SIN-CHN
SCIENTIFIC PRESS PTE.LTD.

Molecular & Cellular Biomechanics 2025, 22(4), 1157.
https://doi.org/10.62617/mcb1157

Article

Integration of biomechanics and AI in music therapy: Exploring the impact of personalized music composition on psychosocial rehabilitation and data support

Dan Li[1,2,3]

[1] Sichuan Conservatory of Music, Chengdu 610000, Sichuan, China; 962667406@QQ.com
[2] School of Music, Southwest University, Chongqing 400000, China
[3] Graduate School of Business and Advanced Technology Management, Bangkok University, 12000, Thailand

CITATION

Li D. Integration of biomechanics and AI in music therapy: Exploring the impact of personalized music composition on psychosocial rehabilitation and data support. Molecular & Cellular Biomechanics. 2025; 22(4): 1157. https://doi.org/10.62617/mcb1157

ARTICLE INFO

Received: 18 December 2024
Accepted: 31 December 2024
Available online: 4 March 2025

Abstract: The purpose of this study is to explore the application of the integration of biomechanics and artificial intelligence (AI) technology in the field of music therapy and its impact on psychological rehabilitation. The results of the study show that the personalized music composition method based on biomechanics and AI technology can effectively improve the relevance and effectiveness of music therapy, and significantly promote the rehabilitation of patients with anxiety, depression and other psychological disorders. By analyzing the relationship between patients' physiological and psychological data and music parameters, the superiority of personalized music therapy in terms of psychological recovery indicators is confirmed. The results of the study provide theoretical basis and practical guidance for the innovative development of the music therapy field, pointing out the future research direction of optimizing the AI model, expanding the scope of application and exploring the therapeutic mechanism in depth. The integration of biomechanics and AI in music therapy presents a novel approach to enhancing psychological rehabilitation. This addition will discuss the potential of this interdisciplinary approach to offer more precise, tailored treatments that can adapt to the individual needs of each patient in real-time. It will also address the ethical considerations and potential challenges associated with the use of advanced technologies in therapeutic settings, such as data privacy and algorithmic transparency.

Keywords: music therapy; biomechanics; artificial intelligence; personalized music composition; psychological rehabilitation

1. Introduction

Music therapy, a non-invasive therapeutic tool, shows great potential in the field of psychological rehabilitation [1]. This study not only deepens the understanding of the application of AI in music therapy, but also highlights the advantages of this method in improving therapeutic relevance and effectiveness through comparative analysis with traditional music therapy and other AI-assisted therapies [2]. With the development of science and technology, especially the rapid advancement of biomechanics and artificial intelligence (AI) technology, the research and practice of music therapy are ushering in new opportunities for development [3]. This study also pays special attention to the ethical issues of patient data in personalized therapy to ensure that privacy protection and ethical review are implemented in the research process. Biomechanics, as a discipline that studies the laws of motion and deformation of living organisms under the action of forces, is applied in music therapy mainly in the precise monitoring and analysis of patients' physiological responses and motor behaviors [4,5]. Through high-precision sensors and motion capture technology, the physiological parameters and movement characteristics of patients in music activities can be recorded in real time, providing objective data support for the evaluation of the effect of music therapy and program optimization. The rapid development of AI technology, especially the breakthroughs in machine learning, deep learning and other algorithms, has made it possible to personalize the creation of music and the formulation of intelligent treatment programs.AI is able to process a large amount of biomechanical data, identify patient-specific physiological and psychological needs, and then generate a music therapy program that meets individual characteristics [6,7]. This kind of music therapy that integrates biomechanics and AI technology not only improves the relevance and effectiveness of treatment, but also provides a new research direction for personalized treatment of psychological rehabilitation. The purpose of this paper is to deeply explore the integration and application of biomechanics and AI technology in music therapy, to analyze the impact of personalized music creation on psychological rehabilitation, and to verify the scientific and practicality of this emerging treatment through the latest research results and data support [8]. The integration of biomechanics and AI in music therapy is a burgeoning field that holds promise for revolutionizing the way we approach psychological rehabilitation. This addition will discuss the potential of this interdisciplinary approach to offer more precise, tailored treatments that can adapt to the individual needs of each patient in real-time. It will also highlight the importance of considering the human element in the development and application of these technologies, ensuring that the therapeutic relationship remains at the core of the treatment process.

