Investigating the Link Between Dalcroze Eurhythmics and Musical Expressivity in Novice Piano Students

Mélina Dalaire

Thesis submitted to the University of Ottawa in partial Fulfillment of the requirements for Master's in Piano Pedagogy

School of Music
University of Ottawa
Ontario, Canada

Abstract

The purpose of this study was to investigate the link between Dalcroze training and the improvement of musical expressivity in piano performance with a young population of novice piano students. This was tested by measuring variations in dynamics, timing and articulation, collected with MIDI data in a single-subject quasi-experimental design in which participants served as their own control. Data was collected from nine children either performing *A Short Story* (Lichner) or *Lightly Row* (folk song). During the *pretest phase,* the 9 participants performed their musical excerpt hands together and right hand only. Pretest 1 occurred one week before the intervention and Pretest 2 occurred immediately before the intervention. During the *intervention phase*, participants received three 60-minute Dalcroze lessons on three consecutive days by a certified and experienced Dalcroze teacher. During the *posttest phase,* participants performed the same excerpts under the same conditions as in the pretests. Posttest 1 occurred immediately after the 3rd Dalcroze lesson and Posttest 2 occurred 1 week after the intervention phase.

Our initial hypothesis stated that evidence of an intervention effect on musical expressivity would be measurable after the Dalcroze lessons. We expected that some participants may perform some posttest phrases with audibly perceptible differences. Musical expressivity was considered "changed" if the post-test phrase arch showed a) larger differences than the pre-test measurements and/or b) measurements would change from *opposite than expected results* in pretests to *expected results* in posttests. The results of the present study refute our hypothesis for all dynamics, timing and articulation analysis.

Keywords: Dalcroze, piano performance, young children, quantitative, musical expressivity, measurement

ACKNOWLEDGEMENTS

To my thesis supervisor: Professor Comeau thank you for your continuous support and encouragement throughout this process. I will always be thankful and grateful for your expertise, guidance, and generosity. You have a special talent in seeing the potential in others.

To Professor Donald Russel, Professor Louise Mathieu, Professor Erin Parks and Teri Slade: thank you for providing me with your expertise and assistance. Your guidance and help at various stages of this project was priceless.

To Jihye Kang for the time and commitment you gave for the success of this project.

To Lu, Mikael, Chen, Nicole and Rawaz: thank you for your professionalism, generosity, kindness, and availability in all technical aspects. You truly make the Piano Lab a wonderful place.

To Lina and Chantal: thank you for your onsite help and being part of my cheering squad.

To all my Dalcroze friends thank you for listening to my concerns and brainstorming with me at the NBS or in a café near Jarvis Street. A special thanks to Cheng Feng and Françoise.

To the parents of my teaching studio: thank you for inquiring on my progress and cheering me on.

To the Ottawa-Gatineau region Suzuki teachers who supported this project: Your collaboration made this study possible. A special thanks to Thérèse who supported me from the beginning of this project.

To all my friends: A special thanks to Tamar, for our weekly, bi-weekly or monthly pep talks; Nisreen, for your continuous positive energy from afar; Stephanie, for your inquisitive spirit and your encouragements; Emmanuelle, Sophie, Julia and François for your emotional support.

To ALL my family. A special thanks to Zack, Mika, Maude, and Aryanne for helping me laugh through the moments where I was discouraged or tired. To Thérèse and Henri for supporting me through some difficult moments. To my Mom and Dad and my siblings who continuously believed in me and my abilities to reach my goals.

Finally, to Alain. I share this thesis with you. Its completion coincides with our 25th wedding anniversary. Thank you for your gift of genuine love. I could not have done this without you. Thank you for your selflessness and your generosity.

Table of Contents

List of Tables

List of Figures

Glossary of Terms

Dynamics: relates to changes of key velocity in piano performances and measured in terms of MIDI units (1 unit=approximately 0.25 dB). Variances in key velocity are identified as increases or decreases in amplitude.

Timing: relates to changes of timing in piano performances and measured in terms of inter-onset intervals (IOI).

Articulation: relates to changes of overlapped or detached sound in piano performances and measured in terms of key-detached time (KDT) and key-overlap time (KOT).

Introduction

At the beginning of the 20th century, many general education movements in Europe and North America had shifted from instruction-based models to child centered models, giving birth to the "jardins d'enfants", or kindergartens that are still present in our school systems today. This shift, which began early with Pestalozzi (Pestalozzi, 1894) transcended into music education and transformed music educational systems. At this time, although music was still considered a complementary subject and still strongly tied to religious practice, Johann Pestalozzi's disciples transferred the age-appropriate Pestalozzian principles of child-centered education to music education by modifying the musical repertoire from the traditional religious hymns to children's songs (Comeau, 1995). Concurrently, in the United States, Lowell Mason's contribution to changes in music education rest on his application of movable *do* and rote singing as a more accessible and developmentally appropriate approach to teaching music to children (Mason, L. 1854; Mason, L.H.,1941). This controverted methodology challenged the theory-based fixed- *do* solfège approach of the end of the 19th century. However, it was not until the early 20th century with the advent of the Child Study Movement (Bradbury & Mcgoech, 1937; Wells, 1900) and the work of progressive education advocates such as John Dewey (1958) that music education became a discipline of study rather than a virtuous addition to the school curriculum of the day. The teaching of theoretical aspects of musical language was replaced by classes based on the appreciation of classical works. Parallel to music appreciation classes, active methods of music education appeared in Europe.

In music, "active methods" are defined as approaches in which the student actively participates in the learning process and by which musical knowledge is acquired through movement, song, and rhythmic activities (Dauphin, 2011). Active methods flourished in an era

where educational specialists and psychologists were interested in the learner and providing each child with accessible and meaningful education. The most well-known of these methods are those developed by Dalcroze, Orff and Kodály. For Emile Jaques-Dalcroze (1865-1950) it is through the body that the mind and ear acquire musical knowledge (Jaques-Dalcroze, 1948, 1965). Dalcroze Eurhythmics specifically engage students to experience musical expressivity through movement. For Carl Orff (1895-1982), rhythm is at the core of each experience (Orff & Keetman, 1950-1954; Werner, 1988). Through the spoken word and movement, children learn to internalize and create music, making the experience emotionally meaningful. On the other hand, Zoltan Kodály (1882-1967) emphasized the acquisition of a developed inner ear through singing and solfège based in the movable *do* system (Kodály, 1963; Kodály & Bónis, 1974). He strongly believed that musicianship was first acquired by singing and this within a very structured framework. This thesis will focus on the first of the active methods in music, the approach developed by Emile Jaques-Dalcroze.

Experiencing music through body movement

Many studies have provided support in favor of learning through movement, specific to Dalcroze. Seitz's literature review (2005) explores how several researchers have defined musical expressivity as it relates to its connection to movement and learning through the body. According to Seitz, Kivy's historical considerations, Papousek and Trehub's developmental theories and Davidson and Clark's considerations regarding the relationship between perceived musical expression and bodily gestures during a musical performance are only a few of many modern theories supporting the relationship between musical expressivity and the body's various roles. It is important to underscore the distinction between using the body to communicate expressivity through gestures and the process of learning through movement. Most of the literature

connecting the body to musical expressivity explores the former (Davidson & Correia, 2002; Davidson, 2012; Whiteside, 1997). Interestingly, Dalcroze remains the most-cited reference in movement-based learning (Ferguson, 2005; Karlsson & Juslin 2008; Seitz, 2005). Echoing Dalcroze's thoughts on musicality, Seitz investigates "how the body could be related to thought and musical expression**"** (p. 419). He supports the Dalcrozian perspective that musical expressivity is about the "fluidity and control of human movement by the physical dynamics of the body as well as to the social interactions of human groups**"** (p. 419-420). Furthermore, he proposes that in music "all major elements-melody, melodic contour, rhythm and phrasing, cadence points, accents, microvariations in timing and dynamics, and harmony are informed by and draw on bodily processes**"** (p. 431).

Various theoretical, philosophical, ethnological, and pedagogical studies support learning through the body. For example, themes evolving around "meaningful pre-reflective and reflective learning through body experience" (Juntunen & Hyvönen, 2004) talk about music "knowing". Walker (2000) offers an argument that learning through the body, as one does in a Dalcroze approach, support the position of "movement as metaphor", that music *is* movement and that the relationship between kinesthesia and understanding music is connected to the concept that "body is mind". Alperson's (1995) qualitative research design offers readers a description of the "Dalcroze" experience from the perspective of the teachers and adult students. In support of learning through movement she states: "Exploration through body movement influenced conceptual thinking about music because it made elements of music more concrete" (p. 16). Other authors have created collections of teaching materials based on a Dalcroze approach (Jacobson, 1989; Nalbandian, 1994) suggesting that movement-based activities enhance musicianship skills. These skills, in turn, enable students to develop sensitivity and

expressivity. These studies underline the importance of providing an enriching pedagogical framework in supporting the connection between movement and music.

For Dalcroze (Jaques-Dalcroze, 1976) the sensory experience develops musical perceptions and in turn, musical expressivity. These sensory experiences are related to physical movement. In turn, these physical movements are internalized and develop an understanding of musical expression. The intention of his Eurhythmics method (or *Rythmique*) was to "set up relations between instinctive bodily rhythms and those created by the will" (p. 5) through various large motor muscle activities. According to Dalcroze (1920), "of the 3 elements (sound, dynamics, rhythm), the last two depend entirely on movement and find their counterpart in our muscular system. Change of tempo (*allegro, andante, accelerando, ritenuto*), changes of force (*forte, piano, crescendo, diminuendo*), can be expressed by the body and the intensity of our musical feelings depends on our physical sensations" (p.160). Dalcroze believed that musical expressivity should first be developed by feeling music through the body; it is through whole body motion that rhythm, nuance, and gesture can be understood. Music expressivity can be felt by students when they are moving through space and students' musical experience can be perceived by the teacher through the quality of each movement, through the amount of space used, through the coordination of limbs and through the amount of energy used to produce a gesture in time.

For Findlay (1971), a well-known Dalcroze teacher, musical expressivity can be experienced through the body that moves to rhythm, tempo, and dynamics. In her book, she states that "with tempo as an expressive element in musical rhythm and (…) movement, not counting (which is the perception of time division and not time itself) is the secret of developing a real

feeling of time" (p. 5). Mead (1994), another influential Dalcroze teacher, identifies several elements that qualify the sensation of "feeling music":

> In a Eurhythmics experience, one feels the physical sensation of moving through space in the timing and with the energy prescribed by the music. One also feels the expressive qualities of the music, such as the well-timed *ritardando* or the gradual excitement of a rising sequence in a melody line. The word "feel" implies that a message was received through the senses, transmitted through the nervous system to the mind, which tells the muscles how to respond. There is a sense of being awakened to the life of the music when experiencing Eurhythmics. We speak of it as activating and integrating the senses, nervous system, intellect, physical body, emotions, and creative and expressive self. (pp 5-6)

Musical expressivity is thus experienced through movement, and it is through the physical sensations that music can be understood.

Urista (2003), a Dalcroze practitioner and academic who's research focuses on the relationship between music and movement, demonstrates the link between movement and musical expressivity by establishing *how* expressivity can be assessed through observation. She demonstrates, through the presentation of several video clip excerpts of Dalcroze classes, how "the moving body develops perception and kinesthetic associations" (p.1). She is promoting the idea that university-level students need to live the experience of music through their bodies to understand and analyse what they are hearing. The excerpts are divided thematically in the following categories: cadence, canon, beat and phrase, climax, and form. When discussing "climax" for example, she proposes that the reader view the video and then read her comments. In Schumann's *Mond Nacht*, her commentary guides the observer to notice the subtle changes in

the physical movements of the participants: “Notice in the video that students made adjustments in timing and energy by slightly delaying the arrival of the cruses or by putting more or less weight in the cruses to represent the subtle changes in tempo and dynamic fluctuation” (p. 4). When introducing *form* analysis of Bartok’s Song of the Harvest, she invites the observers to notice how, movement analysis is executed: “A movement analysis such as this, instead of sketching letter names, labels, or arches (on the score), instead mark these points with expressive physical gestures. Rather than talk about the form, which is traditionally done in formal analysis, the participants’ bodies ‘become’ the *form*” (p. 7). Urista guides the viewer to “measure” the differences in the quality of movement using time, space and energy with data collection tools normally used in a qualitative study: videos and observation.

