Bremmer, Melissa; Nijs, Luc

Embodied music pedagogy. A theoretical and practical account of the dynamic role of the body in music education

Buchborn, Thade [Hrsg.]; De Baets, Thomas [Hrsg.]; Brunner, Georg [Hrsg.]; Schmid, Silke [Hrsg.]: Music is what people do. Rum / Innsbruck : HELBLING 2022, S. 29-45. - (European perspectives on music education; 11)

Table of Contents

IV. MUSIC IS WHAT PEOPLE DO *IN 2020*:
MUSIC (EDUCATION) PRACTICES IN TIMES OF THE PANDEMIC

Melissa Bremmer & Luc Nijs

Embodied Music Pedagogy

A Theoretical and Practical Account of the Dynamic Role of the Body in Music Education

Introduction

Music has the ability to evoke an expressive, physical response in us: we want to interact with and through music, we want to move to it and are emotionally moved by music (Greenhead & Habron, 2015). Interestingly, we also often talk about music in terms of movement, such as *'the music slows down or speeds up'* or *'I am playing a walking bass'*. Not surprisingly, similarities can be found between music and movement: both are time-based, have an intentional direction and are imbued with a certain (emotional) quality (Sievers, Polansky, Casey & Wheatley, 2013; Stern, 2010). Due to these similarities, the body and body movement can play an important role in learning and making sense of music (Nijs & Bremmer, 2019). More broadly, involving our bodies and movement in music education, also allows us to integrate the physical with the aesthetic, cognitive, expressive and social-emotional, in ways that seldom can be found in daily life (Juntunen, 2020). Based on this integration, it can be assumed that music is not only humanly organized sounds (Blacking, 1973), but also a "shared affective motion experience" (Overy & Molnar-Szakacs, 2009, p. 499) through which people make sense of music.

In general, there already exists a practice-based understanding of the importance of the body's role and movement in music education. For instance, the music pedagogies of Jaques-Dalcroze, Orff and Keetman, and Kodaly all acknowledge pupils' natural inclination to move to music, and promote physical activities to foster musical understanding (Campbell, 1986). However, these music pedagogies do not seem to be informed by empirical research findings explaining these understandings (Bremmer, 2015). Even though we will build on these practice-based understandings in this chapter, we also believe

that gaining additional theoretical insights into how the pupils' and teacher's body play a role in music learning could lead to a more conscious involvement of the body in the music learning process.

In this chapter we will, therefore, present how we conceive of an Embodied Music Pedagogy. First, we will shortly discuss the two main theories on which an Embodied Music Pedagogy is based: the theory of embodied music cognition and dynamical systems theory. The former advocates the bodily basis of musical sense-making; the latter, the dynamical nature of human interaction with the environment. With musical sense-making, we mean that pupils develop an understanding of the structural and emotional features of music, as well as of the social-cultural meaning of music. In the next paragraphs, we will consecutively look at the perspective of the pupil, the perspective of the music teacher and the music learning environment from an Embodied Music Pedagogy view. Lastly, we will provide teachers with four basic design principles for Embodied Music Pedagogy.

Theoretical Background of Embodied Music Pedagogy

Embodied Music Cognition

The theory of embodied music cognition and related empirical research findings can provide insights into the role of the pupils' and teacher's body in music education. This theory fits within a broader understanding of cognition as being embodied (the mind emerges from brain-body integration), embedded (the mind is partially generated by the physical world as well), enactive (cognition is shaped through active engagement with the world) and extended (the environment can be part of cognition) (e. g., Schiavio & Van der Schyff, 2018; Rowlands, 2010).

From the perspective of embodied music cognition, bodily involvement shapes the way we perceive, feel, experience, and understand music (Leman, Nijs, Maes & Van Dyck, 2018). While interacting and acting along with music – through listening, dancing, improvising or playing – we can make a sound-movement-intention association that transforms a stream of sounds into a meaningful musical experience (Nijs & Bremmer, 2019). That is, we associate sound patterns (e. g. chord sequence, rhythm patterns or melody), and movement patterns (e. g. shape, direction, energy), with intentional states (e. g. an emotion) underlying these patterns. This bodily involvement with music is also called enactment (Leman et al., 2018). Empirical research has found that different bodily mechanisms facilitate this process of enactment (Leman, 2016), namely entrainment, alignment and prediction. People are born with these mechanisms which aid them in experiencing and making sense of music (Honing, Ladinig, Háden & Winkler, 2009). We will discuss each of these mechanisms separately.

Entrainment: Just imagine yourself dancing with your dance partner… sooner or later your footsteps will unconsciously synchronize and your bodies will sway together in the same rhythm (Bennet, Schatz, Rockwood & Wiesenfeld, 2002). This process of being pulled towards synchronization is called entrainment, and also happens between people and music (Clayton, Sager & Will, 2004). As soon as people listen to music, they are pulled to the beat, which (unconsciously) causes them to seek, find, hold and, in a sense, become the beat (Leman, 2016). For instance, when people listen to or perform music, they often will start unconsciously synchronizing their foot with the music's beat. Interpersonal entrainment happens during music making in a group. Musicians in ensembles, choirs, bands and orchestras synchronize and coordinate their rhythmic movements, enabling them to play in time together in flexible ways (Clayton, Jakubowski & Eerola, 2019; Van den Dool, 2018).

