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Multisensory music representation in primary classroom: preliminary qualitative data on children's perspectives

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Abstract

In GSME 2018 we presented an auditory-tactile, music teaching approach which aimed at enhancing children's beat perception and production skills. The effectiveness of this approach was evaluated using a mixed-methods research design, collecting both quantitative and qualitative data. Here, we present preliminary qualitative data obtained by semi-structured interviews. The interviews were conducted six months after the end of the intervention. With the aim of revealing how children made sense of the pedagogical practice and the possible effects that the music intervention may have on their engagement into music class, 8 children were asked to declare their individual experiences and impressions. Interview data were analyzed with thematic analysis techniques, providing both research-derived and data-derived codes. Key themes that arose across the discussions with the interviewees were that: a) children enjoyed team-working and cooperative activities; b) children's favorable tasks were music games and playing with instruments; c) classroom design and decoration plays an essential role in children's emotional engagement; and d) all children expressed their preference to the sensorimotor tasks of the teaching approach. Children mentioned that listening to and at the same time feeling the music was really interesting and enjoyable. Findings provided encouraging results on how children may experience a bimodal music class, suggesting that the utilization of multisensory music instruction may benefit primary education.

Keywords: elementary rhythmic skills, auditory-tactile stimulation, music in primary school, interviewing children, thematic analysis

Introduction

Our nervous system tends to filter different information inputs into a common perceptual path, automatically integrating them into related processing patterns (Yau et al., 2010). This process, defined as *multisensory integration* may occur between stimuli which are perceived in different times, but they belong to a unique *temporal window* of integration (Bresciani et al., 2008). Multisensory perceptual mechanisms give priority to

the sense most relevant to the task needed (Petry et al., 2018). However, stimuli from different modalities can in some cases inhibit the information processing of a particular input event (Hoffmann et al., 2018). Neuroscience has shown that the brain is capable to activate integration mechanisms for analyzing multisensory cues and to adjust the information processing in order to achieve the optimal perception of the external cues (Ammirante et al., 2016; Elliott et al. 2010; Grahn et al., 2010). The illustration of various effects on human's temporal skills suggests that the temporal processing of cross-modal inputs both from the tactile and the auditory sensory channels should be examined at early and higher levels of information processing (Occelli et al., 2010). Multisensory engagement with musical rhythms has revealed beneficial effects on the perception of temporal events and sensorimotor synchronization abilities (Manning & Schutz, 2013; Su & Pöppel, 2012). However, even though there are direct links between movement, touch and audition, the underlying mechanisms that are engaged in beat sensitivity remain still largely unclear (Damm et al., 2020; Phillips-Silver et al., 2013).

This inquiry explored two fundamental musical skills: beat sensitivity and production. Beat is considered as the fundamental metrical sequence which underlies a musical structure and from which more complex temporal features emerge (Burger et al., 2018; Einarson, 2017; Large and Snyder, 2009; Nozaradan et al., 2011). The perception of beat is connected to brain mechanisms engaged in auditory information processing, involving multisensory integration mechanisms. During auditory beat perception, motor cortical areas are activated even in the absence of any movement, and auditory-motor interactions are reinforced (Villalonga et al., 2020). When listening to music, we respond also actively to the auditory and, usually unconsciously, to the tactile information by predicting and extracting the underlying temporal periodicity. This immediate bodily reaction has been given the term *Sensorimotor synchronization (SMS)* (Repp & Su, 2013). *SMS* is defined as the coordination of rhythmic movement with an external rhythm, covering a wide range of motor activities, such as finger tapping or moving our body in synchrony with external rhythms, including dance (Repp, 2006a; Repp & Su, 2013). Synchronization to music is also a multisensory process involving auditory and motor brain areas, whereby auditory, sensorimotor and cognitive mechanisms cooperate (Damm et al., 2020; Einarson, 2017).

Beat sensitivity and beat production are considered to be dissociative skills (Einarson, 2017). While beat perception appears in very early stages of musical development, the ability of listeners to adjust their motor responses to an external isochronous sequence or to a musical event increases with age, reaching an adult-like level around the age of 12 years old (Drake et al., 2000). On an empirical level both skills appear to be enhanced when lower bass frequencies dominate (Burger et al., 2018; Stupacher et al., 2016; Shivhare & Sanjram, 2021). Neurological analysis has also shown that audio features presented by low frequency instruments reinforce temporal skills (Hove et al., 2014; Kung et al., 2013).

