding the direction of this relationship. Greater musical experience may contribute to the development of stronger reward responses to music, but individuals who find music particularly rewarding may also be more motivated to engage in musical activities and consequently develop greater musical expertise. Longitudinal and experimental research will therefore be necessary to clarify the direction and developmental nature of this association.

In contrast, years of musical training was significantly associated with the adult version of the questionnaire but not with the child version. Although this finding should be interpreted cautiously, one possible explanation is that musical reward sensitivity may be more closely related to specific aspects of musical processing and ability than to the amount of formal musical training received. In this regard, as previously stated, Fullone et al. (2026) found that greater sensitivity to musical reward was associated with better rhythmic processing abilities in non-musicians, suggesting that individual differences in musical hedonia may be related to how individuals process musical information rather than simply to their accumulated musical experience. Musical reward sensitivity may therefore represent a relatively distinct individual characteristic that can emerge independently of extensive musical instruction, even though it may be associated with specific musical abilities. The absence of an association between years of musical training and eBMRQc scores may therefore reflect differences between accumulated musical experience and the individual sensitivity to music as a rewarding stimulus, rather than necessarily indicating inadequate construct validity of the eBMRQc. This interpretation is also consistent with developmental research suggesting that sensitivity to musical reward is observable early in childhood and may be shaped by broader environmental and social musical experiences, rather than formal musical training alone (Kragness et al., 2024; Kathios et al., 2024).

Taken together, the present findings suggest that the Italian eBMRQc represents a promising instrument for assessing individual differences in musical reward sensitivity during development. Establishing reliable measures of musical reward in childhood may ultimately contribute to answering broader questions about the emergence and stability of individual differences in musical pleasure, their relationship with socio-emotional characteristics and musical engagement, and the potential role of children's musical environments in shaping their experiences of music. By demonstrating strong associations with the adult version of the questionnaire while maintaining the multidimensional structure proposed in previous research, the present study provides an important first step toward the availability of a culturally appropriate Italian measure for use with younger populations.

4.1. Limitations and future directions

Although the present study provides encouraging preliminary support for the Italian adaptation of the eBMRQc, several limitations should be acknowledged.

First, the questionnaire was evaluated using an adult sample rather than the target population for which it was designed. Future research should administer the Italian eBMRQc to children within its intended age range. Although the present study provided preliminary evidence of convergent validity by examining the association between the eBMRQc and the eBMRQ in an adult sample, children's cognitive, linguistic, and emotional development may influence their understanding of questionnaire items and their experience of musical reward. Therefore, direct validation in the target population is necessary to determine whether children understand and respond to the adapted items as intended. Testing children across different developmental stages would also make it possible to investigate whether the structure and psychometric properties of the questionnaire remain stable across age groups. This would be particularly relevant given that musical experiences and responses to music may change throughout development as

children's cognitive, emotional, social, and musical experiences become increasingly complex. Although administering both the eBMRQ and the eBMRQc to the same participants allowed for the assessment of convergent validity, the findings cannot be directly generalized to children. Consequently, the psychometric properties of the Italian eBMRQc should be further evaluated in samples of children within the intended age range before definitive conclusions can be reached regarding its validity. The French version (Cantoni et al., 2026) has already been validated on children; similarly, these would be the natural next steps for the Italian one as well.

A second limitation concerns the characteristics of the sample. Although the sample included participants across a relatively broad age range, the overall sample size was modest. A larger and more diverse sample would increase the statistical power of the analyses and improve the generalizability of the findings. Furthermore, the sample was composed predominantly of women, which may limit the extent to which the results can be generalized to the broader population.

Despite these limitations, the present study represents an important first step toward the availability of an Italian measure to assess individual differences in musical reward sensitivity in children. The findings provide a foundation for future research aimed at further validating and refining the eBMRQc in its intended population.

Expanding research on this topic could provide an opportunity to examine musical reward longitudinally. Kathios et al. (2024) demonstrated that aspects of the musical environment experienced during childhood can be associated with musical and socioemotional outcomes later in life. Similarly, research on childhood musical training has reported associations with cognitive and socioemotional development (e.g., Román-Caballero et al., 2022; Hennessy et al., 2019; Lippolis et al., 2022). Future longitudinal studies could therefore investigate whether

individual differences in musical reward sensitivity during childhood predict later musical engagement, emotional regulation, social functioning, or other developmental outcomes.

Future studies could also investigate the relationship between musical reward sensitivity and different forms of musical experience more systematically. The present study found that self-reported musical expertise was associated with both questionnaire versions, whereas years of musical training was associated with the adult eBMRQ but not with the eBMRQc. Future research could examine these relationships in samples with a wider range of musical experiences, including both formally trained and minimally trained participants, while also considering informal musical engagement. This distinction may be particularly important given evidence that children's musical development is influenced not only by formal training but also by everyday musical experiences within the home. For example, Kathios et al. (2024) found that aspects of childhood musical environment were related to later musical outcomes, while Cirelli et al. (2014), Kirschner and Tomasello (2010), and Schellenberg et al. (2015) provide evidence for associations between shared musical activities and children's social and prosocial behavior.

