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The path to happiness for music students: music empathy and music engagement as potential sources of subjective well-being

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Music is widely known to enhance one's subjective well-being. However, we know little about the specific associations and potential pathways between music and subjective well-being among students majoring in music. The purpose of this study was to explore the links between music students' subjective well-being, music engagement, and music empathy while examining parallel mediation models involving self-esteem and prosocial tendencies. Through a questionnaire survey of music students, we found that positive links exist between subjective well-being, music empathy, and music engagement. Mediation analyses further demonstrated that self-esteem and prosocial tendencies parallelly mediate the positive associations of subjective well-being with music empathy and music engagement. These results indicate that perceiving, feeling, experiencing, and engaging more with music may enhance music students' self-esteem and prosocial tendencies and therefore further improve their subjective well-being. Our findings provide evidence for the positive relationship between music and subjective well-being among music students and provide further insights for improving the mental health and well-being of music students in real life.

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Introduction

Happiness is essential for humans. As Epicurus said, “Happiness is the beginning and purpose of a good life because we believe that a happy life is the highest goodness that we can achieve. All our choices are based on happiness, and our ultimate goal is to be happy.” From the perspective of positive psychology, happiness can be considered subjective well-being.

Subjective well-being (SWB) is an individual’s overall assessment of their quality of life in terms of their own personal standards and criteria (Diener 1984). SWB serves as a psychological measure of quality of life. People’s affect reflects immediate reactions to events happening to them, and individuals also make broader judgements about his or her life as a whole, as well as about domains such as marriage and career (Diener et al. 1999). Thus, subjective well-being can be divided into three dimensions (Diener et al. 1985; Diener 2000): positive affect (PA), negative affect (NA), and satisfaction with life (SWL). Students’ subjective well-being has long been a focus of researchers and is closely linked to mental health (Tejada-Gallardo et al. 2020). Numerous studies have investigated the origins and determinants of students’ subjective well-being, such as physical activity, friendship quality, and emotional intelligence (Cao et al. 2023; Ma et al. 2024; Niu et al. 2023; Szegedi et al. 2024). It is worth noting that prior studies have focused mainly on students in general, yet few studies have focused on students in specific domains, such as sports, dance, or music. This research gap could lead to the overlooking of certain factors that may affect the subjective well-being of students in specific domains.

Previous studies have indicated that music can be beneficial for mental well-being, likely because of its ability to express emotions, promote self-development, and provide a mental break (Leung and Cheung 2020; Perkins et al. 2020; Fu and Tu 2023). At the neural level, music is associated with reward pathways and dopamine secretion, which are involved in the generation of positive emotions (Koelsch 2014; Vuust et al. 2022). Additionally, research has shown that positive emotions generated by music can also inhibit responses to pain (Cheng et al. 2017). This evidence from neuroscience supports the positive role of music in subjective well-being. For students majoring in music, music is both an activity and a professional calling. Therefore, music may have a unique association with subjective well-being among music students which is worth exploring.

Music engagement, music empathy, and subjective well-being among music students. Music engagement pertains to an individual’s active participation in music activities, encompassing the frequency and regularity of their involvement, as well as the personal value they attribute to these musical experiences (Chin and Rickard 2012). Engaging in musical activities; such as listening to music, playing musical instruments, and undergoing musical training; has positive effects on people’s mental well-being (Gustavson et al. 2021; Perkins et al. 2020). Music is frequently used to promote emotional health and well-being, with emotion regulation being the most common mechanism (Randall et al. 2014; Leung and Cheung 2020). Even during the COVID-19 pandemic, music engagement has been shown to be effective in regulating negative emotions (Fink et al. 2021). Moreover, Carvalho et al. (2022) explored the moderating role of musical sophistication in emotional regulation through music listening. They reported that, for those with heightened musical sophistication, music listening can benefit the implementation of reappraisal; this suggested that music engagement could be advantageous for the emotional health and mental well-being of music students. Given that emotions are components of subjective well-being and can mediate the effect of music engagement

on mental well-being (Diener et al. 1985; Leung and Cheung 2020), we propose H1: Music engagement has a positive association with subjective well-being among music students.