Alignment: As soon as people listen to music and have established a timing framework, they will often start aligning their physical movements to specific features in the music, thus visualizing music with their body (Eerola, Luck & Toiviainen, 2006). For instance, people can visualize musical phrasing or the expressive character of music through movement. Through research, Leman (2016) found two different forms of alignment. The first form, phase alignment, is when people correspond their movements to rhythmical structures in music; for example, moving their head to the beat. The second form, inter-phase alignment, is when people visualize music in-between beats, such as showing the melodic contour, dynamics, or harmonic structures of music with their body. Such movements help people to develop an expressive and 'felt' understanding of music.

In a choir, band, orchestra or ensemble, musicians also continuously visualize musical aspects with their body; showing, for example, the tempo or the intensity of the music. Alignment, thus, allows musicians to hear and see how fellow musicians express the music; this helps to them to attune musically to each other. Through a shared, active involvement in music, people can take part in each other's sense-making of music. This process is called "participatory sense-making" (Schiavio & DeJaegher, 2017, p. 31), and allows us to co-create and jointly understand music as it develops through time.

Predicting: From an embodied music cognition perspective, the biomechanical constraints of our body (such as the length and form of our legs and arms), our state of arousal (feeling fatigued or being energetic), and the way we entrain and align with music, all play a role in how we predict it. For instance, sometimes the ambiguous nature of music, such as the combination of duple and triple meter in Samba music, may be confusing and make it difficult to predict the beat. This is where our bodies can help us: by making a movement to the beat, such as three steps forward and three steps back, we can solve the confusion of the duple and triple perception as our body helps us to predict and hear the music as a triple meter (see also Naveda & Leman, 2009). Taking two steps at a time would help us predict the music as a duple meter. Thus, movement can help to understand music by focusing attention on a certain element in the music, making it easier to predict.

Dynamical Systems Theory

The core idea of embodied music cognition is that we process and attribute meaning to music through our dynamical bodily engagement with the musical environment. This idea fits well with the dynamical systems theory on human interaction and learning. Within the term dynamical system, the word system refers to a network of components. The word dynamical refers to the way in which those components always influence each other and the system as a whole, and how the system influences the individual components (Thelen & Smith, 1994; Van Gelder, 1995). As such, pupils, music teacher and the learning content are all components, influencing each other and the music lesson as a whole. In turn, the way a music lesson develops influences pupils, music teacher and the learning content.

In short, from a dynamical systems perspective the development of new musical knowledge and skills is the result of multiple interactions over time between pupils, music teachers and learning content (Chow, Davids, Hristovski, Arajo & Passos, 2011). During those interactions, pupils develop a relationship with their learning environment by attuning to its affordances (Renshaw & Chow, 2019). Affordances can be viewed as environmental properties providing pupils with "opportunities for action" (Renshaw & Chow, 2019, p. 10; see also Gibson, 1979): tools (e. g., instruments, tablets, shawls, balls), activities (e. g. listening, dancing, improvisation), and places (e. g., classrooms, concert halls) all have properties that can elicit certain actions in pupils. For instance, when pupils notice a drum, they will often spontaneously start hitting it as the drum provides that opportunity for action.

Based on the notion of dynamical interaction and affordances, a constraint-led pedagogy is being developed (Renshaw & Chow, 2019). The basic idea of this pedagogy is that music teachers can design tasks and apply so-called 'constraints' to help pupils attune to affordances of those tasks. A constraint refers to the boundaries placed on pupils that shape or limit certain behaviours, helping them to focus on specific affordances (Newell, 2003). For instance, when pupils are asked to clap to the music they might focus more on the beat. In this example, clapping would be a constraint. When pupils are asked to move their hands freely through the air, they tend to focus on the melody. In this example, moving hands freely through the air is a constraint. Both constraints help pupils to focus on different affordances of the music.

Newell (2003) distinguishes between three broad constraints shaping or limiting behaviours. Individual constraints refer to a person's characteristics such pupils' gross motor skills, cognitive skills such as audiation, or self-motivation. Task constraints include the goal of a task, feedback on the task, or questions posed by a teacher or peer during a task (Hopper, 2012). Environmental constraints refer to factors surrounding pupils, such as the size of a classroom, materials or social factors such as peer groups (Hopper, 2012). In education, the different constraints interact in a certain way, influencing pupils' development and causing a wide variation in development (Schiavio & Van der Schyff, 2018).

Looking at music education, teachers can design tasks for pupils that, based on the different constraints, invite them to attune to the learning content. During the performance of the task, teachers and pupils – and pupils amongst each other – will interact in dynamical ways. All these dynamical interaction processes influence pupils' musical development. Fig. 1 provides a model of the constraint-led approach to teaching and learning in music education.