Developing a theory of musical expressivity

Dalcroze was greatly influenced by his mentor Mathis Lussy (1828-1910) (Rubinoff, 2004) who shared similar ideas on developing musical expressivity: the student should be able to demonstrate through his performances that he perceives and experiences musical expressivity. According to Lussy and Dalcroze, the underlying issue with music education at the time, was that it was based on teaching individual pieces instead of teaching the rules of expression that could be applied to any piece (Rubinoff, 2004). Lussy actively sought to “formulate a connection between physiology and musical expression” (p.5). An example of this would be Lussy’s ideas on inhalation and exhalation in which inhalation, is what gathers energy, like the anacrusis of a musical bar. Exhalation is characterized as the downbeat, or like Dalcroze would explain, is similar to the crusis part of the musical bar. The goals of Eurythmics can be categorized into three parts: mental and emotional, physical, and musical. At the core of all three goals, ease of expressive movement and performance are key (Moore, 1992).

From a Dalcrozian perspective, musical expressivity is measured through the execution of correct rhythmic movement (Jaques-Dalcroze, 1920). Dalcroze (Jaques-Dalcroze, 1906) believed that most faultiness in musical performance was the consequence of a weak understanding of rhythm and/or expression. The inability to perform expressively is linked to a musician's misunderstanding of rhythm, nuance, and gesture. When the connection between rhythm and movement is faulty, awkward, or executed with difficulty, Dalcroze placed it under the heading of general *arhythmism* (1920). He identified nine events that cause inadequacies in musical expression. They are (a) Inability to maintain a movement for the whole of the natural duration in performance, (b) Quickening or dragging a movement which should be uniformly maintained, (c) Inability to increase or decrease the seed of movement when necessary, (d)Tendency to jerkiness or "bittiness" when the movement should be flowing, and vice versa, (e) Starting or finishing too early or too late, (f) Inability to integrate two movements of a different type (fast/slow, supple/rigid, forceful/gentle, etc.), (g) Inability to execute simultaneously two or more contrary types of movement, (h) Inability to shade a movement by continuous gradation (from piano to forte or vice versa) and (i) Inability to match the rhythmic or metric accentuation of a movement to the requirements of musical logic (as cited in Bachmann, 1993). As the purpose of this method is to experience and understand musical expression through movement, the intent of all activities in a Dalcroze class address these nine inadequacies, allowing students to better feel the musical and expressive intent of the music through movement.

For Emile Jaques-Dalcroze, the categorization of rules of expression appear in his *solfège* books (Jaques-Dalcroze, 1906, vol. 1, 2 and 3), not as a step-by-step method, but as a guide to understanding musical expression. He divided them into three categories: phrasing rules, nuance rules and accentuation rules. There are fifteen rules in the phrasing category and because these

rules demarcate rhythmic groupings, breathing and changes in pitch, they can be concurrently applied to the nuance and accentuation categories (as cited in Moore, 1992). For this thesis, these rules (see Appendix A) will guide the defining and measuring parameters of musical expressivity throughout this research.

Musical expressivity and piano playing

At the beginning of the 20th century, Dalcroze's ideas on musical education challenged the theory and intellectual based process that was being promoted in many *conservatoires* in Switzerland, Belgium, France, and England (Jaques-Dalcroze, 1999). He proposed that the status quo was inefficient, and that music could not be expressed through an instrument if not first experienced through the body. In *Eurhythmics, Arts and Education* (1976) he states: "Before adapting his nature to the movement and sound of an instrument, the pupil should be capable of experiencing in his own body- and then of analysing- both motor and aural sensations" (p.106). He stressed that if rules of expressive performance were taught instead of correcting students based on imitation, they would develop the ability to self-correct and play more expressively (Dalcroze, 1920).

In his paper *The Piano and Musicianship* (1999), Dalcroze expresses his belief that the young piano student must educate "the ear, mind and body prior to developing piano technique" (p.1). He suggests, that before a child can demonstrate expressivity on an instrument, he must first partake two years of Eurhythmic training to develop the "rhythmical feeling (of music) that depends on psycho-physical balance and not on counting" (p.9). He proposes that through the elimination of the nine events of *arrhythmia*, a musical performance would emerge. Musical expressivity can be acquired through the application of a set of specific expressivity rules. With the guidance of a trained Dalcroze teacher who understands these rules and applies them through

various Eurhythmics activities, a student will develop the ability to hear music internally and to spontaneously demonstrate the expressive nature of the music through body movement. This knowledge would then be transferred to the instrument. Ferguson's review of literature (2005) reports that the transfer of skill for certain musical concepts from large motor movement approaches such as Dalcroze Eurhythmics has some expected outcomes. Many qualitative, philosophical, and theoretical studies support this claim. Juntunen (2004) suggests that "knowing through bodily experiences" before conceptual understanding, encourage pre-reflective understanding. Her argument is in line with developmental theories such as Bruner's which propose that conceptual understanding can be transferred from the physical representation of an experience. However only a few studies have used experimental designs to investigate this possible connection.

Application of the Dalcroze principles to piano teaching

The following studies propose instructional Dalcrozian designs applied specifically to piano teaching either in a group or private setting. Nalbandian (1994) presents a series of Dalcroze teaching exercises to be applied to a university music major group piano class to improve the "inadequate" training of the following functional piano skills at the university level: sight reading, transposition, score reading, scales and improvisation. Each exercise is presented with a description, the objective, the procedure, and a discussion, highlighting the Dalcroze feature being applied. Similarly, both Jacobson (1989) and Jang (2002) propose a catalogue of movement-based instruction specifically for young piano students. Jacobson correlates 302 Dalcroze movement-based activities with the four-book Music Tree Series for beginning piano students by Francis Clark and Louise Goss (2000), reinforcing, and preparing the musical concepts presented in the method. Jang presents a collection of piano repertoire from beginner to intermediate level that is

intended to help students discover their personal style of expressiveness and develop their technical skills. Her repertoire selection explores concepts of beat, meter, dynamics, phrasing, articulation, and harmony through the three branches of Dalcroze pedagogy: Eurhythmics, Solfège and Improvisation. Chapter 15, entitled: "Learning Musical Rules of Expressing Phrasing" explains Dalcroze's rules of expression, which are based on rhythmic groups and how they relate to the rules of nuance and accentuation.

Schnebly-Black and Moore (2004) propose specific applications of Dalcroze's ideas of expressive movement tailored to the one-on-one piano lesson. Bringing the Dalcroze "body-as-instrument" to the secondary instrument (piano), is summarized by the authors:

> The Gestures should include awareness of all the energy sources: rhythmic flow, including accent and beat location (anacrusis, crusis and metacrusis); pitch location, including height, intervals, scale degree, and accidentals; patterns of repetitions, variations, and contrast; articulation; and the relationships of the parts (Supraficial) to the whole (Fundamental Gesture) (p. 145).

This handbook on the application of Dalcroze activities to the private piano studio includes a variety of exercises to address issues of coordination, memorization, rhythm, and ear training. In undertaking the expressive nuances of phrasing in a composition, the authors encourage the use of *plastique animée*[1] techniques to guide the student's performance. The transfer of expressive movement to piano technique is supported by Dalcroze himself: "The fingers have to accent certain notes metrically or emotionally, to glide softly over certain keys, fingers and wrists must be alternately light and heavy, active and passive, subtle and rigid: and so the child should be capable

[1] Plastique Animée refers to Dalcroze's idea of representing a musical idea through movement

of sensing throughout is whole body the many shades of intensity and touch" (p. 7 as cited in Schnebly-Black & Moore). Araneda (2019) proposes Dalcroze-based activities that would enhance the 3 branches (Repertoire, Technique and Musicianship) of study in the Royal Conservatory of Music (RCM) piano syllabus. Although many activities are proposed for all aspects of the syllabus, he emphasizes the development of musicianship skills within the sight-reading Four-Star books (2015). He proposes the application of many Dalcrozian principles and teaching strategies to the already established RCM program.

These five above-mentioned Dalcroze-based instructional programs are part of a growing number of publications focusing on the integration of movement-learning to piano instruction. It is interesting to note that parallel to Dalcroze, some 21st century educators and pedagogues have developed similar movement-based approaches to musical performance and the piano (Fritz, 1998; Pierce, 2007; Papageorgiou, 2012). Despite the growing interest between movement-based learning and piano instruction, very few empirical studies have attempted to quantify changes or improvement in musical understanding or expressive performance as it relates to movement instruction (Abril, 2011).

Research problem

Research pertaining to the benefits of learning through movement, especially regarding Dalcroze activities, is widespread. Many Dalcroze method specialists (Abril, 2011; Alperson, 1995; Bachmann, 1993; Juntunen & Hyvönen, 2004; Moore, 1992; Seitz, 2005; Rubinoff, 2004; Urista, 2003) have echoed Emile Jaques-Dalcroze's thoughts on musicality. Most of the literature written by Dalcroze practitioners (Findlay, 1971; Jacobson, 1985; Jang, 2002; Mead, 1994; Nalbandian, 1994; Schnebly-Black, 2004) proposes teaching tools and activities for developing and deepening the musical experience. These teachers provide activities and exercises to address

arrhythmia and foster musical expressivity. The fundamental ideas and principles of the Dalcroze method have been applied in music education with young children (Findlay, 1971; Gell, 1967; Mead, 1994), choirs and choir conducting (Caldwell, 1995; Daley, 2013; Meints, 2014; Schenenberger, 2008), private piano studio (Jang, 2002; Melville-Clark, 2000; Schnebly-Black & Moore, 2004) and school populations (Abramson, 1998). Two research papers have provided an in-depth review of literature pertaining to Dalcroze Eurhythmics: Mathieu (2010) and Anderson (2011). Mathieu divides her work into the following categories: historical studies, studies pertaining to educational program development, comparative studies, empirical and descriptive studies specific to children and to adults, and theoretical studies. Anderson provides readers with definitions and research studies pertaining to kinesthesia[2], music education, philosophical studies as well as a review of empirical studies on the effectiveness of Dalcroze Eurhythmics in music education until 2008.

These reviews of literature confirm that very few empirical studies have measured the effect of Dalcroze pedagogy on expressive performances. Limited research supports the possibility that movement-based learning improves musical expressivity (Abril, 2011; Ferguson, 2005; Fritz, 1998; Lewis, 1; Mangenello, 2011; Papageorgiou, 2012; Pierce, 2007). Some studies have focused on this relationship exclusively within a Dalcroze instructional design (Butke, 2014; Caldwell, 1995; Daley, 2013; Seitz, 2005; Urista, 2003). In one study, the specific link between Dalcroze training and the improvement of musical expressivity in piano performance with university students was explored (Melville-Clark, 2000). The intent of the present study is to investigate this

[2] Kinesthesia broadly refers to movement, muscle memory and hand-eye coordination. Cognitively, it may refer to an awareness of our bodies' sense of balance and spatial perception (Choksy, Abramson, Gillespie & Woods, 1986).

same link between Dalcroze training and piano performance but with a younger population of novice piano students.

No experimental studies were found that measure changes in piano performance after any type of movement-based instruction, including Dalcroze Eurhythmics. The measurement of expressive performance using a rating scale in the content of a Dalcroze approach is limited to one article and one research study: Butke (2014) and Melville-Clark (2000). Butke's article (2014) proposes a self-assessment tool in the evaluation of a *plastique animé*e. The purpose of a *plastique animée*, an integral part of the Dalcroze methodology, is to create "music in motion", to transfer sound to movement and to demonstrate a deeper understanding of the music. The author presents two age and grade school level specific rubrics for the assessment of *expressive and purposeful movement* (see Appendix B). For example, the four rubrics for the Grade 2 class were: rhythmic integrity, legato/staccato, appropriate creativity, and expressivity. The rubrics for the Grade 6 class were: rhythmic integrity, instrumentation, dynamics, appropriate creativity, and expressivity. What is of interest to us is that the given criteria provide us with an example of qualitative descriptors for musical expressivity based on Dalcrozian principles. Both age groups share the same four descriptors that correlate to a four-point rating scale of: *Unacceptable, Progressing, Satisfactory and Outstanding*. The four statements related to musical expressivity are as follows in Table 1:

Table 1

Butke's four-point rating scale

Four-point Scale	Descriptors
Unacceptable	Rarely demonstrates flow, balance, extension, sensitivity. The quality of the movement does not match the quality of the sound.
Progressing	Inconsistently demonstrates flow, balance, extension, sensitivity. The quality of the movement sometimes matches the quality of the sound.
Satisfactory:	Usually demonstrates flow, balance, extension, sensitivity. The quality of the movement usually matches the quality of the sound
Outstanding	Clearly demonstrates flow, balance, extension, sensitivity. The quality of the movement clearly matches the quality of the sound.