On the basis of the Empathizing–Systemizing Theory, music empathy involves the ability to respond to perceiving experiences of the emotional experiences and feelings conveyed through recorded music or music performed by musicians. (Baron-Cohen, 2009; Baron-Cohen et al., 2005; Kreutz et al. 2008). Music empathy consists of two main components (Clarke et al. 2015): emotional music empathy (i.e., experiencing the emotions of music/musicians) and cognitive music empathy (i.e., perceiving the emotions of music/musicians). Emotional music empathy refers to the automatic physical reactions and emotional arousal triggered in response to music or musicians (Sittler et al. 2019). Cognitive music empathy refers to one’s capacity to emotionally comprehend and understand the perspective of music or musicians (Sittler et al. 2019). Lyvers et al. (2018) suggested that the fundamental concept of music empathy should align with interpersonal empathy. Previous studies have demonstrated that music empathy is linked to both general empathy and interpersonal empathy (Dahary et al. 2018; Zhao et al. 2022). General empathy is positively related to emotional intelligence and predicts greater subjective well-being in university students (Cañero Pérez et al. 2019). Music empathy is similar to interpersonal empathy (Lyvers et al. 2018), and interpersonal empathy is positively correlated with subjective well-being (Wei et al. 2011). In addition, music empathy helps individuals perceive more positive emotions in music and gain more rewards from it (Koelsch 2014; Singh and Mehr 2023). Music empathy is more likely to have a positive relationship with music students’ subjective well-being as they are exposed to more music. We therefore propose H2: Music empathy is positively associated with subjective well-being among music students.

The mediating role of self-esteem. Self-esteem refers to one’s subjective attitude toward one’s own competence and value (Rosenberg 1965); it denotes the emotional or evaluative dimension of an individual’s self-concept and reflects the degree to which they feel positively or negatively about themselves (Leary and Baumeister 2000). Self-esteem is vital to an individual’s mental health in daily life (Pyszczynski et al. 2004). A meta-analysis of longitudinal studies revealed that self-esteem was the opposite predictor of anxiety and depression, suggesting that increasing self-esteem could be useful in reducing the risk of depression and anxiety (Sowislo and Orth 2013). Zhang et al. (2021) reported that efforts to improve self-esteem and college adjustment can be beneficial for long-term subjective well-being and mental health. As a psychological resource, self-esteem assists people in forming their self-identity, motivating self-verification, and addressing difficult situations. (vanDellen et al. 2011).

According to the Theory of Human Motivation (Maslow 1943), when the physiological, safety, love, and belonging needs are met, esteem needs become the primary motivator. One’s esteem needs include feelings of self-respect, confidence, achievement, success, self-worth, reputation, and recognition (Maslow 1943). Music is not only an activity for music students but also a means of pursuing professional growth. By engaging with music, music students may gain satisfaction with effort, skills, and achievement, which leads to more self-identity and self-esteem (Bernabé-Valero et al. 2019). As Cogdill (2015) suggested, musicians dedicate extensive effort and time to their musical training, which is perceived as the route to gaining self-esteem and achieving their goals (Bernabé-Valero et al. 2019). Goal Theory posits that an individual’s subjective well-being is dependent on the fulfilment

of needs and the accomplishment of goals (Ryan and Deci 2001; Tay and Diener 2011). Through their involvement in music and composition, music students may attain accomplishments and gain self-esteem, leading to an increase in their subjective well-being. Thus, we propose H3: Self-esteem plays a mediating role in the positive association between music engagement and subjective well-being among music students.

Music empathy enables people to understand and feel the emotions of musicians and the implications of music (Sittler et al. 2019). One previous study indicated that empathy was positively related to life satisfaction and self-esteem (Guasp Coll et al. 2020). Consistently, a meta-analysis confirmed that empathy interventions are effective in improving self-esteem (Thomason and Moghaddam 2021). Music empathy may also be positively correlated with self-esteem, as the underlying concept of music empathy converges with interpersonal empathy (Lyvers et al. 2018). Music students consider music empathy a necessary ability. When listening to music, they tend to understand and analyse the emotions or connotations of musicians/pieces of music from a professional perspective (Preti and Welch 2013). Therefore, music empathy may be beneficial for music students, facilitating the development of self-confidence in their educational pursuits, music appreciation, and performance. Music students can further develop their musical aptitude through music empathy, which can lead to an increased sense of accomplishment and self-worth, thus enhancing their learning satisfaction and subjective well-being (Bernabé-Valero et al. 2019). On the basis of these findings, we propose H4: Self-esteem plays a mediating role in the positive association between music empathy and subjective well-being among music students.