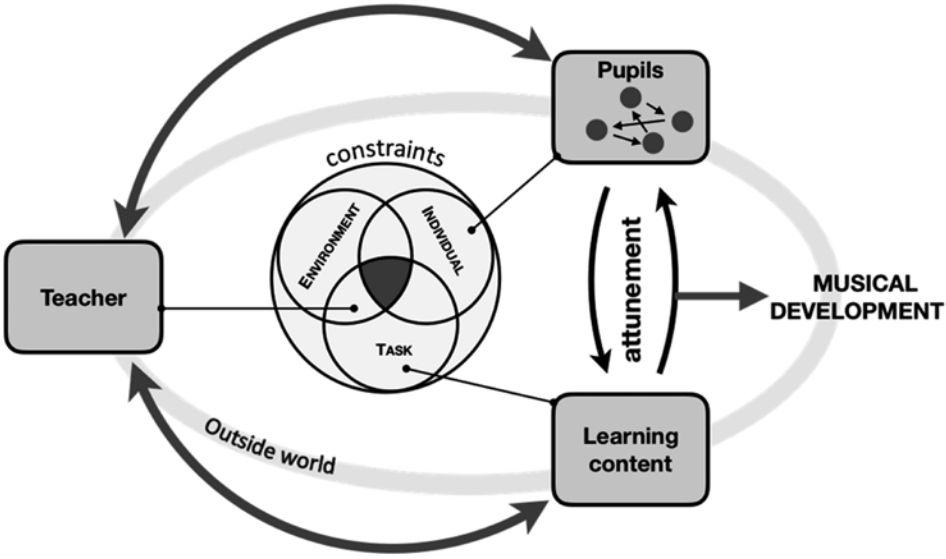

Fig. 1: A model of the constraint-led approach to teaching and learning in music education

Embodied Music Pedagogy

Both embodied music cognition and dynamical systems theory complement each other well and provide a relevant and solid basis for an Embodied Music Pedagogy. This pedagogy acknowledges the fundamental role of pupils' and teacher's physical and expressive interaction with music and each other, and is developed for lessons where communication through/with/in sound and music is the dominant mode (Atkinson, 2018).

Furthermore, Embodied Music Pedagogy is by nature multimodal, inviting musical engagement through all the senses and it addresses pupils' sensorimotor, affective, creative and cognitive resources. Through movement-based music activities, it seeks to deepen the prior musical knowledge of pupils and to stimulate pupils to physically engage with each other in joint musical sense-making. Embodied Music Pedagogy also seeks to enrich pupils' musical experiences, promoting a broader understanding of music practices, by inviting and challenging pupils to physically experience and explore new musical worlds in and beyond the school.

Lastly, Embodied Music Pedagogy, as we conceive of it, embraces a constraints-led approach. Through careful consideration and implementation of constraints, pupils are guided in their music learning process. Teachers consciously shape the learning environment through designing and guiding learning tasks (e. g. using specific movements, exploring different musical roles), introducing materials (e. g. different instruments), and by visiting musical events that offer different music learning opportunities. Depending on the specific learning situation and goals, music teachers may adopt either a teacher-, pupil- or content-centred approach. In the following paragraphs, we will take a closer look at a practical level as to how pupils, music teacher and musical environment influence each other in dynamic, embodied and complex ways.

Perspective of Pupils

From an Embodied Music Pedagogy perspective, pupils' physical interaction with their musical environment plays a pivotal role in experiencing, learning and expressing music. In this section, we discuss how, in our view, this might look like in practice.

Entrainment

Pupils sit in a circle with a djembe or darbuka and the teacher asks if they want to play any pulse they choose, whilst closely listening to each other. Gradually, they may find a common tempo. Then pupils can be asked to play their pulse in such a way that they sound together in a regular pulse. At first, this might require some effort and attention (finding). At a certain point, they will manage to sound together, but staying together might require some effort (keeping). Once the pulse stabilizes, the pupils might experience they no longer need to consciously count the beat but what we would call the mode of becoming the beat. The teacher can then ask to change the tempo of the pulse (find a new slower or quicker pulse), inviting pupils to re-adapt and engage in a new cycle of finding, keeping and being the pulse.

Illustration 1: Interpersonal entrainment

Practising both entrainment and interpersonal entrainment can help pupils to feel and understand music, but also help them learn to play in a group in a coordinated way (Philips-Silver, Atkipis & Bryant, 2010). To practise entrainment, pupils can be invited to seek the beat in music from different music practices (e. g. Javanese Gamelan music or Bebop Jazz) and in music with more unfamiliar meters such as irregular and/or compound meters (e. g. 3 + 2 + 3). They can try to move or play to the beat of those musics and start synchronizing with the beat. Practising interpersonal entrainment is also important to be able to learn how to perform rhythmically coherently as a group. In musical activities, a music teacher can ask pupils in a group to find a pulse together and then, for instance, improvise to that beat. See illustration 1 for a more detailed example of interpersonal entrainment in practice.