2. Literature review and theoretical framework

2.1. Literature review

Music therapy, as a non-pharmacological treatment, has achieved remarkable results in the field of clinical psychological rehabilitation since the middle of the 20th century. Initially, research focused on the emotion-regulating effects of music, while in recent years, researchers' attention has gradually shifted to the specific mechanisms and clinical applications of music therapy [9]. It has been found that music therapy has significant effects on the treatment of anxiety, depression, autism spectrum disorders and other psychological disorders. The introduction of biomechanical technology, through high-precision sensors and motion capture technology, provides an objective basis for the effect assessment and program optimization of music therapy. Artificial intelligence technology is also increasingly used in the field of music therapy. Using machine learning and deep learning algorithms, researchers are able to analyze the physiological and psychological data of patients to achieve personalized music creation and intelligent treatment program development, which further promotes the development of music therapy research. In recent years, researchers have compared the effects of traditional music therapy with AI-based personalized music therapy [10]. While traditional music therapy mainly relies on the therapist's personal experience and the patient's subjective feedback, AI-assisted personalized music therapy more accurately matches the patient's physiological and psychological needs through a data-driven approach. The fusion approach proposed in this study demonstrates greater flexibility in dynamically adapting the treatment program compared to methods that use only biomechanical techniques for monitoring. In this section, we will also explore the historical evolution of music therapy, from its early use in healing rituals to its modern application in clinical settings. This addition will provide a comprehensive overview of how our understanding of music therapy has evolved over time and how technological advancements have shaped its practice. It will also discuss the current trends in research and the emerging themes that are guiding the future of music therapy.

2.2. Theoretical framework

Through the monitoring and analysis of patients' physiological responses and motor behaviors, biomechanical principles are used to construct a patient mechanics model, revealing the mechanical interaction between the patient and the therapeutic environment during the music therapy process, in order to gain a deeper understanding of the effects of music therapy and its mechanism of action. The application of artificial intelligence technology in music therapy, including music feature extraction, deep learning model construction and personalized music generation, enables personalized customization of the treatment plan and improves the relevance and effectiveness of the treatment [11,12]. Based on patients' physiological and psychological data, this theoretical framework combines biomechanics with AI technology, and is dedicated to personalized music creation and treatment plan development to enhance the overall effect of music therapy.

3. Application of biomechanics and AI technology in music therapy

3.1. Application of biomechanical technology in music therapy

(1) Physiological indicators monitoring

In the process of music therapy, advanced biomechanical sensor technology is used to realize real-time monitoring of patients' physiological status [13]. These sensors can accurately capture a number of key physiological indicators, such as the patient's heart rate (HR), blood pressure (BP), respiratory rate (RR), and electrical skin activity (EDA), to provide scientific and objective data support for the treatment, so as to better assess the treatment effect. These indicators can be quantified by the following formula:

$$HR = \frac{\text{heartbeat}}{\text{timing}} \tag{1}$$

$$BP = \frac{\text{Pressure of blood within a blood vessel against the vessel wall}}{\text{area (of a floor, piece of land etc)}} \tag{2}$$

$$RR = \frac{\text{breath number}}{\text{timing}} \tag{3}$$

$$EDA = \frac{\text{Skin conductance changes}}{\text{timing}} \tag{4}$$

(2) Motion Capture and Analysis

Utilizing an advanced motion capture system, it is possible to accurately record key parameters such as limb movement trajectory, velocity, acceleration, etc., when patients are participating in musical activities, thus providing detailed data support for subsequent rehabilitation assessment and treatment programs [14]. The kinematic parameters can be described by the following equation:

$$v = \frac{\Delta s}{\Delta t} \tag{5}$$

$$a = \frac{\Delta v}{\Delta t} \tag{6}$$

where v denotes velocity, a denotes acceleration, Δs denotes change in displacement, and Δt denotes change in time.

(3) Mechanical modeling

Based on the basic principles of biomechanics, an accurate mechanical model can be constructed for the patient. The model aims to deeply analyze the mechanical interaction between the patient and the therapeutic environment during music therapy, so as to more comprehensively understand the effects of music therapy and its mechanism of action [15]. For example, muscle strength and joint forces can be calculated using the following equations:

$$F = m \cdot a \tag{7}$$

$$\tau = r \times F \tag{8}$$

where F denotes the force, m denotes the mass, a denotes the acceleration, τ denotes the moment, and r denotes the arm of the force.