The mediating role of prosocial tendencies. Prosocial behaviour is defined as a broad category of acts that are generally beneficial to other people and performed willingly (Penner et al. 2005). Prosocial tendencies are the trends of prosocial behaviour, reflecting the motivations and tendencies of people engaging in prosocial behaviours (Carlo and Randall 2002; Carlo et al. 2003). Prosocial behaviour not only facilitates the improvement of interpersonal relationships but can also evoke strong feelings of positive emotion, thus increasing one's level of psychological capital (Pfattheicher et al. 2022). It has been confirmed that prosociality and well-being are positively associated (Hui et al. 2020). Hui (2022) presented a reciprocal model suggesting that prosocial behaviour begets well-being and that well-being begets prosocial behaviour.

There are connections between music and prosociality. Music promotes engagement in social interactions, such as communication and cooperation (Koelsch 2014). For example, musical training can promote the development of prosocial behaviours (Wu and Lu 2021). Listening to music with prosocial lyrics can encourage prosocial behaviours, as people are more likely to pay attention to prosocial messages after hearing such music (Ma et al. 2023). For music students, music engagement and prosocial tendencies are inextricably linked. Daily musical learning and cooperative performance necessitate social interaction and collaboration (Preti and Welch 2013), which may also cause one's relationships to develop. Interpersonal relationships are associated with one's subjective well-being (dos Santos et al. 2019). Therefore, music engagement has the potential to promote the prosocial tendencies of music students, which can enhance their subjective well-being. We propose H5: Prosocial tendencies play a mediating role in the positive association between music engagement and subjective well-being among music students.

Music empathy shares similar characteristics with general and interpersonal empathy (Dahary et al. 2018; Zhao et al. 2022). It

has been widely verified that empathy is a powerful factor in the promotion of prosocial behaviours (Coyne et al. 2018; Yin and Wang 2022). As an essential skill for music students, music empathy involves the ability to comprehend and relate to the emotions conveyed by music (Kreutz et al. 2008). Music empathy is correlated with interpersonal empathy, as perspective-taking is one of the common factors of both music empathy and interpersonal empathy (Zhao et al. 2022). Therefore, music empathy may promote prosocial tendencies among music students. Considering that prosocial behaviour has a positive effect on subjective well-being (Hui 2022), we propose H6: Prosocial tendencies play a mediating role in the positive association between music empathy and subjective well-being among music students.

Method

Participants and procedure. Data were collected from universities in Fujian, Henan, Hunan, Guangdong, and Jiangxi via a Chinese survey website (<http://www.sojump.com>). We conducted a questionnaire survey among music students and collected 817 questionnaires. Participants were informed at the start of the survey that their participation was voluntary and confidential. Those who provided online informed consent were instructed to complete the entire questionnaire. The formal survey was completed in approximately seven minutes, and participants were compensated ¥3 (approximately 0.42 dollars) for their involvement. The questionnaire included two attention checks. The participants were removed if they failed either one of the attention checks. After screening via attention checks, 768 valid questionnaires were sorted out, showing valid return rate of 94.0%.

A priori power analysis utilizing G*Power software (Faul et al. 2007) revealed that a sample size of 164 was required, based on an effect size of $f^2 = 0.15$, $\alpha = 0.01$, and 99% power (i.e., $1 - \beta$ error probability). The results derived from our final sample size of 768 should be regarded as valid and robust. The participants in this study were music students with a mean age of 19.89 years ($SD = 1.37$). This group of music students included majors in vocal music, piano, erhu, pipa, guitar, violin, flute, and accordion. Of the 768 participants, 152 (19.8%) were male, and 616 (80.2%) were female. With regard to their university level, 88 students (11.5%) were first years, 267 students (34.8%) were sophomores, 277 students (36.1%) were juniors, and 136 students (17.7%) were seniors. Additionally, 250 students (32.6%) reported being only children, and 518 students (67.4%) had at least one sibling. On average, the students had been studying music professionally for 4.66 years ($SD = 3.82$).

Measures

Positive and Negative Affect Scale. Positive and negative affect were measured via the Positive and Negative Affect Scale (PANAS; Watson et al. 1988). The Chinese version consists of nine items (e.g., "active", "excited", and "enthusiastic") for the Positive Affect (PA) subscale and nine items (e.g., "upset", "nervous", and "afraid") for the Negative Affect (NA) subscale (Qiu et al. 2008). The participants were asked to rate each item on a 5-point Likert scale ranging from 1 (not at all) to 5 (extremely) based on the frequency of their everyday experience. In this study, the Cronbach's α for the PA subscale was 0.94, and that for the NA subscale was 0.91.