Alignment

Music teachers can also design music activities, through which pupils can practise both phase or interphase alignment (Juntunen, 2020). In general, teachers can tend to focus on phase-alignment by inviting pupils to align their movements to the beat of music. However, by paying attention to inter-phase alignment, they can also invite pupils to explore and visualize expressive aspects of music. For example, teachers can ask pupils to listen and physically respond to different elements in the music in their own way, such as phrasing, dynamics, or harmonics. Furthermore, teachers can encourage participatory sense-making, by inviting pupils to imitate each other's movements; also when they are performing with instruments. See illustration 2 for an example in which pupils practise both phase and interphase alignment.

A way to let pupils experience phase and interphase alignment, is to work in dyads whereby each pupil takes on a different role while responding to music (played by the teacher, peer or pre-recorded). One pupil holds a hand drum, and moves the drum through the air to visually express the flow of the music (interphase alignment). The other pupil follows the drum and taps the beat to the drum (phase alignment).

Illustration 2: Alignment in practice

Prediction

Learning to feel what comes next in the music can be developed through a variety of musical activities in which pupils learn to predict a melody, rhythm, harmony or dynamics in the music. For example, teachers can play with pupils' expectations through quick reaction games in which a cue can cause a change in the music. Through regular changes in the music (e. g. from duple to triple meter and vice versa, or from minor to major chords and vice versa), pupils need to immediately adapt their movements to the (expected) changes (e. g. change the direction of walking or other movements). In illustration 3, an example of prediction in practice is given.

Pupils first listen to a 2-chord song (e. g., I-V), such as the pop song *Therefore I Am* by Billie Eilish. Next, they are invited to choose a spot in the room; their home base. While listening to the song, they jump away from their home base when they predict a change of chords (from I to V), and jump back to their base when they predict the change from I to V. The movement helps pupils physically experience and predict a sense of tonic and dominant.

Illustration 3: Prediction in practice

Musical Creativity

From an Embodied Music Pedagogy's perspective, practising entrainment, alignment and prediction also fosters the development of musical creativity (Nijs, Grinspun & Fortuna, forthcoming). For example, being able to enter the mode that we would call becoming the beat gives the freedom to explore and experiment with other aspects of the music (e. g., melody, harmonic development). Free exploration and experimentation can support the development of creativity, allowing participants to go beyond established routines and norms, break with existing orders and codes, and to experiment with new possibilities (e. g., Pürgstaller, 2021). Using different environmental and task constraints, teachers may guide such musical explorations and discoveries. For example, asking pupils to only use certain body parts or certain types of movement (e. g., jerky vs. fluent) may elicit the exploration of different aspects of the music.

Moving to music can also be used to create music. For instance, expressive movements of one or more pupils may be used to guide musical improvisations: certain movements can inspire changes in dynamics or a melodic contour, other movements may elicit certain emotional interpretations (e. g., happy vs. sad). Moreover, drawing can be used to create alternative notation to make scores with and this can be used to compose new music. Interestingly, Fortuna and Nijs (2019) found that the way pupils move to music influences the way they draw. After moving to music, pupils made more action/gesture

drawings; these drawings (e. g., line going up and down) mirror the quality of movement in the represented event (e. g., jumping). Teachers may design tasks in which they use this connection by, for example, inviting pupils to explore similarities between moving, drawing and composing music.

Diversity of Pupils

When music teachers encourage pupils to move in their lessons, it is important to realize that the mobility of pupils' bodies differs. For example, a pupil with a physical disability might have difficulty making whole body movements. This does not mean that these pupils cannot make sense of music and music practices through and with their bodies. For instance, a multimodal approach to music learning can involve seeing music through visuals, feeling it through vibrations and materials, or by being literally moved to music (see for multimodal practices e. g. Bremmer, Hermans & Lamers, 2021; Salmon, 2006).

Furthermore, some pupils might feel self-conscious about moving to music in front of others, afraid of negative reactions (Juntunen, 2020). In this latter case, we believe that music teachers should not force pupils to move, but, if possible, slowly expose pupils over time to sound-movement activities. In such cases, the use of materials may also help pupils to be bodily involved. Furthermore, due to pupils' personal backgrounds or age, their movement repertoire can differ. This requires teachers to respond sensitively to those differences, by adapting their task or environment constraints.

Perspective of Music Teachers

Within an Embodied Music Pedagogy, the music teacher's body plays an equally important role as language: through their body, they can communicate about music and guide a group in a non-verbal manner whilst keeping joint music making and the flow of music going. In this section, we will take a closer look at how the music teacher's body takes on a pedagogical role in practice.