3.2. Application of AI technology in music therapy

(1) Music feature extraction

With the help of advanced artificial intelligence technology, it is possible to accurately extract a variety of features of musical works, including the ups and downs of melody, changes in rhythm, the richness of harmony, and the uniqueness of timbre, etc. [16,17]. The application of this technology provides a more precise and personalized means of analysis for music therapy, thus enhancing the relevance and effectiveness of music therapy. Feature extraction can be expressed by the following formula:

$$f(m) = \left(f_{melody}(m), f_{rhythm}(m), f_{harmony}(m), f_{timbre}(m)\right) \tag{9}$$

where $f(m)$ denotes the feature vector of a musical composition m, and f_{melody}, f_{rhythm}, $f_{harmony}$, f_{timbre} denote the extraction functions for melodic, rhythmic, harmonic, and timbral features, respectively.

(2) Deep Learning Models

Through carefully constructed deep learning models, such as convolutional neural networks (CNNs) or recurrent neural networks (RNNs), AI is able to dig deeper into the intrinsic connection between music and the patient's physiological and psychological state, thus realizing accurate music-assisted therapy [18]. Model training can be optimized by the following loss function:

$$L(\theta) = \sum_{i=1}^{N} (y_i - \hat{y}_i)^2 \tag{10}$$

where L denotes the loss function, θ denotes the model parameters, $y_i$denotes the true label, and $\hat{y}_i$ denotes the model prediction.

(3) Personalized Music Generation

Relying on patients' physiological and psychological data, artificial intelligence, using Generative Adversarial Networks (GAN) or other advanced generative modeling techniques, is able to craft musical compositions to meet the specific needs of individuals and personalize music. The GAN model consists of two parts: a Generator and a Discriminator.

The role of the Generator is to receive a random noise vector z and generate a musical work x that is as close as possible to the real music data distribution. in the context of music generation, the Generator is usually a neural network that learns to map from the space of potentials to the space of musical works. The network structure of the generator may contain multiple fully connected or convolutional layers, depending on the properties of the music data and the desired musical complexity [19]. The role of the discriminator is to receive a musical composition and determine whether the composition is from a real data distribution or a generator. The discriminator is also a neural network, which usually has a similar structure to the generator but has the opposite role.

The training process of GAN (Generative Adversarial Network) is an iterative adversarial mechanism. In this process, the generator and the discriminator compete with each other to make progress. Fix the parameters of the generator and focus on training the discriminator. Use a batch of real music data and fake music data generated by the generator to train the discriminator so that it has a better discriminative ability to accurately distinguish between real and generated music [20]. Keeping the parameters of the discriminator unchanged, turn to training the generator. The generator generates a batch of fake music data, which is evaluated by the discriminator, and then the parameters of the generator are updated according to the evaluation results, so as to make the generated music more realistic and more successful in "deceiving" the discriminator. This process is repeated until the generator and the discriminator reach a dynamic equilibrium. This addition will delve into the specific algorithms and machine learning models used in AI-assisted music therapy, discussing their strengths, weaknesses, and potential for improvement. It will also consider the challenges of implementing these technologies in diverse clinical settings and the need for ongoing training and support for therapists. Furthermore, it will explore the role of patient feedback in refining AI models and the importance of creating a collaborative environment where patients and therapists can contribute to the development of personalized music therapy programs [21].

4. Impact of personalized music creation on psychological rehabilitation

4.1. Individualized music composition method

(1) Collecting patients' physiological and psychological data

Data on patients' physiological indicators and psychological status were collected through high-precision biomechanical sensors and psychological assessment tools [22]. The formulaic description of data collection is as follows:

$$D = \{d_1, d_2, \dots, d_n\} \tag{11}$$

$$d_i = (p_i, s_i) \tag{12}$$

where D denotes the collected dataset, d_i denotes a single data sample, p_i denotes physiological data, and s_i denotes psychological data.

(2) Analyzing patient data using AI technology to identify music therapy goals

machine learning algorithms are used to perform pattern recognition and predictive analytics on the collected data to determine individualized music therapy goals for the patient. For example, cluster analysis may be used to identify common characteristics of patients, or regression analysis may be used to predict the effects of a particular music intervention. The analysis process can be represented as follows:

$$T = A(I(D); \theta) \tag{13}$$

where T denotes the treatment target, A denotes the AI analysis model, I denotes the data preprocessing function, D denotes the dataset, and θ denotes the model parameters.