Satisfaction with Life Scale. Satisfaction with life was measured using the Chinese version of the Satisfaction with Life Scale (SWLS; Xiong and Xu 2009). The SWLS consists of five items, such as "I am satisfied with my life" and "The conditions of my

Table 1 Means, standard deviations, and bivariate correlations (N = 768).

Variable	M ± SD	1	2	3	4	5	6	7	8
1. Gender	1.80 ± 0.40	—							
2. Age	19.89 ± 1.37	-0.04	—						
3. Grade	2.60 ± 0.91	0.14***	0.77***	—					
4. Career	4.66 ± 3.82	0.08*	0.28***	0.31***	—				
5. Music engagement	119.05 ± 15.99	-0.01	0.04	-0.01	0.08*	—			
6. Music empathy	29.77 ± 3.76	0.04	-0.01	-0.03	0.01	0.50***	—		
7. Self-esteem	29.58 ± 4.44	0.06	0.06	0.04	0.10**	0.34***	0.33***	—	
8. Prosocial tendencies	99.73 ± 16.28	-0.04	0.15***	0.09*	0.11**	0.55***	0.29***	0.23***	—
9. Subjective well-being	0.00 ± 2.23	-0.04	0.02	-0.03	0.03	0.35***	0.21***	0.68***	0.29***

Participant gender was coded: 1 = men, 2 = women.
*p < 0.05; **p < 0.01; ***p < 0.001.

life are excellent". The participants were asked to respond with their level of agreement for a given description on a 7-point Likert scale from 1 (strongly disagree) to 7 (strongly agree). The Cronbach's α for the SWLS in the present study was 0.85.

Music USE Questionnaire. Music engagement was measured using the Music USE Questionnaire (MUSE; Chin and Rickard 2012). The Chinese version was translated by Zhao et al. (2022). MUSE includes five factors consisting of 24 items, such as "Certain types of music help me think" and "Practice helps me improve my music-playing skills". Each MUSE item was rated on a 6-point Likert scale ranging from 1 (strongly disagree) to 6 (strongly agree). The total score of the MUSE was used to evaluate an individual's general music engagement. Higher scores indicate greater active participation in music activities. In the present study, Cronbach's α for the entire MUSE was 0.93.

Music Empathizing Inventory. Music empathy was measured using the Music Empathizing Inventory (MEI; Kreutz et al. 2008). The Chinese version was translated by Zhao et al. (2022) and includes nine items, such as "When listening to music, I have thoughts about the emotional state of the writer/composer at the time" and "Music is important to me mainly because it expresses something personal and touching". The participants were asked to answer each item on a 4-point Likert scale ranging from 1 (strongly disagree) to 4 (strongly agree). In this study, Cronbach's α for the MEI was 0.76.

Rosenberg Self-Esteem Scale. Self-esteem was measured via the Chinese version of the Rosenberg Self-Esteem Scale (RS; Wang et al. 1999). It includes ten items (e.g., "I take a positive attitude towards myself" and "On the whole, I am satisfied with myself") ranging from 1 (strongly disagree) to 4 (strongly agree). Item 8 was treated as a positively worded item according to the suggestion of Wu et al. (2017). Higher total scores indicate a higher level of self-esteem. The Cronbach's α was 0.80 for the RS in this study.

Prosocial Tendencies Measure. Prosocial tendencies were measured via the Prosocial Tendencies Measure Chinese version (PTM; Kou et al. 2007), which consists of 26 items, such as "I tend to help people who are in a real crisis or need" and "I tend to help needy others most when they do not know who helped them". The participants rated the items on a 5-point Likert scale ranging from 1 (Does not describe me well) to 5 (Describes me greatly). In the present study, Cronbach's α was 0.96 for the entire PTM.

Data analysis. The data distributions of all the measures are detailed in the Supplementary File. In this study, music

engagement and music empathy were the independent variables, whereas self-esteem and prosocial tendencies were the mediating variables. The dependent variable was subjective well-being. In accordance with the calculation method of Haslam et al. (2009), a composite SWB measure was constructed by standardizing the SWLS and the PANAS and combining them (SWB = SWLS + PA - NA). Statistical analysis was conducted via SPSS version 26.0 and the PROCESS macro version 3.4. SPSS was utilized for generating descriptive statistics, assessing questionnaire reliability, performing correlational analyses, and conducting regression analyses. The PROCESS macro was employed for the mediation analyses (Hayes 2022).