Note: Adapted from Butke, M. (2014). Assessing expressive movement: Measuring student learning outcomes in the general music classroom. *General Music Today, 27*(3), 23-27. doi:10.1177/1048371314525782

Melville-Clark (2000) explores how the application of Eurhythmics can improve expressive performance of advanced university level piano students. This is the only study that was found that measured changes in parameters of musical expressivity in piano students. The eight participants were piano majors and have previously had a minimum of three months Dalcroze training. Data was collected at one facility and participants were both the Eurhythmics and private piano students of the researcher. A pilot study done with two students allowed the researcher to modify the rating scale, some technical issues, and clarifications regarding some terminology. The order of activities for data collection included: the pre-test recording, the individual piano lesson that included Dalcroze-related activities, the post-test recording and the interview session. The five musical concepts defined as part of musical expressivity were: tempo, beat, phrasing, dynamics, and articulation. Each of these concepts was explored in the piano lesson and followed the order of events presented in Table 2:

Table 2

Melville-Clark's chronology of events for research design

Step 1.	Participants were asked to internalize and play their prepared work (inner hearing)
Step 2	A kinesthetic response was set up through gross motor action involving stimulation of the nerves, muscles and proprioceptors "*This time move through the space using any movement you like and show the line of the phrase with the scarf. Change direction if you sense the music changes direction or reaches the end of a phrase length" (p. 58)*
Step 3	The participant was required to consider and/or verbalize this experience "*How did that make you feel?" p 58*
Step 4	If desired, the participant could write, draw or mark a visual representation of the internal image of the piece
Step 5	The participant returned to the piano and applied the imagery to the score changing and adapting as necessary to bring about the desired effect trough performance/improvisation "*Let's take that feeling to the piano. Can you play what you did with the scarf? (p. 58)*

Note: Adapted from Melville-Clark, P. (2000). Eurhythmics and Piano Performance: A Study to determine the benefits of applying Eurhythmic techniques to the preparation of piano works by undergraduate musicians. (Unpublished master's thesis). University of Southern Queensland.

After data collection, a panel of experts evaluated the pre-and post-test audio recordings. The 19 criterion statements (see Appendix C) were designed to reflect the five musical concepts of musical expressivity of tempo, beat, phrasing, dynamics, and articulation. Each of the 19 statements of the evaluation tool was accompanied by the following rating scale: 0-N\A;1-*Not at all; 2-Infrequently; 3-Some of the time; 4-Mostly-At all times*. The order of the pre- and post-test recordings for each participant was random. The evaluators' panel of four professionals (all seasoned teachers, examiners, and skilled piano performers) listened to the blind pre- and post-test recordings and rated most second recordings as improved based on performance criteria. For my study, the Melville-Clark research is of interest because of its pre-posttest design and its

subject matter although many contextual features will differ such as the age and the Dalcroze experience of the participants. The main difference with our study is the use of empirical evaluation based on MIDI data instead of using a factorial analysis tool.

Chapter 1: Review of literature

To understand how expressive playing could be studied and measured, the following literature review will present research pertaining to the measurement of musical expressivity using computational models.

1.1 The measurement of musical expressivity with computational models

Since the 1980's, the purpose of most research using computational models has been to establish, define and measure parameters of musical expressivity (Widmer & Goebl, 2004) by formulating and applying a particular set of rules that establish the parameters for musical expressivity (Frieberg, Bresin, Sundberg, 2006; Sundberg, 1994; Reep, 1998, 1999a, 1999b; Todd, 1985). Prevalence has been given to keyboard performances because of tools such as MIDI and other software that enable the isolations of variants in the musical performances. Preceding computational models, theorists Lerdahl & Jackendoff (1983) advanced a theory to explain how music is "formulated in terms of rules of grammar" (p. xii). In *Generative Theory of Tonal Music,* they focus on grouping and metrical structures of music, suggesting that the perception and understanding of these structures are hierarchical and based on the relationship of rhythm and pitch and the perceived patterns of tension and relaxation. They propose that musical events are predictive and outline four hierarchical dimensions in music: grouping structure, metrical structure, time-span reduction, which is "the structural importance of pitch events within rhythmical units of the piece" (p. 8) and prolongation reduction, which is the perceived patterns of tension and relaxation. According to Lerdahl & Jackendoff (1985), these dimensions are determined by well-formedness rules and preference rules. These well-formedness rules are specific to the possible structural descriptions and the preference rules relate to the listener's hearing of the excerpt. (p.9) Based on Lerdahl & Jackendoff's ideas, some researchers (Clarke,

1987, Todd, 1985) have used computational models of piano performances to quantify the expressive components of musical structure. Although many models exist (Widmer & Goebl, 2004), we are most interested in those that have created a rule-based system that reflect the expressive performance idioms of western classical music in line with Dalcroze's ideas of musical expressivity.

Bruno Repp (1998, 1999a, 1999b) proposed to quantify the qualities of an expressive performance based on the recordings of professional musicians playing a single musical phrase from a Chopin étude[3]. In the first study, four timing strategies were identified: *ritardandos* at the end of a phrase; accelerations; downbeat lengthening; *ritardandos* between and within melodic gestures (1998). Repp concludes that although timing is only one aspect of expressive performance, it is an important one. Its correlation to expressive dynamics is explored in a second study where Repp (1999a) defines dynamics as "the relative intensities of successive and simultaneous tones" (p. 1972). Because dynamics are difficult to measure, only horizontal dynamics are analysed. Five strategies in dynamics were identified within the performances: *crescendo; decrescendo*; basic dynamic volume; variability range; dynamic profile. Overall results show that melody has a wider overall dynamic range, compared to the accompaniment and that no relationship was found between expressive timing and expressive dynamics. The final phase of Repp's study (1999b) was to correlate the measured features of both expressive timing and dynamics to the perceived expressive nature of performances by a panel of judges. After listening to the performances, the panel of judges rated the recordings on a 10-point scale. The overall results demonstrated that although other aspects of performance such as texture, tone and touch contributed to the aesthetic impression of the performance, timing and dynamics are

[3] Étude in E major, op. 10 n. 3 (Bars 1-5).

the primary expressive dimensions that are measurable and assist in determining the "swelling" of a musical phrase.

Similar to Repp, Friberg and his colleagues (1991; 1995a; 1995b, Friberg & Sundberg, 1999; Friberg, Bresin & Sundberg, 2006) have done extensive work in the creation of a rule system link to expressivity for computer-generated musical performance. The team at Kungliga Tekniska Högslolan (KTH) [Royal Institute of Technology] have, over the last two decades, built several rule systems for model-generated performances at the keyboard which are divided in two parts: a context part (describing when to trigger a rule) and an execution part (describing how to perform this musical situation) (Friberg, Bresin & Sundberg, 2006). The aim of these rule-based systems is to find general principles of expressive music performance and consists of up to 30 rules coming from different aspects of music performance in different styles. The researchers at KTH have isolated 21 basic aspects that can be used for most musical styles: articulation, tempo and sound level, phrasing, intonation, micro-level timing, rhythmic patterns, and tonal tension (see Appendix D). The rules "act upon a range of structural characteristics of music, providing an expressive interpretation of musical structure" (p. 148). Measuring musical expressivity with computational models proposes to unveil the link between certain aspects of musical structure, performance choices and the rules that govern these choices. For the present study, the creation of MIDI-generated musical parameters was inspired by KTH's rule system and guided by Dalcroze rules of musical expression. These rules served as a guide to the operational definition of music expressivity chosen for this research. Consequently, the use of MIDI data will provide the necessary information to measure dynamics (velocity), timing (tone lengthening) and articulation (key overlap time -KOT and key detached time-KDT).

Noticeable differences in timing and velocity in piano performance

Research in piano performance use MIDI data to measure key timing (tone lengthening) and key velocity (dynamics). In measuring musical expressivity, Reep (1999) investigated what the threshold may be for timing to be audibly perceptible to the human ear. He reported that a 20ms difference in key timing for non-musicians and a 35 ms for non-musicians is required for a difference to be noticeable. For measuring key velocity, researchers still do not know what this threshold may be. Bellis (2003) reports that only a small number of studies has investigated perceptible sound intensity. Slade et al. (2019) found that the JND (Just Noticeable Difference) for musicians and non-musicians in detecting key velocity changes was approximately 1-2 dB, which translates roughly to 2-4 units in MIDI numbers depending on each instrument or model's specifications. Based on these references, the thresholds for audibly perceptible differences for this study will be: 20 ms for key timing and 4 units for key velocity.

1.3 Scope of research project

The lack of empirical studies measuring musical expressivity and Dalcroze training support the need for more research. In the present study, we propose a single-subject quasi-experimental design with the use of MIDI data in the measuring of musical parameters. To the researcher's knowledge, no other study has measured musical expression at the piano after Dalcroze training with novice students using MIDI data.

Within the scope of this study the following terms have been defined:

1. **A [musical] phrase** is an event within a musical composition comprising of rhythmic and pitch patterns that has a beginning and an end.

2. **A phrase-arch measurement** includes the manipulation of timing (IOI), dynamics (MIDI velocity), and articulation (key-overlap time-KDT and key-onset-time-KOT) by the performer within a musical phrase.
3. **Audibly perceptible** is defined as changes that are large enough in piano key timing and key velocity to be noticeable to the trained musician. A timing difference of 20 ms in IOI would be considered audibly perceptible. A key velocity change of 4 units in MIDI numbers would be considered audibly perceptible.
4. **Musical expressivity** is be defined as the manipulation, by the performer of timing, dynamics, and articulation to produce arch-like phrases which increase in speed and intensity during rising pitch sequences and decreases in speed and intensity during lowering pitch sequences.
5. Musical expressivity will be considered **improved** if the evaluation of MIDI timing and velocity data shows that the posttest phrase arch measurements are greater than the pre-test measurements within audibly perceptible ranges for both dynamics and timing.
6. Musical expressivity will be considered **changed** if the pretest measurements shift from increases (opposite than expected results) to decreases (expected results) or vice versa in the posttest measurements.

Research questions: Can we quantify the effect of Dalcroze Eurhythmics training on the musical expressivity of young novice students' performance at the piano after a short intervention? Can changes in timing and velocity using MIDI data be audibly perceptible?

Hypothesis: We hypothesize that evidence of an intervention effect on musical expressivity will be measurable after the Dalcroze lessons. We expect that some participants may perform some posttest phrases with audibly perceptible difference no smaller than 20ms in IOI for timing and changes no smaller than 4 units in MIDI numbers for key velocity.

Chapter 2: Methodology

Very few empirical studies have attempted to quantify the effects of Dalcroze training on musical acquisition (Abril, 2011). Some experimental studies have measured the possible effects of Dalcroze Eurhythmics on various musical variables such as timing, melody, and rhythm (Berger, 1999, Blesedell, 1991, Crumpler, 1982, Rose, 1995) with young children. Some articles and instructional books advocate the development of musical expressivity through movement (Clarkson, 1980, Schnebly-Black & Moore, 2004) however only the Schnebly-Black and Moore is specific to Dalcroze training. One article proposes an assessment tool for measuring musical expressivity related to Dalcroze training (Butke, 2014) and only one study measures the effect of Dalcroze lessons on piano playing (Melville-Clark, 2000). Different from our study, Melville-Clark used a set of criteria used by a four-member jury listening to the performance to quantify perceptual changes in the performances of university-level students. No study was found that uses empirical MIDI data to measure musical expressivity with novice students after Dalcroze training.

In contrast, the measuring of musical expressivity with the use of computational models and data analysis with MIDI is widespread (Goebl, Dixon & Schubert, 2014; Friberg & Battel, 2002). The purpose of this study is to investigate if a relationship can be established between the participation in Dalcroze activities and an increase in musical expressivity when performing at the piano. A quasi-experimental design was used to measure the impact of three Dalcroze Eurhythmics lessons on the expressive parameters (dynamics, timing and articulation) of piano performances of novice piano students. Musical expressivity was measured with the MIDI data obtained from each performance. In *Tests and Measurements in Music*, Lehman (1968) argues

that quantitative methods enhance the study of the musical process through the production of conclusions attained by accurate and rigorous research designs.

2.1 Design: Within Dalcroze pedagogy and its supporting philosophy, the understanding of musical knowledge is felt through and in the body over several years of training. In investigating this link within an empirical quantitative research design, we would ideally have our participants experiencing Dalcroze classes over several weeks or several months. A larger group of participants would have allowed for both a control group and an experimental group. However, because of a limited time frame, participant availability and ensuring that a certified Dalcroze teacher prepare and disseminate the classes, our design required some tailoring all the while being mindful of reliability and validity issues.

A single-subject quasi-experimental design in which participants served as their own control took place at the University of Ottawa's School of Music in the Spring of 2019. Data was collected from six children performing *A Short Story* (Lichner) and three children performing *Lightly Row* (German folk song). During the first part of the experiment, referred to as the *pretest phase*, the 9 participants performed their musical excerpt hands together and right hand only. Pretest 1 occurred one week before the intervention and Pretest 2 occurred immediately before the intervention phase. During the *intervention phase*, participants received three 60-minute Dalcroze lessons on three consecutive days by a certified and experienced Dalcroze teacher. During the 3rd and final part of the experiment, referred to as the *posttest phase*, participants performed the same excerpts with the same conditions as in the pretests. Posttest 1 occurred immediately after the 3rd Dalcroze lesson and Posttest 2 occurred 1 week after the intervention phase. The Dalcroze lessons were given by Jihye Kang, a certified Dalcroze teacher. All teaching sessions were recorded by video for referencing purposes.