Pedagogical Gestures

During music activities, teachers tend to talk less, and will often guide pupils through the use of gestures (Bremmer, 2015; Chuang, 2010). One type of gestures they apply is guiding gestures that function as a task constraint (Bremmer & Nijs, 2020). For instance, teachers use guiding gestures to communicate when pupils can start or stop playing as a group, can coordinate call-and-response music activities, or cue when to start singing during a round. Another type of gestures are representational gestures that visualize musical aspects, such as a melodic phrase, the beat or dynamics of music (Bremmer, 2015).

As task constraints, representational gestures can signal pupils on which musical aspects they should focus. In illustration 4, an example is given of representational gestures in practice.

When pupils are playing in a band, one pupil might have trouble playing a syncopated rhythm. Whilst the pupils are performing the music, the music teacher may at the same time visualize that specific syncopated rhythm through a representational gesture. Through that gesture, the performed music is temporarily simplified thereby helping the pupil to focus on and understand the syncopated rhythm.

Illustration 4: Representational gestures in practice

Physical Modelling

The music teacher's body can also take on the role of a model (Staveley, 2020; Metz, 1989). In that role, the teacher – or a pupils' peer – can model a musical skill which will be imitated by the group. Physical modelling, however, has been criticized for its unidirectional nature, that can restrict pupils' development of creativity and self-expression (e. g. Burwell, 2012). Although this critique seems legitimate, Bremmer (2021a) found that music teachers will often sensitively tailor their physical modelling to their pupils' needs, e. g. through adjusting the tempo or movements of a music activity. In turn, pupils learn to make sense of a music teacher's physical modelling and to transform those actions into personal motor actions (Bremmer & Nijs, 2020). It is through joint action that both teacher and pupils continually seek to enhance the performance of music (Schiavio & Van der Schyff, 2018; Koopmans, 2019).

Multi-Sensory Assessment

The music teacher's body is also a tool for multisensory assessment. During a music activity, the music learning process of pupils as a group is – at least partially – made overt through body movements, allowing teachers to closely observe and read their pupils' bodies (Juntunen, 2020). Based on what they hear but also see, these teachers can flexibly adapt the musical activity on-the-spot to the learning needs of their pupils. In addition, because teachers often participate in music activities, they can relate the physical feeling a musical activity evokes in their own body (e. g. a sense of weight or tempo) to what the pupils are actually doing. This provides them with information about, for instance, whether a group is speeding up, or slowing down too much.

Music teachers can also gain haptic feedback from pedagogically touching pupils e. g., holding their hands during a rhythm activity, and feeling if the pupils are swaying their arms to the beat. They can also provide haptic feedback by adjusting those rhythmic movements, e. g. swaying slighter faster or slower. In other words, music teachers can draw on multiple senses to gain information about the musical development of pupils, enabling them to assess and provide feedback in a non-verbal way during music making itself (Bremmer, 2021b). In illustration 5, an example is given of multi-sensory assessment in practice.

Find a large enough space where both music teacher and pupils can move freely to the music. This allows pupils to see the movements of the teacher, and the music teacher has every opportunity to observe and read the bodies of the pupils.
Teachers can use all their senses to assess the musical learning process: listen to the musical expression of pupils, observe how pupils are performing music with their bodies and physically feel whether a group is, for example, speeding up or slowing down.
Adapt a musical activity in the moment to what a group or individual needs: this could be slowing down a performed music piece, increasing the difficulty of rhythms of an improvisation, or adding harmonics to a song.

Illustration 5: Multi-sensory assessment in practice

Language

An Embodied Music Pedagogy acknowledges the benefit of using language in music education, due to the distinction between "knowledge in" and "knowledge about" (Brinner, 1995) music. Knowledge in music is developed through the dynamical interaction with music and performing with others, and is embedded in the actions of pupils. It is a non-linguistic form of knowledge that pupils need during active music making (Brinner, 1995). Knowledge about music is created through reflection or theorization about music, in which language plays an important role. Therefore, teachers can introduce language-based activities that give pupils, for instance, a shared language about music practices and the opportunity to enrich their perception and ideas about music – through peer feedback, for example. They can also learn how to formulate their personal feelings and (compositional) ideas about music (Findenegg, 2021). Furthermore, through language pupils can learn to situate music practices in broader, societal contexts (Reimer, 2003; Young & Glover, 1998).

Musical Environment

Both the theory on embodied music cognition and the dynamical systems theory emphasize the interaction with the environment. The richer the environment, the more possibilities pupils have to attune to a variety of affordances and to develop musically in a broad way. In this section, we will discuss how music teachers can actively create a rich musical learning environment through using both task constraints and environmental constraints.

Task Constraints

Music teachers can design musical tasks with specific constraints. Such constraints challenge pupils musically, and can prevent them from taking the most obvious path: one that is primarily based on their existing musical knowledge, skills, and experiences (Bremmer & Heijnen, 2020). A few examples of constraints are: the number of musical building blocks pupils can use when they compose music (e. g. compose a piece with four rhythm patterns); the number of collaborative partners pupils can perform with (e. g. make a band with three pupils); time limitation (e. g. compose a one-minute opera about a local news event); or the musical role pupils are invited to physically and musically explore (e. g. listener, conductor, critic, performer, composer).