Results

Common method variance test. The data were obtained through self-reported measures, which may lead to the presence of common method variance (CMV). Prior to data analysis, Harman's single factor test was conducted as a statistical control measure. Unrotated principal component factor analysis was performed on all the variable items. The results demonstrated that the variance accounted for by the first factor was 24.07%, which was lower than the critical threshold of 40% (Podsakoff et al. 2003). Thus, no significant CMV was detected in this study.

Descriptive and correlation analyses. Table 1 presents the descriptive characteristics (e.g., means and standard deviations) and Pearson's correlations of all the variables. As expected, music engagement, music empathy, self-esteem, prosocial tendencies, and subjective well-being were positively correlated with one another (all r s > 0.20, all p s < 0.001). The relationships among the variables supported the subsequent tests of the hypotheses.

Hierarchical regression of music engagement and music empathy.

We conducted a series of hierarchical regression analyses to examine the respective contributions of music engagement and music empathy to self-esteem, prosocial tendencies, and subjective well-being. Demographic variables (gender, age, grade, and career) were regressed in the first step as control variables, and then music engagement or music empathy was respectively regressed in the second step. The results revealed that music engagement and music empathy separately accounted for the variances in self-esteem, prosocial tendencies, and subjective well-being (all β s > 0.20 all p s < 0.001), as presented in Table 2. These results support H1 and H2.

Parallel mediation analyses. Bootstrap-based mediation analyses were conducted to test the potential mediating roles of self-esteem and prosocial tendencies (Hayes 2022). We set 5000 iterations and a 95% confidence interval. Figure 1 shows the results of the

Table 2 Results of the hierarchical regression analysis in predicting prosocial tendencies, self-esteem, and subjective well-being.

	Music engagement					Music empathy				
	B	SE	β	p	ΔR^2	B	SE	β	p	ΔR^2
Prosocial tendencies	0.56	0.03	0.55	<0.001	0.30	1.27	0.15	0.29	<0.001	0.09
Self-esteem	0.08	0.01	0.34	<0.001	0.11	0.39	0.04	0.33	<0.001	0.11
Subjective well-being	0.05	0.01	0.34	<0.001	0.12	0.12	0.02	0.21	<0.001	0.04

Unstandardized coefficients were presented as B. Standardized coefficients were β . In the first step, all of the $R^2 < 0.03$.

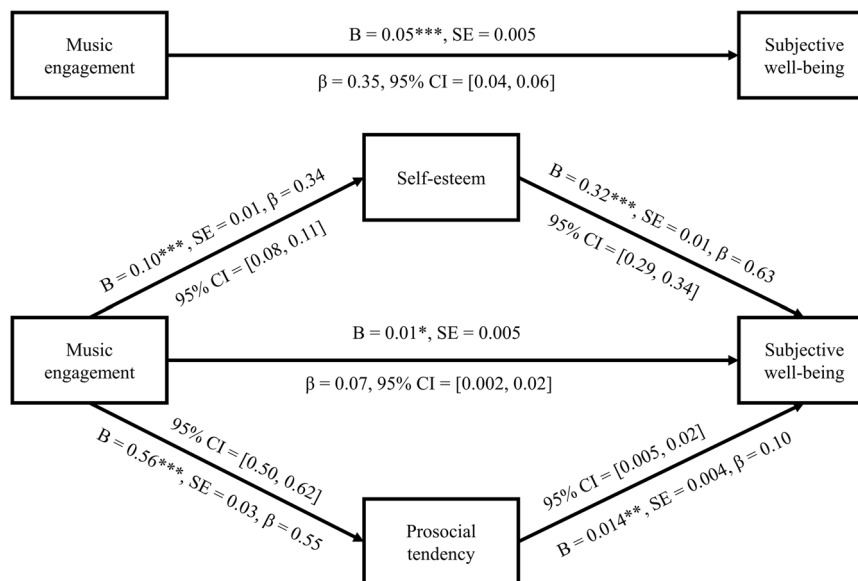


Fig. 1 Parallel mediation model of self-esteem and prosocial tendencies in the relationship between music engagement and subjective well-being.