2.2 Participants: The exclusive selection of Suzuki students ensured that all participants were trained the same way. Establishing this consistency in the musical training of the participants avoided potential variability in results because of different pedagogical approaches. Participants were recruited through the Ottawa/Gatineau Suzuki Piano Association and other independent Suzuki piano teachers in Ottawa/ Gatineau. Suzuki teachers were contacted to recruit potential participants. An invitation to participate in three free Dalcroze workshops was sent out to all students. Students who registered for the workshop were contacted directly by the researcher to confirm registration for the free workshop and were invited to participate in the study (Appendix E). Participant selection was based on age, skill, and training: Suzuki-trained students between the ages of 5-12 years-old having either *A Short Story* or *Lightly Row* as a 'review'[4] piece were invited to participate in our study. A fourth inclusion factor was that participants had no prior experience with a certified Dalcroze teacher. The nine children who fulfilled the inclusion factors performed either *A Short Story* (six participants) or *Lightly Row* (three participants). Participants and parents were not told about the intent of the study until the end of data collection. Teachers were told: a) that their students would be required to perform either *A Short Story* or *Lightly Row* from their review repertoire; b) that they will participate in three Dalcroze group lessons; c) that piano performances would be measured to analyse certain aspects of performance; and d) that they will be asked to continue reviewing *A Short Story* or *Lightly Row* at home for the duration of the study and that this piece should not be played at their regular piano lessons.

[4] In the Suzuki method, students are expected to continue reviewing pieces they have already mastered in preparation for a recital where they will have to play all the pieces contained in one book. These book recitals are milestones in their development. *Lightly Row* is in Book 1 and *Short Story* is in Book 2.

2.3 Data collection

2.3.1 Questionnaire: A questionnaire was administered to each participant and their parent when they arrived for the first visit. Information that was collected included: demographic background information, information regarding their history of Suzuki piano lessons, other music lessons, information about their music teacher and their practice habits. (Appendix E). This data was used to provide descriptions of the population (Boyle and Radocy, 1987) and ensure that the sampling pool be as homogenous as possible.

2.3.2. Logbook: Each participant's parent was asked to keep a logbook of all home practice sessions relating to the review of *A Short Story* or of *Lightly Row*. Specific requirements were imposed for home practice during all phases of the experiment (see Appendix F). These requirements remained consistent and were established as to not overwhelm the students and ensure consistency in every phase of the experiment. The guidelines included: reviewing the entire piece hands separate and reviewing the entire piece hands together for three to five minutes for a minimum of three days and a maximum of four days per week. The parent or caregiver involvement was limited to ensuring that the piece was practiced from three to four times per week for a duration of three to five minutes. Although our analysis only measured the first 8-bars of *A Short Story*, we believed that asking participants to exclusively practice these 8-bars for three to five minutes would be unmotivating because this excerpt takes approximately 15 seconds to perform. We maintained that students performing either *A Short Story* or *Lightly Row* practice the whole piece. Our goal in requesting hands separate instead of right hand alone was to review each hand equally.

2.3.3 Musical excerpt recordings: Participants performed their musical excerpts twice before the intervention (pretests) and twice after the intervention (posttests). For *A Short*

Story, the students played the 1st four phrases hands together and right hand alone for all four recordings. For *Lightly Row*, the students played the 5 phrases of the piece both hands together and right hand alone for all four recordings.

2.4 Procedure:

2.4.1 Chronology of events: All participants came to the University of Ottawa for a total of five visits to fulfill various tasks that included fulfilling administrative activities, recording pre and posttest performances and participating in the Dalcroze lessons. Table 3 shows which activities occurred during the five visits.

Table 3

Chronology of events for research design

	Visit 1	Visit 2	Visit 3	Visit 4	Visit 5
Timeline	One week before intervention	One week after Visit 1	One day after Visit 2	One day after Visit 3	One week after Visit 4
Activities					
Administrative tasks	-Distribution of practice log to parents -Consent forms signatures for students and parents -Administering questionnaire by researcher	None	None	None	-Return of logbooks by parents -Debriefing form signatures
Pretests and posttests	1st pretest recording	2nd pretest recording-immediately before the 1st Dalcroze class	None	1st posttest recording-Immediately after the 3rd Dalcroze Class	2nd posttest recording
Dalcroze lessons	None	1st Dalcroze class	2nd Dalcroze class	3rd Dalcroze class	None

2.4.2.1 Administrative tasks: All documents including the questionnaire, logbook, information letter, consent and assent forms, debriefing documents and questionnaire were prepared in accordance with the University of Ottawa's standard Ethics procedures. Distribution of documents and signature requirements were met during visits 1 and 5. The information letter, recruitment documents, consent, and debriefing documents are included in Appendix E.

2.4.2.2 Pre and Posttests: To ensure a strong research design, two pretests and two posttests were administered. Two pretests allowed us to establish a baseline to which we could compare with the posttest outcomes. The timing of the second pretest and the 1st posttest was designed to "capture" the optimal "effect" of the Dalcroze lessons from the onset to the completion of the experimental phase. The pre and posttest performances were recorded during Visits 1, 2, 4 and 5.

The recordings were done at the University of Ottawa's Piano Lab on a Disklavier Mark III. The MIDI generated data and video files were recorded and saved three ways: (a) directly on the researcher's laptop for categorization and analysis; b) on the Piano Lab's video recording device's minidisc for backup and c) on the Piano lab's floppy disk for MIDI backup. In accordance with standard ethics procedures, the data collected on the researcher's personal laptop and on the Piano Lab's devices will be destroyed after 5 years. The participants all performed either *A Short Story* by Lichner or *Lightly Row* (German Folk Song) (Appendices G and H). Recordings were verified immediately and transferred to the researcher's laptop.

2.4.2.3 Dalcroze Lessons: Anecdotally, piano teachers using Dalcroze-based activities during one-on-one lessons report improvements (Schnebly-Black & Moore, 2004) in

musical concepts transferred to the instrument. An experimental design in which only one Dalcroze lesson would have been given may not have been enough to have an effect, especially with young students who had not experienced a movement-based music lesson beforehand. By providing participants with three lessons on three consecutive days, it may be possible for internalization of concepts to occur, which in turn may result in some expected effects of the intervention. The participants were divided into two groups based on their age and what piece they were playing. A larger number of students participated in each class to ensure that movement-based group learning could occur. For the *A Short Story* group, nine Suzuki-trained children between the ages of 7 and 11 years old participated in the free Dalcroze lessons. Six of these children accepted to participant in the study For the *Lightly Row* group, six Suzuki-trained children between the ages 5 and 7 years old participated in the free Dalcroze lessons. Three of these children accepted to participate in the study. Only the Dalcroze teacher and the researcher were present with the children in the classroom. Classes were video recorded as backup for the researcher. These files were not and will not be used for future data analysis.

Activities during the lessons focused on the understanding of phrasing based on Dalcrozian principles and the phrases found in *A Short Story* and *Lightly Row*. The musical events in the score that were identified and corresponded to Dalcroze rules of phrasing, nuance and accentuation served as a guide for lesson-plan development. The Dalcroze teacher prepared three lessons for each group based on the musical components that were to be measured in the study. The lesson plans (Appendices I and J) were slightly modified after each lesson in response to the children's reactions. An important principle of Dalcroze pedagogy is the ability to adapt to students' needs. Lesson plans were themed around the quality of phrasing for either *A Short Story* or *Lightly Row*. The activities offered students an opportunity to acquire a "learning-

through-movement" experience.

2.5 Analysis

2.5.1 Measurement and selection of musical phrases: Specialists in music audio analysis Friberg et al. (2006) echo Lerdahl and Jackendoff's (1983) ideas on western classical music's hierarchical structures. Of interest to us is the musical phrase which is considered a "high-level" issue in which expressive performance generate "an arch-like shape" that can be applied to tempo and dynamics. Typically, a phrase is slow/soft in the beginning, fast/loud in the middle and ends slow/soft. This model of an "expressive musical phrase" creates a crescendo/accelerando, decrescendo/rallentando pattern which have been demonstrated in various MIDI analysis studies by Todd (1985). This same rule set was again reviewed and applied by Repp for Schumann's Trauemerei (1992). It is important to point out that the performance rules are essentially a set of principles that follow or enhance the structure of the music. KTH's *phrase arch rules* (1995b) outline timing and sound level parameters (Appendix D) that correspond to the expressive contours that are outlined in music with long phrases. The production of an expressive musical phrase can be measured by parameters of timing and dynamics (intensity) much like Dalcroze's own rules of phrasing, nuance, and accentuation. (Appendix A). These rules have guided the measurement parameters and sub-sequentially the analysis parameters for the present study. Two musical excerpts were selected for analysis: the first 4 melodic phrases of *A Short Story* and all 5 melodic phrases for *Lightly Row*. It was decided to limit the analysis of the first 4 phrases of *A Short Story* because of the large amount of data that each phrase generated. It was decided to include all five phrases of *Lightly Row* because of the limited number of parameters that were to be analysed in each phrase

2.5.2 Hands together and Right-hand performances: In a small pilot test with

adult music teachers as subjects, several recordings were collected under several circumstances. Outcomes for most performances were as expected: flat performances had lower medial scores than expressive performances. However, expressive performances with right hand alone scored higher than hands together performances in both amplitude and timing means. As we were not certain why this occurred, we asked the young students to include both right hand and hands together directives for practice and data collection purposes.

2.5.3 Raw Data*:* The raw data collected for analysis was generated from the pre and posttest piano performances on the Disklavier recordings and saved to a floppy disk. These audio files were uploaded to an audio cutter software, in which all left-hand notes and any additional melodic notes were cut, leaving only the melodic notes that were part of the targeted phrases for analysis. The modified MP3 data was then converted to MIDI numbers and entered into the *MIDI Analyzer*, a program created by Rawaz Kader Kahraman, a software engineer at the Piano Lab. This software processes the MIDI numbers by dividing them into dynamic, timing or articulation data.

2.5.4 Midi Analyzer: Our goal was to quantify variations in dynamics (amplitude), timing (tone lengthening) and articulation for each performance in relationship to each musical phrase being analysed. The *Midi Analyzer* software tool generates columns and graphs that includes numbers on tone lengthening, (using IOI or inter onset intervals), dynamics (key velocity) and articulation (key overlap time and key detached time). The tool is coded in C#, which uses multiple libraries to handle UI and .xlsx files. All variables are calculated manually written within the code. (R. Kahraman, personal communication, October 9, 2019).

Chapter 3: Results

The following section presents the results of our analysis for *A Short Story* and for *Lightly Row* performances. Dynamics, timing, and articulation measurements are presented by phrase. *A Short Story* has four phrases and *Lightly Row* has five phrases. Each phrase analysis is correlated with its associated Dalcroze rule and intervention activities. Description of results and short summaries complete each analysis. The MIDI numbers for each parameter was calculated in a specific way. Within the scope of this analysis, the following specifications have been defined:

1. *The mean score of a slur* refers to the number obtained by adding the MIDI numbers of a group of notes and dividing that number to obtain an average. This was done for both dynamics and for timing.
2. Increases and decreases between two numbers for dynamic and timing measurements was calculated by adding or subtracting the distance in absolute value between the two numbers.
3. The term *amplitude* or *amplitude numbers* refers to measurements (MIDI numbers) relating to dynamics.
4. *Amplitude increase* or *amplitude decrease* refers to the difference between two MIDI numbers. A higher MIDI number = a higher amplitude result. A lower MIDI number=a lower amplitude result
5. Reference to *timing increase* or *timing decrease* = MIDI numbers that represent the IOI (inter-onset interval) between two consecutive notes. A positive number=a slower speed. A negative number=a faster speed.

6. The term *IOI speed* is used interchangeably with *MIDI numbers* in reference to timing measurements.
7. MIDI numbers presenting variations in articulation= KDT (Key-Detached time) and KOT (Key-Overlap time). A positive number=KDT and a negative number=KOT.