Environmental Constraints

Music teachers can introduce environmental constraints through the musical instruments they provide in learning activities. Musical instruments – from boomwhackers to tablets – all have unique affordances. Teachers can be sensitive to both the pupils' physiology and existing movement repertoire (individual constraints) and the affordances of the instrument (environmental constraint) when designing tasks (task constraint) in which pupils can explore and learn to play these instruments.

Music repertoire, too, can be viewed as an environmental constraint with specific affordances (e. g., Krueger, 2014). While exploring new repertoire, teachers can invite pupils to entrain and align with the new music through a variety of bodily-based music activities (Fortuna & Nijs, 2019). Pupils can be temporarily confused by new repertoire, or even dislike it. However, giving time to physically feel and construct meaning in the new repertoire can also broaden the pupils' horizons, and provides them with the possibility to hear new affordances in the music.

Another environmental constraint is the use of materials other than music instruments. Due to their specific affordances, materials can give pupils physical sensations, in addition to hearing the music. The use of all kinds of materials provides pupils with the opportunity to feel the structure and expressive qualities of music (Bremmer, Hermans & Lamers, 2021); for example, feeling the weight of an object can help to emphasize the pulse.

Finally, by visiting musical events beyond the school, pupils can physically experience different – some known, some unknown – music practices, each with unique musical artefacts and musical and culturally defined procedures (e. g. as an audience, are you allowed or even supposed to move?). Even the act of listening itself is embodied, as an audience will often move with the performers, or be emotionally moved by the music (Krueger, 2014).

Design Principles of Embodied Music Pedagogy

In this chapter, we have given a short overview of Embodied Music Pedagogy. Based on this overview, we offer four basic design principles that can inspire teachers to develop their own movement-based music activities that promote pupils' embodied understanding of music.

Provide a Space to Do Music

Provide a space for pupils to experience and make sense of music through the bodily mechanisms of entrainment, alignment and prediction. Try to explore different ways of moving (internal, external, personal, joint) and different ways of using the space (e. g., free, structured). Through the development of the bodily mechanisms, musical expressiveness and creativity can be fostered.

Allow for Group and Individual Musical Expression

Invite pupils to attune to each other through entrainment and alignment. In this way, a group can create joint meaningful and expressive musical experiences (participatory sense-making). Simultaneously, allow for individual musical expression, choice and creativity e. g. through personal interpretation of music, choice of movements and improvisation solos. To keep the flow of (joint) music making going, teachers can guide music activities through gestures, modelling and touch.

Create a Rich Music Learning Environment

Design a variety of musical tasks, using task and environmental constraints, which focus pupils' attention to a variety of affordances: pupils can experience different music traditions and practices; a repertoire that varies, for example, in style, meter, tonalities; and different musical roles. Offer pupils diverse materials and (technological) instruments to support their musical learning process. Invite pupils to explore music practices beyond the school, by visiting music events in different musical contexts.

Stimulate the Development of Knowledge in and about Music
Use language to broaden pupils' knowledge *in* music to knowledge *about* music. Invite pupils to formulate their personal feelings and (compositional) ideas about music, develop a shared language about theoretical aspects of music and provide pupils with a language to situate music practices in broader, societal contexts.

Conclusion

In this chapter, we presented how we conceive of an Embodied Music Pedagogy in which music learning and teaching is all about doing music together with and through the body, both in and beyond the classroom. In our view, an Embodied Music Pedagogy can provide music teachers with insights into the role of the pupils' and teacher's body and body movement in music learning and teaching. In turn, these insights can invite the teacher to reflect on the nature of music learning and teaching, and may support the design and guidance of movement-based musical activities. Such activities aim to challenge pupils to deepen their musical knowledge, yet broaden their musical horizon by exploring new (contemporary) music practices.

Taking a broader outlook, we believe that through the physical, expressive interaction with music and peers, pupils have the opportunity to develop in a rounded way: not only musically, but also personally and socially. The process of learning music can encourage human connection and foster well-being (Nijs & Nicolaou, 2021) and, at the same time, stimulate our imagination, creativity and self-expression (Verneert, 2021). These valuable, manifold opportunities are what doing music offers us.

References

Atkinson, R. (2018). The Pedagogy of Primary Music Teaching: Talking about Not Talking. *Music Education Research* 20 (3), pp. 267–276.

Bennet, M., Schatz, M., Rockwood, H. & Wiesenfeld, K. (2002). Huyghens's Clocks. Proceedings: Mathematics. In *Physical and Engineering Sciences* 458, pp. 563–579.

Blacking, J. (1973). *How Musical is Man?* Seattle: University of Washington Press.

Bremmer, M. (2015). *What the Body Knows about Teaching Music: The Specialist Preschool Music Teacher's Pedagogical Content Knowing Regarding Teaching and Learning Rhythm Skills Viewed from an Embodied Cognition Perspective.* Unpublished PhD thesis, Exeter: University of Exeter.