(3) Creation of musical compositions with specific melodies, rhythms, and timbres based on therapeutic goals

The generator network will generate musical melodies based on the patient's physiological and psychological data, while the discriminator network is used to assess the consistency of the generated music with the treatment goals. The specific formula is as follows:

$$G(z) \to x \tag{14}$$

$$D(x) \to 0{,}1 \tag{15}$$

where G denotes the generator network, z denotes the random noise, x denotes the generated music piece, and D denotes the discriminator network.

(4) Evaluating the effect of music therapy and adjusting music parameters

Evaluate the effect of music therapy through post-treatment physiological and psychological assessments, as well as feedback from patients. Based on the assessment results, the parameters of the music piece are adjusted to optimize the therapeutic effect. The assessment and adjustment process can be expressed as follows:

$$\phi' = E(M, D'; \psi) \tag{16}$$

$$M' = G(T; \phi') \quad (17)$$

where in E denotes an effect assessment function, D' denotes data collected after treatment, ψ denotes an assessment parameter, ϕ' denotes an adjusted music generation parameter, and M' denotes an adjusted musical composition.

4.2. Empirical studies

(1) Research design

This study utilized a rigorous experimental design to screen a certain number of people with mental illnesses as research subjects. The demographic characteristics of the participants included age, gender, and education level. The randomization method used a computer-generated random sequence to ensure that the allocation of the experimental and control groups was hidden. Inclusion criteria were patients diagnosed with psychological disorders such as anxiety, depression, and autism spectrum disorders, and exclusion criteria included severe physical illnesses and cognitive dysfunction [23]. Sample size was determined based on pre-test results and effect size calculations to ensure the strength of statistical tests. The experimental group received a personalized music therapy program tailored to the patient's characteristics, and the control group received conventional traditional music therapy. The intervention program consisted of 60 min of music therapy three times a week for 12 weeks.

(2) Data collection

At the critical pre- and post-treatment time points, a series of comprehensive and detailed physiological and psychological assessments were implemented for all patients. These assessments not only included standardized psychological scales, but also involved the precise testing of a number of physiological indicators, so as to comprehensively assess the overall condition of the patients from multiple dimensions.

(3) Statistical analysis

This study used analysis of variance (ANOVA) and post hoc multiple comparison tests (e.g., Tukey's HSD method) to meticulously compare and analyze the differences in psychological rehabilitation indicators between the two groups of patients. This study also deeply explored the intrinsic connection between personalized music therapy and psychological rehabilitation effects by performing correlation and regression analyses, with a view to revealing the interaction mechanism between the two [24].

(4) Discussion of results

The results of the study showed that the psychological recovery indexes of the experimental group patients were significantly better than those of the control group after treatment, a finding that fully proves the superiority of the personalized music therapy method, which can effectively enhance the efficacy of music therapy. The study reveals the quantitative relationship between music therapy parameters and patients' psychological recovery, which provides strong empirical support for the treatment of psychological diseases in the future. This addition will present a case study or series of case studies that demonstrate the practical application of personalized music therapy in real-world scenarios. These examples will help to illustrate the challenges and successes of implementing personalized music therapy and provide insights into its potential for improving patient outcomes. It will also discuss the importance of cultural sensitivity in music selection and the role of music in promoting cross-cultural understanding and communication within therapeutic settings.

5. Data support and analysis

5.1. Data collection

In this study, comprehensive data were collected and recorded from patients during music therapy, covering key physiological and psychological indicators, as well as key parameters of the musical piece. Physiological data included heart rate (HR), heart rate variability (HRV), electrical skin activity (EDA), respiratory rate (RR), and blood pressure (BP) to monitor the patient's physiological responses, while psychological assessments were conducted to quantify the patient's emotional and psychological well-being through standardized tools such as the Hamilton Anxiety Scale (HAMA) and Beck Depression Inventory (BDI). Characteristics such as melodic complexity, rhythmic tempo, volume, timbre, and harmonic structure of musical compositions were recorded in detail. **Table 1** presents an overview of some of the data collected, providing a detailed basis for subsequent analysis.

Table 1. Overview of selected data.