3.1 Results for *A Short Story*

3.1.1 Dynamics-HT

Dynamics-A Short Story Phrase 1-HT

The results of the dynamic measurements of Phrase 1 are associated with the following rules and intervention activities:

Dalcroze rule: Every descending melody ought to be sung with a *decrescendo*

Dalcroze activities during intervention: The experience of musical phrases with decrescendo was practiced through movement and singing. The teacher used both improvisational materials at the piano and the familiar 4 phrases from the *A Short Story* melody (Figure 1)

a) Lesson 1: Painting by sound
b) Lesson 2: Drawing rainbows, elastic band exercise
c) Lesson 3: Ball exercise

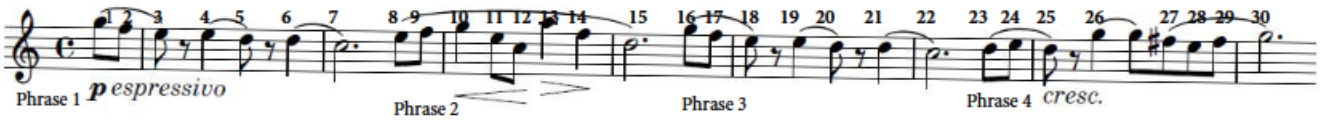


Figure 1. Excerpt from *A Short Story* illustrating the section of the musical score that was analysed.

The dynamics in Phrase 1 were measured by taking the mean score of the 1st slur (notes 1-2-3) and comparing them to the mean score measurements of the 3rd slur (notes 6-7).[5] In Table 4 each number corresponds to the mean score of each slur. Decreases or increases in amplitude between Slurs 1 and 3 complete each column. It was expected a) that posttests would show

[5] The measurements of the 2nd slur 2 note-slur was not analysed because we are interested in the decrease from the beginning to the end of the phrase. How the 2nd slur was managed was not addressed in the Dalcroze lessons but has been included for transparency.

decreases in amplitude between slurs 1 and 3, and b) that the decrease numbers (negative numbers) would be higher for the posttests when compared to pretest numbers.

Table 4

Dynamics: A Short Story- Phrase 1 HT

Participant	Pretest 1	Pretest 2	Posttest 1	Posttest 2
Participant 1				
Slur 1	49.3	42.6	46.3	51.6
Slur 2	57.5	58	56.2	55
Slur 3	53.5	53	53.5	54.5
Decrease or increase	+4.2	+10.4	+7.2	+2.9
Participant 2				
Slur 1	43.3	49.3	43.6	38
Slur 2	54	52	50	49.5
Slur 3	53	46.5	51	41.5
Decrease or increase	+9.7	-2.8	+7.4	+3.5
Participant 3				
Slur 1	41	45	33.6	43.6
Slur 2	51.5	47.5	34.5	54.5
Slur 3	50.5	50.5	42	49.5
Decrease or increase	+9.5	+5.5	+8.4	+5.9
Participant 4				
Slur 1	38.3	34	35	34.3
Slur 2	51.5	47.5	34.5	54.5
Slur 3	49	40.5	46	48.5
Decrease or increase	+10.7	+6.5	+11	+14.2
Participant 5				
Slur 1	49	46.3	48.3	52
Slur 2	44	52	50.5	51
Slur 3	47.5	51	50.5	49.5
Decrease or increase	-1.5	+4.7	+2.2	-2.5
Participant 6				
Slur 1	52.6	47.6	50.3	45.6
Slur 2	59.5	58	62.5	55
Slur 3	63.5	40	61.5	54.5
Decrease or increase	+10.9	-7.6	+11.2	+8.9

Table 4 shows that all participants maintain increases in amplitude from pretests to posttests except for *Participants* 2, 5 and 6 who highlight one decrease number in each of their respective pretests. However, results underscore that 11 times out of 12[6] posttest results show increases in amplitude. No improvements are noted in any of the posttests for Phrase 1, HT.

Dynamics-A Short Story Phrase 3-HT

The results of the dynamic measurements of Phrase 3 are associated with the same rules and intervention activities as Phrase 1 (Figure 1). It was expected that Phrase 3 produce similar results to Phrase 1 because both phrases are the same (Table 5).

Table 5

Dynamics: A Short Story- Phrase 3 HT

Participant	Pretest 1	Pretest 2	Posttest 1	Posttest 2
Participant 1				
Slur 1	51	55.3	56.6	54
Slur 2	52.5	62	54.5	58
Slur 3	51.5	57	53	52.5
Decrease or increase	+0.5	+1.7	-3.6	-1.5
Participant 2				
Slur 1	54.3	49	49.3	47.6
Slur 2	54.5	53	58.5	49.5
Slur 3	55.5	51.5	56	45.5
Decrease or increase	+1.2	+2.5	+6.7	-2.1
Participant 3				
Slur 1	55	44.6	44.6	55
Slur 2	53	44	49.5	58.5
Slur 3	51.5	47	49.5	54
Decrease or increase	-3.5	+2.4	+4.9	-1
Participant 4				
Slur 1	46	46.3	43	41.6
Slur 2	53	44	49.5	58.5
Slur 3	50	52	47.5	49

[6] Each participant performance 2 posttests (6x2=12)

Decrease or increase	+4	+5.7	+4.5	+7.4
Participant 5				
Slur 1	48.3	53.3	51.6	52.3
Slur 2	53	55.5	56	53
Slur 3	49.5	50	51.5	50.5
Decrease or increase	+1.2	-3.3	-0.1	-1.8
Participant 6				
Slur 1	56.6	54	56.6	47.6
Slur 2	60.5	61.5	60	53.5
Slur 3	65	64.5	59	56.5
Decrease or increase	+8.5	+10.5	+2.4	+8.9

Table 5 shows that *Participants* 1, 2, 4 and 6 maintain increases in amplitude in both pretests. *Participan*t 1 shows decreases in both posttest performances and *Participant* 2 shows 1 decrease in one posttest performance.

Results underscore that 6 times out of 12[7], individual performances are played with an increase (expected numbers) in amplitude between the first and third slurs which is opposite to expected outcomes. The intervention modified performances for 3 posttest performances for *Participants* 1 and 2.

In comparing results of Phrases 1 and 3, we can observe that Phrase 3 performances produced more expected performances (1/12 in Phrase 1 in contrast to 6/12 in Phrase 3[8]) and that 2 participants (*Participants 1 and 2*) showed expected results in posttests with an increase of more than 4 units showing a possible effect of the intervention. Phrase 3 is partially in line with what was expected for 2 of the participants.

Dynamics-A Short Story Phrase 2-HT

[7] Each participant played 2 posttests (6x2=12)

[8] The total number of posttest performances that showed a decrease in amplitude.

The results of the dynamic measurements of Phrase 2 are associated with the following rules and intervention activities:

Dalcroze rules:

a) Every ascending melody ought to be played with a *crescendo*
b) Every descending melody ought to be played with a *decrescendo*
c) The highest note of a descending rhythmic group ought to be strongly accented even if it occurs on a weak beat.

Dalcroze activities during intervention: The experience of musical phrases with crescendo and decrescendo was practiced through movement and singing. The teacher used both improvisational materials at the piano and the familiar 4 phrases from the *A Short Story* melody (Figure 1)

a) Lesson 1: Painting by sound
b) Lesson 2: Drawing rainbows, elastic band exercises
c) Lessons 3: Exercise with rhythm sticks and drums: singing *A Short Story* melody with Note 13 being the strongest and decrescendo following

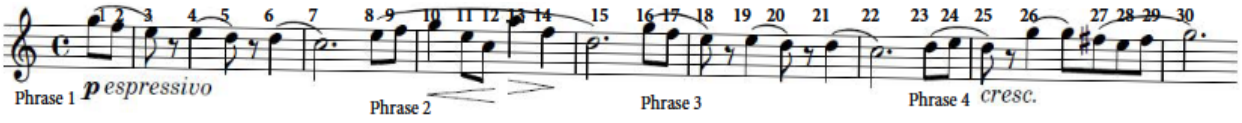


Figure 1. Excerpt from *A Short Story* illustrating the section of the musical score that was analysed.

Three amplitude measurements were taken in Phrase 2 to quantify dynamics: a) comparing the MIDI numbers of Notes 8 and 13, b) comparing the MIDI numbers of Notes 13 and 15; c) identifying the note with the highest MIDI number between Notes 8 and 15. It was expected that an increase in amplitude would occur between Notes 8 and 13, that a decrease in amplitude would occur between Notes 13 and 15, and that Note 13 would have the highest amplitude number. In Table 6, the bolded number shows the note with the highest amplitude. Increase and decrease differences between Notes 8 and 13 and between Notes 13 and 15 complete both sections of t each note row.

Table 6

Dynamics: A Short Story- Phrase 2 HT

Participant	Note 8	Note 9	Note 10	Note 11	Note 12	Note 13	Increase or decrease between Notes 8 and 13	Note 14	Note 15	Increase or decrease between Notes 13 & 15
Participant 1										
Pretest 1	52	**60**	54	51	52	57	+5	55	52	-5
Pretest 2	57	57	57	57	56	60	+3	60	**63**	+3
Posttest 1	52	55	55	54	54	**58**	+6	57	56	-2
Posttest 2	58	57	59	56	52	**59**	+1	56	44	-15
Participant 2										
Pretest 1	63	62	63	65	68	**76**	+13	68	56	-20
Pretest 2	60	59	58	63	62	**68**	+8	65	49	-19
Posttest 1	60	64	63	66	70	**76**	+16	70	58	-18
Posttest 2	55	52	52	56	56	**68**	+13	63	41	-27
Participant 3										
Pretest 1	50	48	58	55	52	**59**	+9	50	47	-12
Pretest 2	50	**54**	52	51	46	39	-11	45	47	+8
Posttest 1	43	48	**50**	48	49	38	-5	45	44	+6
Posttest 2	**60**	54	48	43	46	47	-13	48	46	-1
Participant 4										
Pretest 1	55	49	52	**53**	50	50	-5	46	46	-4
Pretest 2	51	52	57	49	48	**59**	+8	49	52	-7
Posttest 1	53	53	**54**	51	49	51	-2	48	44	-7
Posttest 2	51	53	**59**	53	52	**59**	+8	51	56	-3
Participant 5										
Pretest 1	53	53	**55**	53	49	53	0	51	50	-3
Pretest 2	50	53	**58**	53	**58**	52	+2	53	54	+2
Posttest 1	55	**56**	**56**	50	51	52	+3	55	54	+2
Posttest 2	50	57	**61**	53	55	53	+3	53	54	+1
Participant 6										
Pretest 1	63	58	**67**	62	57	62	-1	61	62	0
Pretest 2	60	56	**63**	58	44	61	+1	61	60	-1
Posttest 1	60	54	60	60	54	**62**	+2	59	49	-13
Posttest 2	57	51	59	55	44	64	+7	**66**	59	-5

Table 6 shows mixed results for all 3 measurements.

When comparing the MIDI numbers of Notes 8 and 13: *Participants* 1 and 2 maintain increases in both pre and posttests. *Participants* 3, 4, 5 and 6 show mixed results with increases and

decreases in pre and posttests. *Participant* 2 has a slightly higher number in one of their posttests.

When comparing MIDI numbers of Notes 13 and 15: *Participants* 2 and 4 maintain decreases in all pre and posttests. *Participants* 1, 3, 5 and 6 show mixed results with increases and decreases in pre and posttests. *Participant* 2 has a number higher than 4 units showing a possible effect of the intervention.

When identifying the note with the highest MIDI number: *Participan*t 2 maintains the highest amplitude for Note 13 for all pre and posttests. *Participants* 3, 4 and 5 show mixed results and no effect from the intervention. *Participants* 1 and 6 show expected results in at least one of their posttests with Note 13 having the highest number. Overall, in posttest results, 6/12 posttests performed Note 13 with the highest amplitude.

Overall, *Participants* 1, 2 and 6 show some slightly higher numbers in amplitude measurements.

Dynamics-A Short Story Phrase 4-HT

The results of the dynamic measurements of Phrase 4 are associated with the following rules and intervention activities:

Dalcroze rules:

a) Every ascending melody ought to be played with a *crescendo*
b) Every descending melody ought to be played with a *decrescendo*
c) The highest note of a descending rhythmic group ought to be strongly accented even if it occurs on a weak beat
d) Every final note loses some of its sonority, except when it is the final note of a crescendo

Dalcroze activities during intervention: The experience of musical phrases with crescendo and decrescendo was practiced through movement and singing. The teacher used both improvisational materials at the piano and the familiar 4 phrases from the *A Short Story* melody (Figure 1)

a) Lesson 1: Painting by sound
b) Lesson 2: Drawing rainbows, elastic band exercises
c) Lessons 3: Exercise with rhythm sticks and drums: singing *A Short Story* melody with Notes 26 and 30 being the strongest

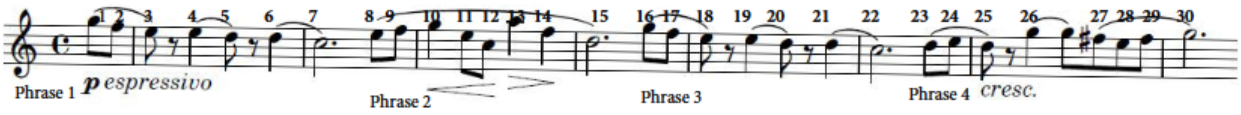


Figure 1. Excerpt from *A Short Story* illustrating the section of the musical score that was analysed.