Unstandardized coefficients are presented in B. Standardized coefficients are presented in β . SE standard error. CI confidence interval. $**p < 0.01$, $***p < 0.001$.

mediation analysis with music engagement as the independent variable. The total effect of music engagement on subjective well-being was significant ($\beta_{total\ effect} = 0.35$, $t = 10.21$, $p < 0.001$). The direct effect of music engagement on subjective well-being was also significant ($\beta_{direct\ effect} = 0.07$, $t = 2.32$, $p = 0.021$). Music engagement was positively related to self-esteem ($\beta = 0.34$, $t = 10.12$, $p < 0.001$) and prosocial tendencies ($\beta = 0.55$, $t = 18.18$, $p < 0.001$). Both self-esteem ($\beta = 0.63$, $t = 22.79$, $p < 0.001$) and prosocial tendencies ($\beta = 0.10$, $t = 3.19$, $p = 0.002$) were positively related to subjective well-being. Moreover, the indirect effects of self-esteem ($\beta_{indirect\ effect} = 0.22$, $t = 8.66$, $p < 0.001$) and prosocial tendencies ($\beta_{indirect\ effect} = 0.05$, $t = 2.62$, $p = 0.009$) on the relationship between music engagement and subjective well-being were both significant. These results support H3 and H5.

Similarly, Fig. 2 shows the results of the mediation analysis with music empathy as the independent variable. The total effect of music empathy on subjective well-being was significant ($\beta_{total\ effect} = 0.21$, $t = 5.93$, $p < 0.001$). The direct effect of music empathy on subjective well-being was not significant ($\beta_{direct\ effect} = -0.03$, $t = -1.94$, $p = 0.052$). Music empathy was positively related to self-esteem ($\beta = 0.33$, $t = 9.81$, $p < 0.001$) and prosocial tendencies ($\beta = 0.29$, $t = 8.27$, $p < 0.001$). Both self-esteem ($\beta = 0.66$, $t = 23.79$, $p < 0.001$) and prosocial tendencies ($\beta = 0.15$, $t = 5.41$, $p < 0.001$) were positively related to subjective well-being. Moreover, the indirect effects of self-esteem ($\beta_{indirect\ effect} = 0.22$, $t = 8.45$, $p < 0.001$) and prosocial tendencies ($\beta_{indirect\ effect} = 0.04$, $t = 4.15$, $p < 0.001$) on the relationship between music empathy

and subjective well-being were both significant. These results support H4 and H6.

Discussion

Previous studies have demonstrated that music can enhance subjective well-being and improve mental health (Koelsch, 2014; Leung and Cheung, 2020; Perkins et al. 2020; Singh and Mehr, 2023; Vuust et al. 2022). Here, we further explore the associations between subjective well-being and music engagement and empathy among students majoring in music. Our results, which were based on a sample of 768 music students, indicate that music engagement and music empathy are positively associated with subjective well-being among music students. Further mediation analyses revealed that self-esteem and prosocial tendencies play parallel mediating roles in these associations. These findings suggest that music engagement and music empathy may benefit music students' self-esteem and prosocial tendencies, which may further improve their subjective well-being.

The positive links between subjective well-being and music engagement. The results of this study demonstrate that music engagement is positively associated with subjective well-being among music students. Music can be seen as an effective tool for emotion regulation and can positively affect emotional well-being, thus contributing to overall mental health (Gustavson et al. 2021; Randall et al. 2014; Perkins et al. 2020). Our findings underscore the importance of music not only as a form of artistic expression for music students but also as a powerful tool for

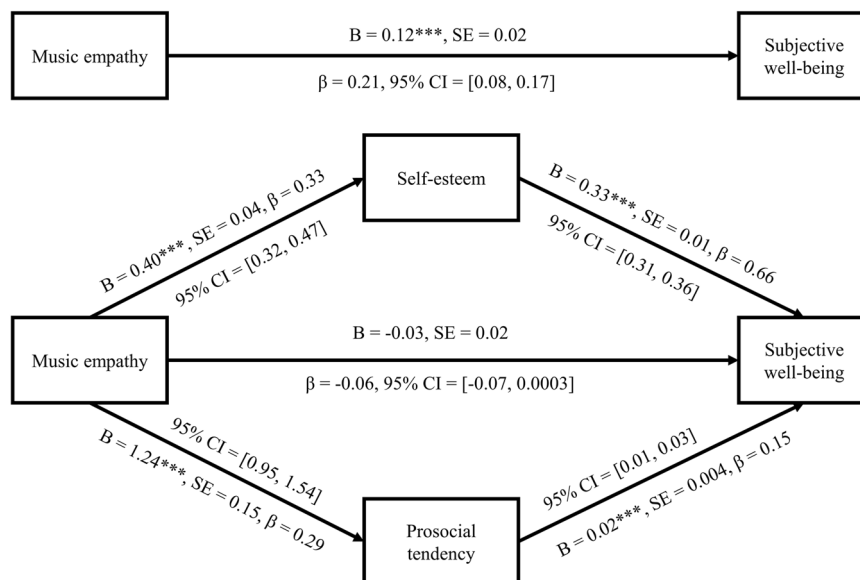


Fig. 2 Parallel mediation model of self-esteem and prosocial tendencies in the relationship between music empathy and subjective well-being. Unstandardized coefficients are presented in B. Standardized coefficients are presented in β . SE standard error, CI confidence interval. $***p < 0.001$.