Another important direction concerns the investigation of cultural differences in musical reward sensitivity. Once the Italian eBMRQc has been validated in children, comparisons between Italian and French samples (Cantoni et al., 2026) at first, and more diverse samples in the future, could provide an opportunity to investigate the cross-cultural consistency of the construct and determine whether the dimensions of musical reward are expressed similarly across different cultural contexts. Such research could contribute to a broader understanding of whether individual differences in musical reward sensitivity in children are relatively consistent across cultures or are partly shaped by cultural and environmental factors.

Once adequately validated in its target population, the eBMRQc could also have potential applications in research involving children with different developmental and learning profiles. This possibility is particularly relevant given evidence that music-based activities may support several aspects of children's development and may represent a particularly engaging context for children with learning difficulties. For example, Schellenberg et al. (2015) found that group music training was associated with improvements in children's social abilities, while Williams et al. (2015) and Winsler et al. (2011) have reported associations between musical experiences and emotional regulation. Evidence from systematic reviews further suggests that music-based interventions may have beneficial effects in children with learning disabilities. Mina et al. (2021), for instance, found evidence supporting a role for music-based interventions in improving reading skills and phonological awareness in children with learning disabilities, although evidence for effects on other outcomes, including writing, arithmetic, working memory, and broader cognitive abilities, was more limited (Mina et al., 2021). Similarly, Rushton et al. (2023) reported promising findings regarding the use of music-based interventions for individuals with profound and multiple learning disabilities, particularly in relation to social outcomes, while highlighting the limited and heterogeneous nature of the available evidence (Rushton et al., 2023). These findings raise an important question concerning individual differences in children's responses to music-based activities. Although music may provide a valuable context for supporting learning and development, children may differ considerably in the extent to which they find musical experiences pleasurable, engaging, and motivating. Future research could investigate whether children with learning or developmental difficulties show different patterns of musical reward sensitivity and whether these individual differences are associated with participation in, engagement with, or responsiveness to music-based interventions. Such research could also examine whether musical reward sensitivity moderates the effectiveness of different forms of music-based

intervention or contributes to individual differences in their outcomes, potentially helping to identify the conditions under which music-based approaches are most beneficial for children with diverse developmental and learning profiles. In this context, the eBMRQc should not be considered a diagnostic instrument, but rather as a measure of individual differences that could be used alongside cognitive, emotional, social, and educational assessments.

Furthermore, the multidimensional nature of the eBMRQc may allow future research to move beyond the investigation of overall musical reward sensitivity and examine individual profiles across different dimensions of musical reward. Once the factor structure and reliability of the instrument have been established in children, researchers could investigate whether specific dimensions, such as Emotion Evocation, Mood Regulation, Social Reward, Musical Seeking, Sensory-motor or Absorption in Music, are differentially associated with developmental, emotional, or social characteristics. This approach could be particularly informative when investigating children with different developmental profiles and may eventually contribute to a more individualized understanding of how children experience music as rewarding and of how music may be used in educational, developmental, or intervention contexts.

5. Conclusions

The present study aimed to develop and provide an initial evaluation of the Italian adaptation of the eBMRQc, with the broader goal of contributing to the assessment of individual differences in musical reward sensitivity during development. More specifically, the study examined the association between the newly adapted eBMRQc and the adult version of the questionnaire, the eBMRQ, as well as their relationships with measures of musical background.

Overall, the findings provide encouraging preliminary evidence for the Italian adaptation of the eBMRQc. In an adult sample, a strong positive association was observed between the total scores of the eBMRQ and eBMRQc, and significant positive associations were also found across all corresponding subscales. These findings suggest that the Italian eBMRQc broadly retains the multidimensional structure of musical reward represented by the adult questionnaire and provides preliminary support for its convergent validity. The associations observed with musical background measures further suggest that individual differences in musical reward are related, at least to some extent, to individuals' perceptions of their own musical expertise.

At the same time, the present findings should be considered an initial step rather than a complete validation of the instrument. Specifically, since the present study was conducted in an adult sample, further research involving children within the intended age range is necessary to establish whether the eBMRQc functions as intended in its target population.

Despite these limitations, the present study contributes to the growing literature investigating musical reward from a developmental perspective by providing an Italian adaptation of a measure specifically designed to assess this construct in children. The availability of such an instrument may facilitate future research examining how musical reward develops across childhood, how it relates to children's musical environments and experiences, and how

individual differences in the experience of musical reward may be associated with emotional, social, and educational outcomes.

Ultimately, understanding why music is experienced as particularly rewarding by some individuals and less so by others in childhood represents an important step toward understanding the broader role of music in human development. The Italian eBMRQc provides a promising starting point for investigating these individual differences in younger populations and may contribute to future developmental and applied research on the multifaceted role of music in children's lives.

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