Patient Number	HR (bpm)	HRV (ms)	EDA (μS)	RR (breaths/min)	BP (mmHg)	HAMA (points)	BDI (points)	tempo (BPM)	music volume (dB)
001	72	50	5	16	120/80	14	9	80	60
002	78	45	4	18	125/85	18	12	85	65

5.2. Data analysis

In order to explore in depth the differences between the personalized music therapy group and the conventional music therapy group in terms of the indicators of psychological rehabilitation, this study comprehensively used a variety of statistical methods. Through descriptive statistical analysis, the basic statistics (e.g., mean and standard deviation) of the two groups were calculated in detail. By using the analysis of variance (ANOVA) method, it was tested whether the difference between the means of the two treatment groups on the indicators of psychological rehabilitation was statistically significant. The correlation between physiological and psychological indicators was analyzed by calculating the Pearson correlation coefficient. Using multiple regression analysis, the predictive role of music parameters on psychological rehabilitation effects was explored. **Table 2** demonstrates the results of the hypothesis analysis of ANOVA, which provides data support for further research.

Table 2. Table of ANOVA results for hypotheses.

source	SS	df	MS	*F*	*p*
intergroup	3.5	1	3.5	4.56	0.036
within a group	12.2	27	0.452		
total	15.7	28		N/A	N/A

In **Table 2**, SS denotes sum of squares, df denotes degrees of freedom, MS denotes mean square deviation, F denotes F-value, p denotes significance level, and N/A indicates not applicable. The results show a significant $p < 0.05$ difference between the groups, indicating that there is a significant difference between the personalized music therapy group and the conventional music therapy group in terms of psychological rehabilitation indicators. **Figure 1** is a hypothetical scatter plot showing a negative correlation between music tempo and HAMA scores, i.e., the faster the music tempo, the lower the HAMA scores, indicating a possible reduction in anxiety. In this addition, we will discuss the role of advanced statistical techniques in analyzing the complex data generated by biomechanical and AI technologies in music therapy. This will include an exploration of how these techniques can help to identify patterns and trends that can inform treatment decisions and improve patient outcomes. It will also consider the importance of data visualization in making complex data accessible and understandable to both clinicians and patients, fostering a more collaborative approach to treatment planning and evaluation.

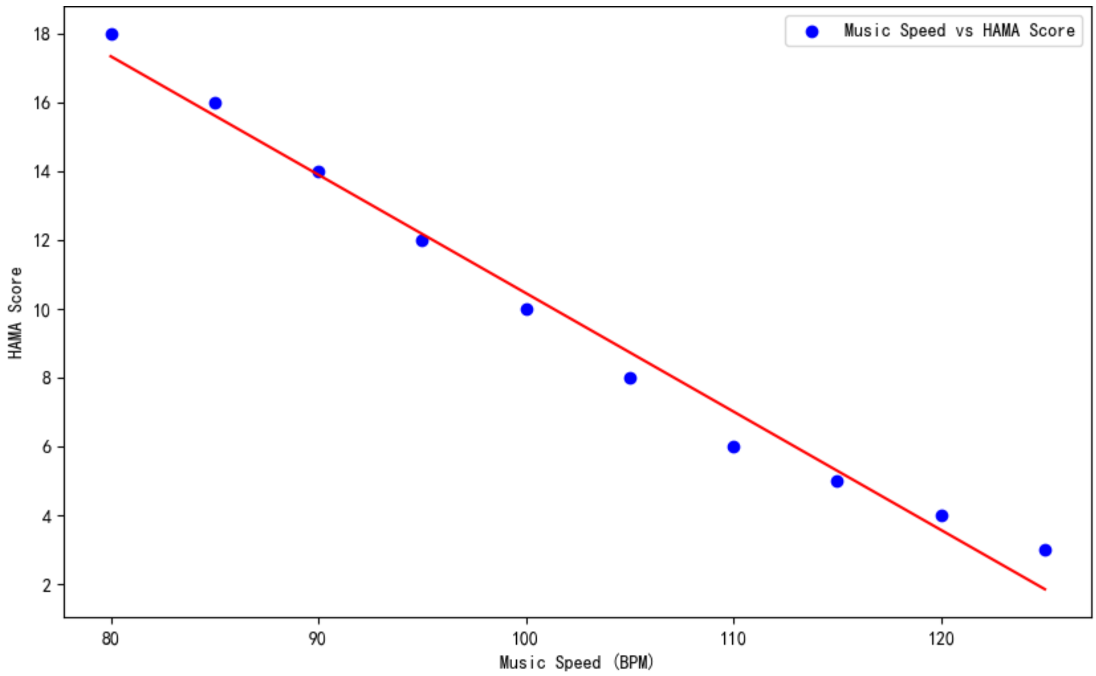

Figure 1. Relationship between music tempo and HAMA scores.