Three amplitude measurements were taken in Phrase 4 to quantify dynamics: a) comparing the MIDI number of Notes 23 and 26; b) comparing the MIDI number of Notes 27 and 30; c) identifying the notes with the highest MIDI number. It was expected that a) Note 26 would have a higher amplitude when compared to Note 23, b) that Note 30 would have a higher amplitude when compared to Note 27 and c) that posttests would have a higher amplitude number than pretests. In Table 7, the bolded numbers show the notes with the highest amplitude. Increase and decrease differences between Notes 23 and 26 and Notes 27 and 30 complete both sections of each note row.

Table 7

Dynamics: A Short Story- Phrase 4 HT

Participant	Note 23	Note 24	Note 25	Note 26	Increase or decrease between Notes 23 and 26	Note 27	Note 28	Note 29	Note 30	Increase or decrease between Notes 27 & 30
Participant 1										
Pretest 1	54	57	54	**64**	+10	51	48	57	**59**	+8
Pretest 2	55	58	60	**69**	+14	57	58	61	**61**	+4
Posttest 1	54	52	55	**60**	+6	52	51	53	**55**	+3
Posttest 2	54	54	52	**60**	+6	50	49	53	**54**	+4

Participant 2										
Pretest 1	58	57	58	**73**	+15	**70**	70	61	59	-11
Pretest 2	56	58	59	**75**	+19	**68**	66	58	56	-12
Posttest 1	56	63	65	**80**	+24	70	**72**	61	65	-5
Posttest 2	52	54	56	**67**	+15	**58**	62	55	47	-11
Participant 3										
Pretest 1	53	53	54	**57**	+4	51	53	48	**59**	+8
Pretest 2	**46**	41	51	44	-2	47	49	**52**	41	-6
Posttest 1	40	46	51	**55**	+15	46	**52**	48	48	+2
Posttest 2	45	55	55	**61**	+16	53	**57**	47	46	-7
Participant 4										
Pretest 1	51	55	46	**61**	+10	57	57	52	**58**	+1
Pretest 2	55	59	53	**59**	+4	52	54	54	**56**	+4
Posttest 1	52	51	48	**57**	+5	50	53	42	**57**	+7
Posttest 2	46	55	53	**58**	+12	51	53	48	**54**	+3
Participant 5										
Pretest 1	49	52	54	**57**	+8	54	42	53	**55**	+1
Pretest 2	52	55	58	**59**	+7	57	**61**	56	59	+2
Posttest 1	**58**	**58**	55	54	-4	53	55	57	**58**	+5
Posttest 2	54	55	**59**	58	+4	56	54	51	**59**	+3
Participant 6										
Pretest 1	60	57	56	**63**	+3	**61**	49	**-**	52	-9
Pretest 2	60	48	62	**63**	+3	54	58	51	**62**	+8
Posttest 1	56	56	62	**69**	+13	59	**63**	60	62	+4
Posttest 2	57	55	54	**63**	+6	54	**61**	52	57	+3

Table 7 shows mixed results for all three measurements.

When comparing the amplitude numbers of Note 23 to Note 26: *Participant* 5 shows mixed results in posttests. *Participants* 1, 2, 4 and 6 maintain expected increases in all pre and posttests. *Participant*s 2, 4 and 6 show higher increases in at least one of the posttests. *Participants* 2, 4 and 6 show increases in amplitude in one or both posttests compared to pretests. *Participants* 2 and 6 performed at least one posttest with an increase of more than 4 units showing a possible effect of the intervention.

When comparing the amplitude numbers of Note 27 to Note 30: *Participant* 1 maintains expected increases in all pre and posttests with no significant changes in posttests. *Participant*s 3 and 6 show mixed results in pretests with expected increases in both posttests. *Participant* 2

shows opposite than expected decreases in all pre and posttests. *Participants* 4 and 5 show increases in amplitude scores for at least one posttest.

When identifying the notes with the highest MIDI number: Note 26 had the highest amplitude reading in 19/24 of all pre and posttests. *Participants* 2 and 6 show higher amplitude numbers compared to their pretest scores. Note 30 was the note with the highest amplitude number in 13/24 of all pre and posttests. None of the posttest numbers show evidence of possible effects from the intervention.

Summary of results for A *Short Story*-Dynamics HT

Two items of information can be noted for dynamic measurements with HT. Only a few posttest measurements for HT performances showed evidence of an intervention effect. However, it was noted that Phrase 3 outcomes were closer to expected results than in any other phrase analysis. In cases where measurements changed in posttest scores, they were participant specific, sporadic and below the 4 units threshold to be audibly perceptible. For example, *Participants* 1, 2 and 6 showed expected outcomes in some posttests in most phrase performances. However, because pretests were not always consistent, significant posttest outcomes are suggestive. RH performances show a trend towards being closer to the expected results for some participants.

Results to RH results-A Short Story Phrases 1 and 3-Dynamics

Table 8 shows the results of Phrase 1, RH, showing similar outcomes to Phrase 1, HT (Table 4).

Table 8

Dynamics: A Short Story- Phrase 1 RH

Participant	Pretest 1	Pretest 2	Posttest 1	Posttest 2
Participant 1				
Slur 1	48.6	52	50.3	52.7

Slur 2	54	60	60.5	57.5
Slur 3	50	58.5	57.5	56.5
Decrease or increase	+1.4	+6.5	+7.2	+3.8
Participant 2				
Slur 1	42.3	46.3	44.3	39.7
Slur 2	48.5	43.5	43.5	44
Slur 3	50	44.5	45	35.5
Decrease or increase	+7.7	-1.8	+0.7	-4.2
Participant 3				
Slur 1	51	43.3	46	43
Slur 2	54	47.5	51	49
Slur 3	54	46.5	45.5	52.5
Decrease or increase	+3	+6.2	-0.5	+9.5
Participant 4				
Slur 1	42	36.3	32.6[9]	39.7
Slur 2	54	47.5	51	49
Slur 3	38	42.5	42.5	41
Decrease or increase	-4	+6.2	+9.9	+1.3
Participant 5				
Slur 1	45	47	49	50
Slur 2	49	46.5	45	48
Slur 3	44	46	47.5	41
Decrease or increase	-1	-1	-1.5	-9
Participant 6				
Slur 1	44	46.3	54	53.3
Slur 2	55.5	60	61.5	60
Slur 3	55	62.5	52	51.5
Decrease or increase	+11	+16.2	-2	-1.8

Three participants performed expected decreases in posttest performances: *Participant* 3 in posttest 1, *Participants* 5 and 6, in both posttests. *Participant*s 5 and 6 shows the most significant difference: pretests were performed with increases and both posttests were performed with the expected decreases with a difference of more than 4 units, showing a possible effect of the intervention.

[9] Note 1 of this measurement is an outlier.

Although many results are similar between HT and RH performances, Table 9 shows that three exceptions can be observed.

Table 9

Results: Dynamics, A Short Story, Comparison between HT and RH performances-Phrase 1

Participant	Comparison between increases or decreases for each HT and RH performance			
	Pretest 1	Pretest 2	Posttest 1	Posttest 2
Participant 1				
HT	+4.2	+10.4	+7.2	+2.9
RH	+1.4	+6.5	+7.2	+3.8
Participant 2				
HT	+9.7	-2.8	+7.4	+2.9
RH	+7.7	-1.8	+0.7	-4.2
Participant 3				
HT	+9.5	+5.5	+8.4	+5.9
RH	+3	+6.2	-0.5	+9.5
Participant 4				
HT	+10.7	+6.5	+11	+14.2
RH	-4	+6.2	+9.9	+1.3
Participant 5				
HT	-1.5	+4.7	+2.2	-2.5
RH	-1	-1	-1.5	-9
Participant 6				
HT	+10.9	-7.6	+11.2	+8.9
RH	+11	+16.2	-2	-1.8

Table 9 shows *that Participant* 3 shows a significant change from two pretest increases to one posttest decrease. *Participan*t 5 shows expected results in all RH performances with a higher increase in both posttests. *Participant* 6 shows a significant change in RH from two pretest increases to two posttest decreases. For these 3 participants, playing RH shows clearer expected outcomes than in HT performances. For *Participants* 5 and 6 the differences would be audibly perceptible for at least on of the posttests.

Similar to the results between Phrase 1 and Phrase 3 HT, we can observe significant changes between Phrase 1 and Phrase 3 RH. Table 10 shows that more participants performed closer to expected results in Phrase 3 than in Phrase 1.

Table 10

Dynamics: A Short Story- Phrase 3 RH

Participant	Pretest 1	Pretest 2	Posttest 1	Posttest 2
Participant 1				
Slur 1	55.3	57.7	54.3	54
Slur 2	55.5	61	57.5	51
Slur 3	49.5	55.5	59	53.5
Decrease or increase	-5.8	-2.2	+4.7	-0.5
Participant 2				
Slur 1	50	47	49	42
Slur 2	47.5	39.5	45	34.5
Slur 3	44	43.5	37.5	32.5
Decrease or increase	-6	-7.7	-11.5	-9.5
Participant 3				
Slur 1	54.3	52.3	53.7	55
Slur 2	56	46	53.5	55
Slur 3	53	47	52	49.5
Decrease or increase	-1.3	-5.3	-1.7	-5.5
Participant 4				
Slur 1	45	47.7	42	44.7
Slur 2	56	46	53.5	55
Slur 3	37.5	46.5	40.5	42.5
Decrease or increase	-7.5	-2.5	-1.5	-2.2
Participant 5				
Slur 1	50.3	50	49.3	51.7
Slur 2	48.5	47	45.5	48
Slur 3	47.5	45	42.5	37
Decrease or increase	-2.8	-5	-6.8	-14.7
Participant 6				
Slur 1	59	58.3	55.7	58.3
Slur 2	61	61	53	58
Slur 3	66	64.5	45	38
	+7	+6.2	-10.7	-20.3

Decrease or increase

Phrase 3 RH results show that *Participant* 1 performed with mixed results: *Participants* 3 and 4 show consistent decreases in all pre and posttests. *Participant* 3 shows a slightly larger decrease in posttest2. *Participants* 2, 5 and 6 show expected decreases in posttests with significant differences amplitude between pre and posttest results, enough to be audibly perceptible.

As with Phrase 1, comparing HT and RH performances of Phrase 3, we would expect some similarities and some important differences for some participants (Table 11).

Table 11

Results: Dynamics, A Short Story, Comparison between HT and RH performances-Phrase 3

Participant	Comparison between increases or decreases for each HT and RH performance			
	Pretest 1	Pretest 2	Posttest 1	Posttest 2
Participant 1				
HT	+0.5	+1.7	-3.6	-1.5
RH	-5.8	-2.2	+4.7	-0.5
Participant 2				
HT	+1.2	+2.5	+6.7	-2.1
RH	-6	-7.7	-11.5	-9.5
Participant 3				
HT	-3.5	+2.4	+4.9	-1
RH	-1.3	-5.3	-1.7	-5.5
Participant 4				
HT	+4	+5.7	+4.5	+7.4
RH	-7.5	-2.5	-1.5	-2.2
Participant 5				
HT	+1.2	-3.3	-0.1	-1.8
RH	-2.8	-5	-6.8	-14.7
Participant 6				
HT	+8.5	+10.5	+2.4	+8.9
RH	+7	+6.2	-10.7	-20.3

Table 11 shows that in RH pretests *Participants* 2 to 6 have a higher rate of decrease. Additionally, *Participants* 2, 3, 5 to 6 show that at least one posttest has an expected and

increased amplitude. *Participant* 6 has an increase of more than 20ms with pretest results, suggesting an intervention effect.

Results RH-A Short Story Phrase 2-Dynamics

As with Phrase 2 HT, it was expected that an increase in amplitude would occur between Notes 8 and 13, that a decrease in amplitude would occur between Notes 13 and 15 and that Note 13 would have the highest amplitude. In Table 12, the bolded number shows the note with the highest amplitude. Increase and decrease differences between Notes 8 and 13 and between Notes 13 and 15 complete both sections of each note row.