Based on the findings of the fields of multimodal interactions, a novel bimodal teaching approach was presented in GSME 2018. This approach embraced embodied learning, Dalcroze Eurhythmics and principles of Kodály practice and it was presented to 60 primary school children (4th and 3d grades). The training covered a wide range of musical activities by designing a play-based set of 16 sessions which included different activities, such as moving, playing with instruments, singing, chanting, spelling, telling stories, making sound effects, beat and rhythm entrainment and improvisation. Children were assigned into an experimental-group which received a bimodal training with auditory-tactile stimulation and a control-group which completed the same activities without tactile feedback. The main research aim was to assess whether tactile information

could improve children's beat perception and production skills. Quantitative analysis was conducted to determine numerically whether there was an impact of the intervention on children's performance, using an age-appropriate tool, the *complex Beat Alignment Tapping Test (cBATT)* (Einarson, 2017).

To understand and reflect the perspectives of the children involved in the intervention and to gain deeper insight into the impact of the instructional intervention a sequential mixed methods procedure was employed which combined the quantitative inquiry with a qualitative approach. The qualitative study was designed to accomplish the experimental procedure and to provide insights into the possible effects of the intervention, facilitating our understanding of auditory-tactile musical experience. Qualitative methods might capture a distinctive character of social and interpersonal interactions; combined with quantitative methods that can provide a numeric description of a dataset, mixed-methods design may present research findings in a more accessible and therefore useful way to teachers and research community (Braun and Clarke 2013).

Here, we desire to present preliminary findings that may offer a deeper conceptual understanding of the research process and highlight key elements that the quantitative analysis had disregarded, suggesting that a mixed-methods design could assist educational research in this field.

Methodology

Regarding children's own perspectives as the best evidence about themselves (Instone, 2002), eight semi-structured interviews were conducted. Various factors had to be considered, such as how data should be obtained, recorded, handled, analyzed and finally reported (Jamshed, 2014; Kutrovatz, 2017). Two key parameters needed to be addressed: (a) the memory skills, particularly how much and for how long children can remember, retrieve from memory and communicate past events; (b) the musical experiences in the time span between the end of the training and the interviews (Hritz et al. 2015; Zajac & Brown 2017). Age-related trends in memory have indicated that children's recalls improves with age; after the age of 6 years old most children have the cognitive and language capabilities to be interviewed (Bauer & Dugan 2020; Schneider & Ornstein 2019).

Designing the Interview

Semi-structured interviews had a number of pre-determined questions, while they functioned also like conversations around the topic (Jamshed, 2014). There was a central core of questions and unwritten questions. Reactions and follow-ups were added during the conversations. To support children's recall, external cues were included, such as drumming on a percussion instrument, singing a particular melody from a music game and listening to musical excerpts from the experimental stimuli. The introduction was written in a scenario-based pattern (Jaidin, 2018) in which the reason of participating in the interview was explained (Ponizovsky-Bergelson et al., 2019) (see Table1).

Table 1. Scenario-Based Pattern serving as an introduction tool

Short-story Introduction

Hey! I am so happy to see you again! First, I have to tell you the reason I am here again and why you are here also. Don't be afraid, we are not going to write a test! (laughing). I would like you to share with me some memories from the previous year and if possible to answer to some questions. Because, you know, something very strange has happened to me... and I was really surprised. Two weeks ago I was walking around and I met a classmate of yours (I am not gonna tell who! (laughing). We talked about many different things, and when I asked him or her, if there was something that he or she

remembered from our music lesson, I took a negative response. Then I started asking several questions and I realized that he or she could not remember anything. Oh, that is so weird, I said to myself. I really want to go back and see what is going on. Maybe something really terrible happened during the period I am absent from school. Maybe there is a monster which devours children's memory. If one has totally forgotten what we did, then it is possible that everyone has no memories anymore. So, here I am, trying to solve this mystery of the lost memories.

Procedure

All interviews were conducted in the school library, in a quiet and friendly environment. Eight children from both groups were randomly chosen (4F; 4M). An ethical approval was obtained by the research ethics committee and a parental consent was received. The duration of the interviews ranged between 9.24min and 18.10min (M=12.3min; SD=2.67). At the beginning of each interview children were informed about the purpose of their participation with a short-story introduction, followed by direct and open-ended questions that were adjusted to their responses.

Interviews were recorded in *REAPER v6* via an *AKG D5* vocal dynamic microphone, using a *MacBook Pro v10.14.6*, while the teacher-researcher was noting special reactions, face and body expressions or other cues that could be used in the analysis.

Table 2. Example questions

Sample questions included

How did you feel about the music lesson?

If you were the music teacher, how would you plan the music lesson?