Bremmer, M. (2021a). Does the Body Count as Evidence? Exploring the Embodied Pedagogical Content Knowledge Concerning Rhythm Skills of a Dutch Specialist Preschool Music Teacher. In *International Journal of Music in Early Childhood* 16 (1), pp. 89–103.

Bremmer, M. (2021b). Where's the Body? Reconsidering the Concept of Pedagogical Content Knowledge through Research in Music Education with Dutch Specialist Preschool Music Teachers. In *British Journal of Music Education* 38 (2), pp. 119–130.

Bremmer, M. & Heijnen, E. (2020). Bridging Contradictions: The Design of Wicked Arts Assignments. In E. Heijnen & M. Bremmer (eds.), *Wicked Arts Assignments*. Amsterdam: Valiz, pp. 23–32.

Bremmer, M., Hermans, C. & Lamers, V. (2021). The Charmed Dyad: Multimodal Music Lessons for Pupils with Severe or Multiple Disabilities. In *Research Studies in Music Education* 43 (2), pp. 259–272.

Bremmer, M. & Nijs, L. (2020). The Role of the Body in Instrumental and Vocal Music Pedagogy: A Dynamical Systems Theory Perspective on the Music Teacher's Bodily Engagement in Teaching and Learning. In *Frontiers in Education* 5 (79). doi: 10.3389/feduc.2020.00079.

Brinner, B. (1995). *Knowing Music, Making Music. Javanese Gamelan and the Theory of Musical Competence and Interaction.* Chicago: The University of Chicago Press.

Burwell, K. (2012). Apprenticeship in Music: A Contextual Study for Instrumental Teaching and Learning. In *International Journal of Music Education* 31 (3), pp. 276–291.

Campbell, P. S. (1986). Major Approaches to Music Education: An Account of Method. In *Music Educators Journal* 72 (6), pp. 26–31.

Chow, J. Y., Davids, K., Hristovski, R., Arajo, D. & Passos, P. (2011). Nonlinear Pedagogy: Learning Design for Self-Organizing Neurobiological Systems. In *New Ideas in Psychology* 29, pp. 189–200.

Chuang, Y. A. (2010). *Metaphors and Gestures in Music Teaching: An Examination of Junior High Schools in Taiwan.* Unpublished PhD thesis, York: University of York.

Clayton, M., Jakubowski, K. & Eerola, T. (2019). Interpersonal Entrainment in Indian Instrumental Music Performance: Synchronization and Movement Coordination Relate to Tempo, Dynamics, Metrical and Cadent Structure. In *Musicae Scientiae* 23, pp. 304–331.

Clayton, M., Sager, R. & Will, U. (2004). In Time with the Music: The Concept of Entrainment and Its Significance for Ethnomusicology. In *ESEM CounterPoint* 1, pp. 1–45.

Eerola, T., Luck, G. & Toiviainen, P. (2006). An Investigation of Pre-schoolers' Corporeal Synchronization with Music. In M. Baroni, A. R. Addessi, R. Caterina & M. Costa (eds.), *Proceedings of the 9th International Conference on Music Perception and Cognition*. Bologna: Alma Mater Studiorium University of Bologna, pp. 472–476.

Findenegg, R. (2021). *Authentic Composition Education in Primary School.* Amsterdam: Lectoraat Kunsteducatie, Amsterdamse Hogeschool voor de Kunsten.

Fortuna, S. & Nijs, L. (2019). Children's Representational Strategies Based on Verbal Versus Bodily Interactions with Music: An Intervention-based Study. In *Music Education Research* 22 (1), pp. 107–127.

Gibson, J. J. (1979). *The Ecological Approach to Visual Perception.* Boston: Houghton Mifflin.

Greenhead, K. & Habron, J. (2015). The Touch of Sound: Dalcroze Eurhythmics as a Somatic Practice. In *Journal of Dance & Somatic Practices* 7 (1), pp. 93–112.

Honing, H., Ladinig, O., Háden, G. P. & Winkler, I. (2009). Is Beat Induction Innate or Learned? Probing Emergent Meter Perception in Adults and Newborns Using Event-related Brain Potentials. In *Annals of the New York Academy of Sciences* 1169 (1), pp. 93–96.

Hopper, T. (2012). Constraints-led Approach and Emergent Learning: Using Complexity Thinking to Frame Collectives in Creative Dance and Inventing Games as Learning Systems. In *The Open Sports Sciences Journal* 5 (1), pp. 76–87.

Juntunen, M. L. (2020). Ways to Enhance Embodied Learning in Dalcroze-inspired Music Education. In *International Journal of Music in Early Childhood* 15 (1), pp. 39–59.

Koopmans, M. (2019). Education is a Complex Dynamical System: Challenges for Research. *Journal of Experimental Education* 88 (3), pp. 358–374.

Krueger, J. (2014). Affordances and the Musically Extended mind. In *Frontiers in Psychology* 4, p. 1003.