5.3. Discussion of results

The results of this study showed that the use of a personalized music composition method based on the integration of biomechanics and AI had a significant positive effect on psychological rehabilitation, in which the patients in the personalized music therapy group were significantly better than the control group who received conventional music therapy in terms of psychological rehabilitation indicators. The ANOVA results showed that HAMA and BDI scores in the personalized music therapy group were significantly lower than those in the conventional music therapy group ($p < 0.05$). Multiple regression analyses further revealed music tempo and volume as significant variables predicting psychosocial rehabilitation effects ($p < 0.01$). These findings not only confirm the study hypothesis, but also suggest the need to explore the intrinsic mechanisms of personalized music therapy for psychological rehabilitation.

The results of this study should be integrated with theoretical models to more fully understand the role of music therapy. For example, the link between music tempo and psychological state may be realized by modulating the release of neurotransmitters, e.g., music may promote the secretion of dopamine and 5-hydroxytryptophan, which play key roles in regulating mood and alleviating symptoms of anxiety and depression. In the future, it may be possible to further explore how music therapy may promote psychological recovery by influencing neurobiological pathways. This study should discuss differences in efficacy between different patient groups. Although personalized music therapy is effective overall, there may be differences in efficacy between patients with anxiety and those with depression. For example, faster-paced music may be more appropriate for patients with anxiety disorders, whereas music with rich tones and calming melodies may be more appropriate for patients with depression [25]. An in-depth analysis of these differences would help to develop a more precise treatment plan. The practical significance of this study is that it suggests an innovative and effective treatment pathway for psychological rehabilitation. Future research directions should include improving personalized music therapy protocols, for example, by increasing the variety of music genres to meet the needs of different patients, as well as exploring the application of this treatment to a wider range of populations, such as children, older adults, or people with non-psychological disorders [26]. Research could also consider how to integrate this personalized treatment approach into the existing mental health service system to enhance its accessibility and utility.

6. Conclusion

This study explores the application of the integration of biomechanics and artificial intelligence technologies in music therapy and the significant advantages for psychological rehabilitation, confirming the value of personalized music composition methods in enhancing therapeutic relevance and effectiveness. To further advance the field, it is recommended that future research focuses on optimizing the AI model to improve the accuracy of personalized music generation and explore its application to a wider range of groups, such as children, the elderly, and patients with non-psychological disorders. Meanwhile, the intrinsic mechanism of music therapy should be explored in depth to reveal the connection between music elements and psychological rehabilitation, and consideration should be given to integrating personalized music therapy into the mental health service system to enhance its accessibility and practicality, and to provide a more scientific and personalized solution for the treatment of mental illnesses. This final addition will summarize the key findings of the study and their implications for the future of music therapy. It will also highlight the need for further research to fully understand the potential of personalized music therapy and to develop best practices for its implementation in clinical settings. Additionally, it will discuss the potential for integrating personalized music therapy into broader healthcare systems, emphasizing the importance of interdisciplinary collaboration and the need for policy support to facilitate the adoption of innovative therapeutic approaches.

Ethical approval: Not applicable.

Conflict of interest: The author declares no conflict of interest.