emotional well-being and mental health enhancement. Specifically, this study affirms the viewpoint of Carvalho et al. (2022) that music can enhance the subjective well-being of those with a musical background. Active participation in musical activities enhances feelings of achievement, belonging, and purpose for music students, highlighting their profound engagement in musical endeavours. This sense of engagement and connection with music can lead to a heightened emotional experience, increased self-awareness, and a greater sense of fulfilment, all of which contribute to subjective well-being.

Conversely, the variations in music engagement levels may shed light on the complex interplay between academic performance and psychological well-being for music students. Specifically, some students may exhibit poor academic performance due to limited music engagement, which could be linked to their levels of self-esteem and subjective well-being (Mak and Fancourt 2019). Students with lower music engagement levels may encounter challenges associated with a lack of positive attitudes and motivation, potentially impacting their academic performance. Moreover, the absence of music engagement could result in students missing out on positive experiences and emotional connections related to music, which in turn could affect their academic achievements and self-perception (Wang and Huang 2024). This deficiency may further influence their self-esteem and subjective well-being, leading to adverse effects on their mental health. In this context, the role of music educators becomes crucial. It is essential for music educators to instil a positive attitude towards music engagement in their students. By motivating students to participate in musical activities, encouraging skill development, and supporting their musical performances, music educators can help students cultivate a positive musical identity and self-concept, thereby enhancing their musical engagement and overall psychological well-being (Bonville-Roussy et al. 2020).

The positive links between subjective well-being and music empathy. Music empathy plays a crucial role in enhancing emotional intelligence, empathy, and interpersonal relationships among music students (Getz et al. 2014). Our findings demonstrate that music empathy is positively associated with higher levels of subjective well-being, which is consistent with previous

research (Wei et al. 2011; Weon et al. 2020). Furthermore, the relationship between music empathy and trait empathy, as suggested by Lyvers et al. (2018), indicates that individuals with high levels of music empathy may also exhibit greater empathy in their general interactions with others. This heightened empathy can result in improved interpersonal relationships, increased social support, and a greater ability to manage negative emotions effectively (Chen and Xu 2021). Benefiting from empathy, they are more likely to consider others perspectives and manage their negative emotions in their daily life, which can improve their subjective well-being and mental health (Chung et al. 2021).

The parallel mediating roles of self-esteem and prosocial tendencies. The findings of our study suggest that self-esteem and prosocial tendencies have mediating effects on the connection between music engagement and subjective well-being. Music participation has been demonstrated to enhance the self-esteem of music students (Bernabé-Valero et al. 2019), which in turn leads to an increase in their subjective well-being (Zhang et al. 2021). Goal theory posits that the achievement of goals is the primary factor in determining a person's level of satisfaction and happiness (Ryan and Deci 2001; Tay and Diener 2011). With the effect of achievement motivation, music engagement satisfies music students' needs and improves their self-esteem, thus enhancing their subjective well-being. Music engagement can promote music students' prosocial tendencies, which is consistent with the findings of a previous study showing that music training can promote the development of prosocial behaviours (Wu and Lu 2021). Ma et al. (2023) reported that music with prosocial lyrics also promotes participation in prosocial behaviours. Music students who frequently engage in music are likely to be exposed to more prosocial music lyrics, which, in turn, can result in more prosocial behaviours. Possessing more prosocial tendencies, music students may find it more rewarding to partake in collective performance, resulting in a heightened sense of well-being. Those music students who demonstrate a more prosocial attitude may experience greater pleasure when partaking in cooperative performance, resulting in an increase in their subjective well-being.