Table 12

Dynamics: A Short Story- Phrase 2 RH

Participant	Note 8	Note 9	Note 10	Note 11	Note 12	Note 13	Increase or decrease between Notes 8 and 13	Note 14	Note 15	Increase or decrease between Notes 13 & 15
Participant 1										
Pretest 1	**57**	51	52	55	55	**57**	0	50	44	-13
Pretest 2	**61**	54	56	52	52	56	-5	60	51	-5
Posttest 1	57	53	58	**60**	54	56	-1	**60**	52	-4
Posttest 2	**62**	56	59	53	40	54	-8	59	56	+2
Participant 2										
Pretest 1	58	55	61	66	72	**75**	+17	58	46	-29
Pretest 2	54	57	61	68	68	**75**	+21	61	42	-33
Posttest 1	58	59	60	73	69	**76**	+18	64	50	-26
Posttest 2	48	48	48	58	59	**62**	+14	46	40	-22
Participant 3										
Pretest 1	52	51	**61**	50	53	38	-14	50	53	+15
Pretest 2	42	48	**53**	45	45	52	+10	51	46	-6
Posttest 1	52	51	42	46	30	42	+10	**53**	43	+1
Posttest 2	**54**	50	53	53	47	**54**	0	51	52	-2
Participant 4										
Pretest 1	50	48	**62**	47	39	50	0	45	41	-9
Pretest 2	46	52	56	44	48	**58**	+12	15	45	-13
Posttest 1	39	47	**55**	49	41	44	+5	44	45	+1
Posttest 2	45	53	**54**	45	47	52	+7	43	49	-2

Participant 5										
Pretest 1	52	50	**54**	51	47	48	+4	48	43	-5
Pretest 2	48	50	**55**	48	54	51	+3	44	44	-7
Posttest 1	47	48	**57**	50	43	31	+16	44	39	+8
Posttest 2	45	45	**51**	47	50	**51**	+6	50	43	-8
Participant 6										
Pretest 1	54	48	58	52	50	**64**	+10	56	65	+1
Pretest 2	57	51	57	61	52	**63**	+6	**63**	54	-9
Posttest 1	63	54	65	64	46	67	+4	**71**	60	-7
Posttest 2	56	50	62	56	41	**66**	+10	55	49	-17

Table 12 shows mixed results for all 3 measurements for Phrase 2, RH. Only *Participants* 5 and 6 show expected posttest performances. When comparing amplitude numbers for the 3 measurements in Phrase 2, results are participant specific.

When comparing amplitude numbers of Notes 8 and 13: *Participant 5* played with similar results in both RH and HT.

When comparing amplitude numbers of Notes 13 and 15: *Participants 5 and 6* played with the expected decrease in posttest 2

When identifying the note with the highest amplitude number: *Participants 3 and 5* played posttest 2 with the highest amplitude.

Overall, *Participants* 5 and 6 seems to show some possible effects of the intervention on their dynamic measurements in both HT and RH performances. Phrase 2 RH performances were not closer to expected outcomes as was the case for Phrases 1 and 3.

Results RH-A Short Story Phrase 4-Dynamics

As with Phrase 4, HT, it was expected that: a) Note 26 would have a higher amplitude number than Note 23; b) that Note 30 would have a higher amplitude number than Note 27; and c) that notes 26 and note 30 would have the highest amplitude numbers overall. In Table 13, the bolded

numbers show the notes with the highest amplitude. Increase and decrease differences between Notes 23 and 26 and Notes 27 and 30 complete both sections of each note row.

Table 13

Dynamics: A Short Story- Phrase 4 RH

Participant	Note 23	Note 24	Note 25	Note 26	Increase or decrease between Notes 23 and 26	Note 27	Note 28	Note 29	Note 30	Increase or decrease between Notes 27 & 30
Participant 1										
Pretest 1	42	44	53	**65**	+23	50	54	55	**57**	+7
Pretest 2	57	54	63	**69**	+12	54	50	54	**55**	+1
Posttest 1	51	52	62	**61**	+10	56	49	**60**	59	+3
Posttest 2	57	58	64	**69**	+12	**62**	50	55	57	+7
Participant 2										
Pretest 1	54	57	58	**75**	+21	**70**	65	60	57	-13
Pretest 2	49	58	59	**73**	+24	64	**68**	60	63	-1
Posttest 1	46	63	65	**70**	+24	**70**	67	55	46	-24
Posttest 2	47	54	56	**71**	+24	64	66	**68**	50	-14
Participant 3										
Pretest 1	54	56	59	**67**	+13	54	**62**	54	52	-2
Pretest 2	48	52	50	**55**	+7	47	**62**	52	52	+5
Posttest 1	49	55	54	**61**	+12	50	49	**51**	46	-4
Posttest 2	41	54	52	**65**	+24	**56**	33	42	32	-1
Participant 4										
Pretest 1	38	52	46	**59**	+21	48	54	48	**60**	+12
Pretest 2	49	56	50	**63**	+14	49	58	50	**53**	+4
Posttest 1	45	52	48	**58**	+13	46	49	55	**57**	+11
Posttest 2	45	53	43	**54**	+9	43	47	48	**56**	+13
Participant 5										
Pretest 1	45	51	**54**	**54**	+9	50	52	48	**54**	+4
Pretest 2	48	49	52	**56**	+8	**55**	51	48	52	-3
Posttest 1	46	50	**56**	51	+5	51	54	52	**56**	+5
Posttest 2	47	47	51	**56**	+9	**54**	52	48	**54**	0
Participant 6										
Pretest 1	62	58	60	**70**	+8	57	56	56	**64**	+7
Pretest 2	51	57	57	**67**	+16	61	57	59	**64**	+3
Posttest 1	61	61	56	**70**	+9	60	55	55	**63**	+3
Posttest 2	51	**54**	49	8[10]	--	58	59	55	**63**	+5

Table 13 shows the results of Phrase 4, RH, showing similar outcomes to Phrase 4, HT (Table 7) with some differences.

When comparing the amplitude numbers of Note 23 and Note 26: *Participants* 1, 2, 3 and 4 maintain expected increases in all pre and posttests. *Participants* 5 and 6 show mixed posttest results. *Participant* 3 show higher increases in at least one of the posttests of more than 4 units, showing a possible effect of the intervention.

When comparing the amplitude numbers of Note 27 and Note 30: *Participants* 1, 4 and 6 maintains expected increases in all pre and posttests with no significant changes in posttests. *Participan*ts 2, 3 and 5 show mixed results in pre and posttests. *Participant 4* shows a slight increase in one posttest score.

When identifying the notes with the highest amplitude: Note 26 had the highest note in 22/24 of all pre and posttests. Note 30 was the note with the highest amplitude in 13/24 of all pre and posttests. None of the posttest numbers show evidence of possible effects from the intervention. Overall, no significant evidence of effects of the intervention can be noted in any of the 3 measurements

Summary for *A Short Story*- Dynamics HT and RH

It was expected that posttests would maintain expected pretest decreases with higher amplitude scores and/or that posttests would change from pretest increases to posttest decreases. To show a possible effect of the intervention, a 4-unit difference for performance changes to be audibly perceptible. In only eight measurements overall for hands together and right-hand performances did *Participants* 2, 5 and 6 show a possible audible effect of the intervention. However, if we solely look at the MIDI numbers, (excluding the 4-unit difference criteria), some trends can be

observed. Table 14 is divided by *Participant* and each column summarizes the total number of measurable expected posttest results for each parameter. Only numbers where a baseline could be established were collected for this summary.

Table 14

Summary by participant of expected increases and decreases in posttests outcomes-Dynamics A Short Story

Participant	Phrase 1	Phrase 3	Phrase 2	Phrase 4	Total expected posttests outcomes
Participant 1	HT-0 RH- 0	HT-2 RH- 0	HT-3 RH- 0	HT-0 RH-0	HT=5 RH=0
Participant 2	HT-0 RH- 0	HT-1 RH- 2	HT-2 RH-0	HT-2 RH-0	HT=5 RH=2
Participant 3	HT-0 RH-1	HT-0 RH- 1	HT-0 RH 0	HT-0 RH-0	HT=0 RH=2
Participant 4	HT-0 RH-0	HT-0 RH-0	HT-0 RH-0	HT-2 RH-1	HT-2 RH-1
Participant 5	HT-1 RH-2	HT-0 RH- 2	HT- 0 RH-2	HT-1 RH-0	HT=2 RH=6
Participant 6	HT-0 RH-2	HT-0 RH- 2	HT-0 RH-2	HT-3 RH-0	HT=3 RH=6

Amplitude measurements for *A Short Story* produced some expected results in MIDI numbers only for both HT and RH performances. Overall, an equal number of expected outcomes (17/34) was performed for HT and for RH. Except for *Participants* 1 and 3, each participant shows at least one expected posttest outcome for both HT and RH performances. Although the intention of the study was not to compare HT and RH performances, the analysis of the data in these two cases raises some questions regarding RH and HT performances. Outcomes are participant specific: *Participants* 1 and 2 show more expected results in HT posttests; *Participants* 3 and 5

show more expected results in RH performances; and *Participants* 4 and 6 show similar results in both testing conditions. The increase and decrease differences, were, although measurable with MIDI data, not large enough to be perceivably different.

Because pretests were not always consistent, some posttest results were not included in Table 12. Some participants performed with expected outcomes in posttests when pretests were mixed. Further investigation into expected posttest outcomes void of consistent pretest results yielded a total of 14 additional expected posttest outcomes.

Table 15 shows the number of expected outcomes in posttests when pretests were mixed. Only posttest results where the velocity number was larger than pretest numbers were compiled for this table.

Table 15

Summary by participant of expected increases and decreases in posttests outcomes with mixed pretest results-Dynamics A Short Story

Participant	Phrase 1	Phrase 3	Phrase 2	Phrase 4	Total expected posttests outcomes
Participant 1	HT- 0 RH- 0	HT-0 RH-0	HT-1 RH- 0	HT- 0 RH- 0	HT=1 RH=0
Participant 2	HT-0 RH- 1	HT-0 RH-0	HT-0 RH- 0	HT-0 RH-0	HT=0 RH=1
Participant 3	HT-0 RH-0	HT-0 RH-0	HT-0 RH- 0	HT-0 RH- 0	HT=0 RH=0
Participant 4	HT-0 RH-0	HT-0 RH-0	HT-0 RH-0	HT-0 RH-0	HT-0 RH-0
Participant 5	HT-1 RH-0	HT-0 RH-0	HT-2 RH-0	HT-0 RH-1	HT-3 RH-1
Participant 6	HT-0 RH-0	HT-0 RH-0	HT-4 RH-0	HT-0 RH-0	HT-6 RH-0

12/14 expected outcomes were in HT performances. *Participants* 3 and 6 shows stronger outcomes in HT performances. These outcomes cannot be identified as *improved* or *changed* because the baseline was not clearly established.

3.1.2 Timing-HT

Timing-A Short Story Phrase 1 HT

The results of the timing measurements of Phrase 1 are associated with the following rules and intervention activities:

Dalcroze rule: Choices in timing are related to dynamics

Dalcroze activities during intervention: The experience of equal timing and variances in timing were practiced with movement, rhythmic and singing activities. The teacher used both improvisational materials at the piano and the familiar 4 phrases from the *A Short Story* melody (Figure 1)

a) Lesson 1: Finger Cymbals, Walk/Gallop/Run, Singing, clapping and stepping rhythms
b) Lesson 2: Tapping the knee, changing directions at a musical signal by the teacher, drawing rainbows, singing while drawing on the score
c) Lesson 3: Interrupted Canon, Passing the ball in a circle, Drawing the rainbow with a ball

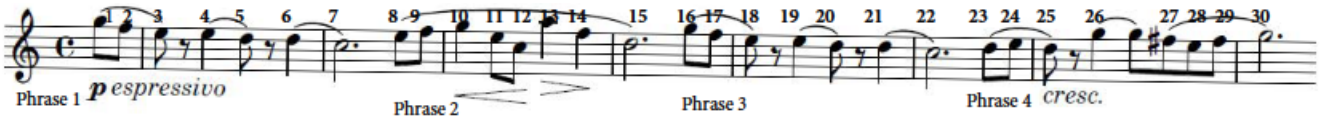


Figure 1. Excerpt from *A Short Story* illustrating the section of the musical score that was analysed.

The timing measurements were calculated with the IOI (inter-onset interval) of each note. Because IOI is calculated from the onset of the 1st note to the onset of the 2nd note, the presentation of note identification is done in pairs (Notes 1-2, 2-3, 3-4, 4-5 and 5 to 6-7). In the case of Phrase 1 (Table 16), the mean score for each slur includes: notes 1-2 and 2-3 (slur 1), notes 4-5 (slur 2) and notes 6-7 (slur 3). Decreases or increases in timing between slurs 1 and 3 complete each column. Longer held notes equal positive numbers and shorter held notes equal

negative numbers equal shorter held notes. It was expected a) that posttests would show decreases in timing between slur 1 and slur 3, and b) that the decrease would be greater for the posttests when compared to pretest numbers.