References

1. Wetherick D. Gatekeeping and fence-making: Themes and discourses of musicianship in UK music therapy training. British Journal of Music Therapy,2024,38(2):90-100.
2. Sinnott S, Buckle N, Sweeney A, et al. The impact of music on health and wellbeing of children and young people with rare diseases in healthcare settings: A scoping review. British Journal of Music Therapy,2024,38(2):101-112.
3. Vidal M M, Lousada M, Vigário M. Music effects onphonological awareness development in 3- year - oldchildren. Applied Psycholinguistics, 2020,41(2): 299-318.
4. CancerA, Stievano G, Pace G, et al. Cogni-tive processes underlying reading improvement during arhythm- based intervention: A small - scale investiga-tion of ltalian children with dyslexia. Children, 2019,6(8):91.
5. Frey A, Francois C, Chobert J, et al. Music training positively influences the preattentive per-ception of voice onset time in children with dyslexia: Alongitudinal study. Brain Sciences, 2019,9(4): 91.
6. Corrigendum to Music therapy for adolescents in a child welfare setting - a qualitative interview study. British Journal of Music Therapy. Epub ahead of print 21 February 2023. DOI: 10.1177/13594575231155267.British Journal of Music Therapy,2024,38(2):156-156.
7. Cruz D M, Wood S. Rewording and reworlding the music therapy space – a call and response (book review): Foluke Taylor, Unruly Therapeutic Foluke Taylor, Unruly Therapeutic. British Journal of Music Therapy,2024,38(2):148-151.
8. Legarte R, Moncrieff S S. Book Review: A playLeslie Bunt, Sarah Hoskyns and Sangeeta Swamy (eds), The Handbook of Music Therapy 2nd Edition.British Journal of Music Therapy,2024,38(2):138-148.
9. Mccarron E, Curran E, Mcconkey R. Promotingthe wellbeing of youth with disabilities through music mentor-ing. Youth, 2022,2(3):258-270.
10. Lu Q, L W, Yin Y, et al. The effeet of music therapy onlanguage recovery in patients with aphasia after stroke: asystematic review and meta-analysis. Neurol Sci,2022,43(2):863-872.
11. Cipriani G, Antichi L, Carapelli L, et al. Video analysis of music therapy interaction for children experiencing neurodevelopment delay. British Journal of Music Therapy,2024,38(2):113-127.
12. Twyford K, Taylor S, Valentine J, et al. Functional outcomes in children and adolescents with neurodisability accessing music therapy: A scoping review. Developmental medicine and child neurology,2024,
13. Mehrotra B, Rai N, Mr R, et al. Impact of Dance or Music and Meditation on the Progression of Parkinson Disease With Mild or Moderate Severity: Protocol for a Pilot Randomized Controlled Trial. JMIR research protocols,2024,13e59018.
14. Hadar T. Parenting in the Face of Trauma: Music Therapy to Support Parent–Child Dyads Affected by War and Displacement.Children,2024,11(10):1269-1269.
15. Cancer A, Bonacina S, Antonietti A, et al. Theeffectiveness of interventions for developmental dyslexia: Rhythmic reading training compared with hemispherespecific stimulation and action video games. Frontiers inPsychology，2020, (11):1158.
16. Jacob U, Pillay J, Oluwawumi O, et al. Music therapyfor individuals with intellectual disability: a systematic review. Int J Early Child Spec Educ, 2022,14(2): 2022.
17. Mino-roy J, St-jean J, Lemus-folgar O, et al. Effects of music, dance and drama therapies for people with an in.tellectual disability: a scoping review [I]. Brit I Learn Disabil.2021,50(3):385-401.

18. He Y, Wong A, Zhang Y, et al. Effects of Mozart–Orff parent–child music therapy among mothers and their preschool children with autism spectrum disorder: A mixed-methods randomised controlled trial. BMC Pediatrics,2024,24(1):665-665.
19. Bourdaghs W S, Silverman J M. Theoretically grounded music therapy interventions for people with obsessive compulsive disorder. The Arts in Psychotherapy,2024,91102217-102217.
20. L B G, T D T. Music Therapy for Autistic People. American family physician,2022,106(6):622A-622B.
21. Qiu J. Music Therapy and Advanced Dementia. International Journal of Clinical and Experimental Medicine Research,2022,6(4):
22. Catharina M, Lisa S, Ole L B, et al. Music programming for psilocybin-assisted therapy: Guided Imagery and Music-informed perspectives. Frontiers in Psychology,2022,13873455-873455.
23. Jagoda R, Joanna S, Paweł K. Neurologic Music Therapy in Geriatric Rehabilitation: A Systematic Review.Healthcare,2022,10(11):2187-2187.
24. Kobus S, Bologna F, Maucher I, et al. Music Therapy Supports Children with Neurological Diseases during, Physical Therapy Interventions. Int J Environ Res Publie Health,2022,19(3):1492.
25. Piccolo A, Corallo F, Cardile D, et al. Music Therapyin Global Aphasia: A Case Report. Medicines (Basel),2023.10(2):16.
26. Rajendran T, Summa-chadwickm. The scope andpotential of music therapy in stroke rehabilitation. J IntegrMed, 2022, 20(4): 284-287.