Our findings show that self-esteem and prosocial tendencies play parallel mediating roles in the link between music empathy

and subjective well-being. The results of a prior study demonstrated that empathy interventions are effective in boosting self-esteem (Thomason and Moghaddam 2021). Music students can experience their musical skills and achievements through music empathy, which improves their self-esteem and learning satisfaction, enhancing their subjective well-being (Bernabé-Valero et al. 2019). The concept of music empathy converges with interpersonal and general empathy (Lyvers et al. 2018). This study revealed that music empathy is positively associated with music students' prosocial tendencies, which is in line with the positive influence of empathy on prosocial behaviours (Coyne et al. 2018; Yin and Wang 2022). The findings also verify that prosocial behaviour is positively associated with one's subjective well-being (Hui 2022). Thus, music empathy promotes music students to engage in more prosocial behaviours and thereby enhances their subjective well-being.

Implications. The current study has both theoretical implications and practical value. Theoretically, these findings confirm that music engagement and music empathy are positively correlated with subjective well-being among music students. Moreover, music engagement and music empathy may benefit music students' prosocial tendencies and self-esteem and further improve their subjective well-being. This study reveals the mechanism through which music engagement and music empathy are linked to the psychological state of music students, thus highlighting the beneficial effects of music on their subjective well-being.

This paper can offer valuable insights for music education that can be practically implemented. First, music tutors should instil in their pupils a favourable attitude towards participating in music, stimulating them to take part in musical activities with greater enthusiasm; this will give them more self-esteem in future music listening, music instrument playing, and music performance. Second, music major courses should focus not only on honing the musical abilities of students but also on imparting an understanding and appreciation of the creative process and feelings of musicians; this will allow music students to feel more confident and accomplished in creating and experiencing music. Third, when instructing music students to perform together, teachers should teach them how to better cooperate with the group, which is conducive to group success and self-achievement. These proposals are advantageous to the mental health and subjective well-being of music students.

Limitations and future studies. In this study, several limitations should be noted. The current study explores the links of music engagement and music empathy with music students' subjective well-being, ignoring the role of other factors. For example, musical training and talent are both affected by intelligence, an aspect that this study has not examined (Swaminathan et al. 2017). Music students' preferences for particular genres and the instruments they study may have an impact on their experience of music engagement. However, this study does not distinguish the role of different instruments and genres. A more in-depth exploration of these potential influencing factors should be undertaken in future studies.

For music students, music is both a hobby and a field of study. The current study does not distinguish the effects of the two. It is difficult to determine whether the improvement in subjective well-being is due to the role of musical activities or professional participation through this study alone. Nevertheless, this study provides evidence that music engagement and music empathy are positively correlated with music students' SWB. The professional engagement and professional empathy of students in other

majors are also likely to affect their subjective well-being, and further research is therefore necessary.

This study exclusively examines the relationships among music engagement, music empathy, and subjective well-being among music students. Nevertheless, it does not examine the effects of music engagement and music empathy on subjective well-being among non-music students. Previous studies have shown that music engagement can improve subjective well-being among older adults and adolescents (Kwon et al. 2020; Galinha et al. 2022), but the potential mechanism is unknown. Future studies can further investigate the moderators of music engagement or music empathy in a more general population. In addition, subjective well-being cannot reflect mental health comprehensively. Mental health also involves coping with the normal stresses of life and exhibiting low levels of depression and anxiety (Wahlbeck 2015). Therefore, the impacts of music engagement and music empathy on psychological elasticity, trait anxiety, and trait depression need to be explored in future studies.

Conclusions

All the hypotheses of the present study have been confirmed, and the conclusions can be drawn as follows: (1) music engagement and music empathy are positively correlated with subjective well-being among music students; (2) self-esteem and prosocial tendencies play parallel mediating roles in the positive associations of music engagement and music empathy with subjective well-being. The findings demonstrate that music engagement and music empathy may benefit music students' prosocial tendencies and self-esteem to further improve their subjective well-being.

Data availability

All data generated or analysed during this study are included in this published article [and its supplementary information files].

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Author contributions

Conceptualization, JT and HF; methodology, HF and JT; validation, HF; formal analysis, HF; investigation, JT; data curation, JT and HF; writing—original draft preparation, HF and JT; writing—review and editing, HF and JT; visualization, HF; supervision, HF. The authors have read and agreed to the published version of the manuscript.

Competing interests

The authors declare no competing interests.

Ethical approval

Approval was obtained from the ethics committee of the School of Music and Dance at Guangzhou University (No. GZHUMUSDAN20220906). The procedures used in this study adhere to the tenets of the Declaration of Helsinki.

Informed consent

Online informed consent was obtained from all individual participants included in the study.

Additional information

Supplementary information The online version contains supplementary material available at <https://doi.org/10.1057/s41599-024-03533-0>.

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