Leman, M. (2016). *The Expressive Moment: How Interaction (with Music) Shapes Human Empowerment.* Cambridge: The MIT Press.

Leman, M., Nijs, L., Maes, P.-J. & Van Dyck, E. (2018). What is Embodied Music Cognition? In R. Bader (ed.), *Springer handbook of systematic musicology*. Berlin: Springer, pp. 747–760.

Metz, E. (1989). Movement as a Musical Response among Preschool Children. In *Journal of Research in Music Education* 37 (1), pp. 48–60.

Naveda, L. & Leman, M. (2009). A Cross-modal Heuristic for Periodic Pattern Analysis of Samba Music and Dance. In *Journal of New Music Research* 38 (3), pp. 255–283.

Newell, K. M. (2003). Change in Motor Learning: A Coordination and Control Perspective. In *Motriz Rio Claro* 9 (1), pp. 1–6.

Nijs, L. & Bremmer, M. (2019). Embodiment and Early Childhood Music Education. In B. Ilari & S. Young (eds.), *Music in Early Childhood: Multi-disciplinary Perspectives and Inter-disciplinary Exchanges*. Amsterdam: Springer International Publishing, pp. 87–102.

Nijs, L., Grinspun, N. & Fortuna, S. (forthcoming). Creativity Through Movement: Navigating the Musical Affordance Space. In *Creativity Research Journal*.

Nijs, L. & Nicolaou, G. (2021). Flourishing in Resonance: Joint Resilience Building through Music and Motion. In *Frontiers in Psychology* 12, p. 1986.

Overy, K. & Molnar-Szakacs, I. (2009). Being Together in Time: Musical Experience and the Mirror Neuron System. In *Music Perception* 26 (5), pp. 489–504.

Phillips-Silver, J., Aktipis, C. A. & Bryant, G. A. (2010). The Ecology of Entrainment: Foundations of Coordinated Rhythmic Movement. In *Music Perception* 28 (1), pp. 3–14.

Pürgstaller, E. (2021). Assessment of Creativity in Dance in Children: Development and Validation of a Test Instrument. In *Creativity Research Journal* 33 (1), pp. 33–46.

Reimer, B. (2003). *A Philosophy of Music Education: Advancing the Vision.* Upper Saddle River: Prentice Hall.

Renshaw, I. & Chow, J. Y. (2019). A Constraint-led Approach to Sport and Physical Education Pedagogy. In *Physical Education and Sport Pedagogy* 24 (2), pp. 103–116.

Rowlands, M. (2010). *The New Science of the Mind: From Extended Mind to Embodied Phenomenology.* Cambridge: MIT Press.

Salmon, S. (2006). The importance of playsongs in inclusive teaching. In S. Salmon (ed.), *Hearing, Feeling, Playing: Music and Movement with Hard-of-hearing and Deaf Children.* Wiesbaden: Zeitpunkt Musik, pp. 243–262.

Schiavio, A. & De Jaegher, H. (2017). Participatory Sense-making in Joint Musical Practice. In M. Lesaffre, P. J. Maes & M. Leman (eds.), *The Routledge Companion to Embodied Music Interaction*. London: Routledge, pp. 31–39.

Schiavio, A. & Van der Schyff, D. (2018). 4E Music Pedagogy and the Principles of Self-organization. In *Behavioural Sciences* 8, pp. 72–87.

Sievers, B., Polansky, L., Casey, M. & Wheatley, T. (2013). Music and Movement Share a Dynamic Structure that Supports Universal Expressions of Emotion. In *Proceedings of the National Academy of Sciences of the United States of America (PNAS)* 110 (1), pp. 70–75.

Staveley, R. M. (2020). *Embedding Embodied Cognition and Neuroscience in Music Pedagogy.* Unpublished PhD thesis, Sydney: University of Technology Sydney.

Stern, D. N. (2010). *Forms of Vitality: Exploring Dynamic Experience in Psychology, the Arts, Psychotherapy and Development.* Oxford: Oxford University Press.

Thelen, E. & Smith, L. B. (1994). *A Dynamic Systems Approach to the Development of Cognition and Action.* Cambridge: MIT Press.

Van den Dool, J. (2018). *Move to the Music: Understanding the Relationship between Bodily Interaction and the Acquisition of Musical Knowledge and Skills in Music Education.* PhD thesis, Erasmus Universiteit Rotterdam.

Van Gelder, T. (1995). What Might Cognition Be, if not Computation? In *The Journal of Philosophy* 92 (7), pp. 345–381.

Verneert, F. (2021). Kunsteducatie in het secundair onderwijs, van bijzaak naar hoofdzaak [Arts education in secondary school, from afterthought to main thought]. In H. Schmidt (ed.), *Mogen we nog verwonderd zijn? Een pleidooi voor meer kunsteducatie in het onderwijs* [May we still be surprised? A plea for more arts education in education]. Ghent: Owl Press, pp. 89–108.

Young, S. & Glover, J. (1998). *Music in the Early Years.* London: Routledge.