Analysis

Interview data were analyzed using thematic analysis techniques. The design of the analysis process followed seven steps (Braun & Clarke, 2013): transcription, reading and familiarization, coding, searching for themes, reviewing themes, defining and naming themes, and finalizing the analysis. Both data-derived codes and researcher-derived codes were established (Atkinson, 2018). While data-derived codes provide a “succinct summary of the explicit content of the data” (Braun & Clarke 2013:207), labeled as *semantic* codes, the teacher-research-derived codes interfere conceptual and theoretical aspects to draw inherent meanings and connotations which are labeled *latent* codes.

Findings

Research focused on four main themes as described in Table 3.

Table 3. Themes and Codes

Themes	Codes
<i>Impact of teaching intervention</i>	- Development of individual skills - The game's and the physical activities' impact - Experiences from group/team activities
<i>Experiences concerning the beat</i>	- Experiences concerning the perception of the beat and the ability to synchronize - Evaluation tests
<i>Physical classroom arrangement</i>	- Effect of spatial design and spatial function throughout the musical activities - Auditory - tactile surfaces experience

The music lesson at school

- Personal views and expectations regarding the music lesson
 - Comparing the music lesson with other lessons in the school schedule
 - The teacher's influence
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Impact of Teaching Intervention aimed at capturing children's personal perspectives and the impact the intervention may have had on cognitive and social skills.

Children enjoyed this learning experience and working on various musical activities. All students mentioned feeling relaxed and at ease, while in some cases they faced difficulties with different exercises. Music games and playing with musical instruments were the most favorable tasks (Gooding & Standley, 2011).

(...I liked it very much) *"most of all, what we did with the harmonium. That we made our own songs. And we wrote them. The one we did and we had also sung our own too, a bit scary"* (M, D control-group)

Team activities appeared to improve children's physical and emotional engagement and their social interactions.

"...that song with the ball that we passed around in the circle".. (do you remember how it was played?). "Yes! By heart!" (A, C control-group).

The children that completed the auditory-tactile condition could define more particular difficulties than their control-group peers, underpinning the assumption that tactile feedback may stimulate children's knowing-how and long-term memory in a different way.

"The classroom quizzes were getting a bit more difficult... eeerrr... that the games we played were a bit more difficult, so..." "...that thing when you had us listen to the notes and you told us if it was higher or lower. . . and you asked to follow the notes with our voices"(A, D experimental-group).

Experiences concerning the Beat summarized how children appreciated beat in a musical or temporal context and displayed their experiences with the *cBATT*. All children mentioned the heart rate to determine beat as something steady. However, only one student distinguished clearly beat from rhythm, while all other children mixed up the two terms in various occasions, indicating confusion about what beat really represents:

"it's one stable" (A, D experimental-group)

"it's...(short pause) the beat that you do that is steady" (A, D control-group).

"a song's pace" (M, D experimental-group)

"like a pattern" (L, C control-group).

This confusion was made clear in either cases of trying to define beat verbally or bodily where most of the children tapped spontaneously a repeated rhythmical pattern and corrected themselves when they defined what beat exactly represents:

(small pause) *"...our heart...(err)...the beat changes, it goes up, down, it changes"* (L, C control-group)

Only three children commented that they faced some difficulties in the perceptual evaluation task, mentioning particular the control-test:

"I found some trouble with one of the tests, the one upstairs in the classroom" (**testing**

beat perception) “we listen to the music and we want to do the same” (**what was the question?**) (**pause indicating he is trying to remember**) “There was the sound of the drum...” (**he is looking at me**) (**And you? What did you have to answer?**) “different sounds..different instruments..maybe” (V, C experimental group).

In contrast, all children detailed the instructions of the sensorimotor task and indicated their preference:

“I liked the classroom quiz that we did using the electronic drum”.. “I liked those quizzes with the drum, because, I don’t know, because it was nice. Because we tested our abilities and you saw how capable we were of following the rhythm” (A, D experimental-group)

Physical Classroom Engagement demonstrated the significance of the physical classroom arrangement, highlighting a strong relationship between the class architecture and students’ engagement. During the interviews all children expressed several positive impressions and preferences:

“...we were down on the floor and sometimes you had us listen to songs (eeerrrr) and we were relaxed (V, C experimental-group).

Children felt really relaxed. Not wearing shoes and lying down or sitting side-by-side on the tactile surfaces was “just super”. All children described feeling coziness, pleasure and joy and had a highly positive experience with the tactile surfaces:

“yes, we had those little stools and those cushions” (**Would you have the classroom this way?**) *“Oh, sure I would, Mrs! It was relaxing”* (L, C control-group)

Children from the experimental-group were asked to express if they felt uncomfortable with the vibratory signals. None of them expressed any annoyance, indicating various experiences with the tactile surfaces, such as relaxation, pleasure and motivation to move or dance:

“I liked them. No, ok, I liked them... it was rather musical. Now ok, it’s not very nice. They have taken away the carpets, too. They’ve only got desks...” (**disappointed**) (D, C experimental)

“we used to sit on them and listen”..(what were they doing while we were listening? remember?) ... “yes. It was like they were striking us with music” (**Did you like that?**).. *“I liked it when I lay down. And the music was tickling me. . . it made me wanna dance! (laughs)... because it danced along”* (V, C experimental-group)

The Music Lesson at School depicted the impact of the music class on children’s emotional competence. Children emphasized the aspects of teamwork, playing in groups, self-expression and interaction with each other and with the teacher-researcher. They highlighted the fact that music class is only once during the week and they suggested that it would be better to have music lesson in between the other subjects:

“I didn’t like having it during the last hour, because we were tired and bored. I would like having it either during the second or the fourth hour” (L, C control-group).

All students spontaneously compared Music lesson to Greek language or Maths, (even Gym), expressing a strong preference for the music lesson:

“I used to say... I used to say. . . Nice! Because I like Music more than Greek Language

or Maths. They make me feel bored..." (A, D control-group)

At the end of the interview they were encouraged to describe their ideal teaching practice, as if they were the music instructors:

"I would have this thing that Mrs does, writing notes. I would combine both I mean" (Oh, tell me about it) "We could write notes, ..., you could play them on the piano and then give us, let's say, a xylophone and we would have to find them and play them. And I would do this thing with the music and the instruments. And the one that Mrs also does, where she says if some music is sadder or happier. Because I can tell we are having fun" (When you get to move around, huh? Is this nice?) "Or when we play the instruments. I like it better when we play the instruments!" (A, D experimental-group)

Discussion

The present study has focused on qualitative data, provided by 3d and 4th grade children which initially participated in three different quantitative experiments (see Παπαδόγιαννη-Κουραντή & Αναγνωστοπούλου, 2019). The main purpose of the 'follow-up' qualitative research was to unitize, categorize, label and give examples of children's responses and to report how children made sense of the pedagogical practice, both with auditory-tactile stimulation and the particular teaching approach. Qualitative data aimed also at pointing out which impact may the intervention had on children's working and individual emotional practices. Questions examining a contradiction between the auditory-tactile condition and the audio-only experience were not included, but rather the major interest was to display the way that children from both groups realized musical activities.

Interviews have portrayed that social, emotional and learning skills of children have been positively affected by the multimodal and the embodied practices in the classroom, suggesting that the stimulation of different sensation channels improves music and cognitive skills (Manning & Schutz, 2013; Su & Pöppel, 2012). Children liked mostly team activities and highlighted the importance of active engagement, suggesting that the coactivation of multisensory channels and embodiment in music may have a positive impact on children's music performance and motivation (Damm et al., 2020; Shivhare & Sanjram, 2021). Auditory-tactile experience appeared to enhance children's musical skills and their ability to describe music features with greater accuracy, supporting research evidence that underlies that both skills are reinforced in the presence of lower frequencies, both on the behavioral and on the neurological level (Burger et al., 2018; Hove et al., 2014; Kung et al., 2013; Stupacher et al., 2016; Shivhare & Sanjram, 2021). Personal views and expectations of children on the subject of music lesson emphasized also the significance of playing music and music games (Gooding & Standley, 2011). Some children had fewer memories of the songs which they had sung and played. One reason may be that since the teaching process was similar for all songs, children could not reflect particular memories of song-activities or lyrics, but a general picture of their experiences (Bauer & Dugan 2020; Zajac & Brown 2017).

Educational research is rife with different methodological and ethical issues that needed to be considered. Some of them, such as the establishment of personal relationships in order to make children feel comfortable during the research, were overtaken by the fact, that they were familiar with the interviewer, as the teacher-researcher. Selecting the research-group required the consideration of exploring commonalities and differences in common age-groups, as well as the implementation of

a suitable qualitative approach. According to developmental perspectives, children of this age-group are considered competent to be able to participate actively in an individual interview. However, children's responses revealed that age-based differentiations should not be bounded to developmental stages. Discrepancies in music appreciation and in communication skills were observed during the interviews, since children's competences rely also on social interactions, family background and individual attributes. Reporting children's personal standpoints about the music lesson provided key themes for future reform of the teaching approach.

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