Table 16

Timing-A Short Story Phrase 1 HT

Participant	Pretest 1	Pretest 2	Posttest 1	Posttest 2
Participant 1				
Slur 1	11.8	2.93	16.64	14.72
Slur 2	4.44	7.9	12.5	8.1
Slur 3	-2.71	-4.94	-5.81	-0.78
Decrease or increase	+14.51	+7.87	+22.45	+15.5
Participant 2				
Slur 1	13.54	31.83	20.66	25.08
Slur 2	10.96	10.97	14.64	17.08
Slur 3	9.11	6.07	12.47	2.18
Decrease or increase	+4.43	+25.76	+8.19	+22.9
Participant 3				
Slur 1	-0.87	4.25	-8.42	-7.50
Slur 2	-41.78	4.36	3.29	15.81
Slur 3	-1.14	0.26	-1.13	7.57
Decrease or increase	+0.27	+3.99	-7.29	-15.07
Participant 4				
Slur 1	8.7	8.77	10.17	11.75
Slur 2	6.25	7.45	5.88	7.12
Slur 3	8.05	5.63	-2.36	-2.13
Decrease or increase	+0.65	+3.14	+12.53	+14.05
Participant 5				
Slur 1	16.32	-5.4	5.11	5.65
Slur 2	4.5	-2.19	10.06	-1.06
Slur 3	1.69	-2.19	9.3	0.09
Decrease or increase	+14.63	-3.21	-4.19	+5.56
Participant 6				
Slur 1	3.88	-5.31	-11.01	-1.33
Slur 2	8.3	-1.98	2.86	8.7
Slur 3	6.86	17.44	-5.43	-4.49
Decrease or increase	-2.98	-22.75	-5.58	+3.16

In Phrase 1, results are participant specific. *Participant 3* maintain opposite than expected increases in both posttests. *Participant 5* shows mixed results in both pre and posttests. *Participant* 2 maintains expected increases in speed in both pre and posttests. *Participants* 1, 4 and 6 show posttest decrease outcomes in MIDI numbers only. All numbers are less than the 20ms threshold to be audibly perceptible.

Timing-A Short Story Phrase 3 HT

The results of the timing measurements of Phrase 3 are associated with the same rules and intervention activities as Phrase 1. It was expected that Phrase 3 (Table 17) produce similar results to Phrase 1 because both phrases are the same (Table 15).

Table 17

Timing-A Short Story Phrase 3 HT

Participant	Pretest-1	Pretest 2	Posttest 1	Posttest 2
Participant 1				
Slur 1	1.4	-0.59	0.51	-7.81
Slur 2	-5.75	1.89	-3.41	0.04
Slur 3	-51.03	-4.53	-9.3	0.04
Decrease or increase	+52.43	+3.94	+9.81	-7.85
Participant 2				
Slur 1	8.65	2.3	-0.9	-0.93
Slur 2	-14.75	-11	-7.25	-3.51
Slur 3	-11.42	-0.09	-1.57	-7.04
Decrease or increase	+20.07	+2.39	+0.67	+6.11
Participant 3				
Slur 1	-1.14	-9.32	-8.66	-3.56
Slur 2	3.77	3.99	-3.4	-5.74
Slur 3	-3.6	-1.11	1.38	7.3
Decrease or increase	+2.46	-8.21	-10.04	-10.86
Participant 4				
Slur 1	-1.29	2.49	-4.59	-0.42
Slur 2	-1.62	5.14	-0.13	0.09

Slur 3	-1.13	-0.47	-3.91	-2.82
Decrease or increase	-0.16	+2.96	-0.68	+2.4
Participant 5				
Slur 1	-0.75	-10.13	-7.08	-1.82
Slur 2	0.56	-6.92	-3.46	-4.13
Slur 3	-5.44	-7.48	-6.13	-2.78
Decrease or increase	+4.69	-2.65	-0.95	+0.96
Participant 6				
Slur 1	1.95	-1.05	-1.76	2.01
Slur 2	6.04	3.75	4.78	1.13
Slur 3	1.74	-0.69	3.05	-5.2
Decrease or increase	+0.21	+0.36	-4.81	+7.21

In Phrase 3, results are participant specific. *Participant* 2 maintains expected increases in both pre and posttests. *Participants 1, 3, 4 and* 5 show mixed results in both pre and posttests. *Participant* 6 show posttest decrease results in one of the posttests.

Timing-A Short Story Phrase 2 HT

The results of the timing measurements of Phrase 2 are associated with the same rules and intervention activities as Phrases 1 and 3.

Three measurements were taken in Phrase 2 to quantify timing: a) comparing the IOI of Notes 8-9 to Notes 12- 13, b) comparing the IOI of Notes 13-14 to Note 14-15; c) identifying the note with the longest IOI speed between Notes 8 and 15. It was expected that a) the IOI of Notes 8-9 would be shorter than the IOI speed of Notes 12-13; b) that the IOI speed of Notes 14-15 would be longer than the IOI speed of Notes 13-14 and that c) the IOI of Notes 12-13 would be the highest (longest held note). In Table 18, the bolded number shows the longest held note. Increase and decrease differences between the IOI of Notes 8 and 13 and between Notes 13 and 15 complete both sections of the note row.

Table 18

Timing: A Short Story- Phrase 2 HT

Participant	Notes 8-9	Notes 9-10	Notes 10-11	Notes 11-12	Notes 12-13	Increase or decrease between Notes 8 and 13	Notes 13-14	Notes 14-15	Increase or decrease between Notes 13 & 15
Participant 1									
Pretest 1									
Pretest 2	-5.53	10.07	1.84	-6.4	**40.84**	-46.37	-5.53	8.99	-14.52
Posttest 1	-8.88	10.18	2.31	-3.49	**27.57**	-36.45	3.14	2.93	+0.21
Posttest 2	-11.48	2.47	-3.85	3.78	**59.16**	-70.64	-8.65	2.26	-10.91
	-17.32	9.55	-5.54	-3.26	**38.49**	-55.81	-2.23	4.18	-6.41
Participant 2									
Pretest 1	-5.32	16.5	0.78	-0.88	**9.48**	-14.8	-0.14	6.15	-6.29
Pretest 2	-1.67	**7.5**	-1.2	-2.31	-8.95	7.28	-1.36	-1.36	0
Posttest 1	-5.41	**9.3**	1.44	-6.75	4.95	-10.36	-4.24	2.44	-6.68
Posttest 2	4.35	-11.1	-2.16	0.01	6.24	-1.89	-0.8	3.8	-4.6
Participant 3									
Pretest 1	-19.82	-2.37	-0.32	-1.28	**43.72**	-63.54	0.9	6.36	-5.46
Pretest 2	-12.18	3.74	5.61	-7.45	**22.4**	-34.58	-0.86	0.88	-1.74
Posttest 1	-16.31	-3.88	1.02	-4.6	**4.49**	-20.8	114.7	-4.48	---[11]
Posttest 2	-3.84	-8.73	12.19	2.68	**18.17**	-22.01	8.66	-0.44	+9.1
Participant 4									
Pretest 1	-9.16	**11.82**	-2.61	2.97	6.9	-16.06	0.34	2.15	-1.81
Pretest 2	-5.26	**8.61**	-1.46	2.66	5.63	-10.89	6.96	4.31	+2.65
Posttest 1	-3.56	**6.73**	1.76	-3.22	-4.93	1.37	4.5	-2.36	6.86
Posttest 2	-4.36	**6.26**	-0.76	1.47	-3.68	-0.68	1.12	-1.28	+2.4
Participant 5									
Pretest 1	-11.44	**5.07**	-2.63	-6.19	**5.07**	-16.51	-5.44	0.56	-6
Pretest 2	-14.48	2.54	-7.86	-7.67	**5.95**	-20.43	-4.27	-3.32	-0.95
Posttest 1	-1.75	7.01	-3.08	-11.27	**8.15**	-9.9	-0.79	0.73	-1.52
Posttest 2	-6.81	**3.93**	-2.02	1.63	2.39	-9.2	2.01	0.67	+1.34
Participant 6									
Pretest 1	2.36	15.05	9.32	0.31	**40.44**	-30.08	6.45	7.89	-1.44
Pretest 2	-0.13	-9.01	0.61	-4.94	0.24	0.37	**8**	1.53	6.47
Posttest 1	-6.39	-0.23	-7.16	-9.09	**2.86**	-9.25	1.7	1.32	0.38

[11] The data was not retrievable

Posttest 2	-16.63	6.23	-0.45	-13.82	**6.94**	-23.57	-0.98	-0.62	-0.36

Results for timing measurements in Phrase 2 varied:

In comparing the IOI of Notes 8-9 to Notes 12-13: All participants performed with expected decreases in speed in all pre and posttests with two exceptions (*Participant* 2, Pretest 2 and *Participant* 4, Posttest 1). *Participant* 1 performed with a larger decrease in speed in both posttests.

In comparing the IOI of Notes 13-14 to Notes 14-15: Results were varied. *Participants 4 and 6* performed all pre and posttests with mixed and inconsistent results in both pre and posttests. *Participant*s 3 and 5 performed all pretests with expected results and posttests with inconsistent or opposite than expected results. *Participant* 1 performed with mixed results in pretests and consistent, expected results in post-test. *Participant* 2 performed with expected results in all pre and posttests with a slightly larger decrease in speed.

IOI measurements for Notes 12-13 varied: Out of 24 pre and posttests measurements, Notes 12-13 was the longest held note 15/24 measurements. Only *Participants 1 and 3* performed with expected decreases in all pre and posttests. *Participant* 1 shows higher decrease numbers in both posttests.

In comparing HT and RH performances, results are similar with some variances. *Participants* 4, 5 and 6 show no effects of the intervention in the HT performances but show expected and improved posttests results in the RH performances. *Participant* 2 shows one posttest improvement in the HT performance. *Participant* 3 shows expected outcomes in HT performance and one in the RH performance. *Participant* 1 shows 2 expected and increased number differences in results for both HT performances and in one RH performance.

Timing-A Short Story Phrase 4 HT

The results of the timing measurements of Phrase 4 are associated with the same rules and intervention activities as Phrases 1 and 3.

Three timing measurements were taken in Phrase 4 to quantify timing: a) comparing the IOI speed of Notes 23-24 to the IOI speed of Notes 25-26, b) comparing the IOI speed of Notes 26-27 to Notes 29-30; c) identifying the note with the longest IOI speed between Notes 23 and 30. It was expected that a) the IOI of Notes 23-24 would be shorter than the IOI speed of Notes 25-26; b) that the IOI speed of Notes 26-27 would be shorter than the IOI speed of Notes 29-30 and that c) the IOI of Notes 26-27 or Notes 29-30 would be the highest (longest held note). In Table 19, the bolded number shows the note with the highest IOI. Increase and decrease differences between the IOI of Notes 23 and 26 and between Notes 26 and 30 complete both sections of the note row.

Table 19

Timing: A Short Story- Phrase 4 HT

Participant	Notes 23-24	Notes 24-25	Notes 25-26	Increase or decrease Notes 23-24 and 25-26	Notes 26-27	Notes 27-28	Notes 28-29	Notes 29-30	Increase or decrease Notes 26 & 30
Participant 1									
Pretest 1	-13.33	1.4	2.05	-15.38	-1.92	0.1	-1.63	**8.77**	-10.69
Pretest 2	-25.03	-3.49	**1.69**	-26.72	-6.25	-10.95	-13.43	-0.18	-6.07
Posttest 1	-28.05	**3.78**	-2.32	-25.73	-6.68	-2.76	-7.99	2.04	-8.72
Posttest 2	-18.56	-4.09	-8.43	-10.13	-6.71	-6.57	-14.43	**1.7**	-8.41
Participant 2									
Pretest 1	-9.76	-8.28	-15.67	+5.91	-8.4	-14.19	-6.8	**-5.69**	-2.71
Pretest 2	-20.64	**-1.36**	-19.22	-1.42	-15.48	-14.64	-14	-11.47	-4.01
Posttest 1	-12.76	**-6.41**	-12.26	-0.5	-19.67	-21.12	-16.78	-11.43	-8.24

Posttest 2	-12.46	-10.29	-12.59	+0.13	-13.27	-26.01	-17.07	-**6.22**	-7.05
Participant 3									
Pretest 1	-20.91	3.08	-1.55	-19.36	12.99	-12.19	-17.1	**31.99**	-19
Pretest 2	-3.72	**7.47**	-3.97	0.25	2.83	-1.98	-18.65	-4.97	7.8
Posttest 1	**-0.53**	-11.05	-7.23	6.7	-7.63	-10.1	-8.9	-7.94	0.31
Posttest 2	-13.34	-17.69	**5.94**	-19.28	-6.64	-12.8	-23.67	-12.53	+5.89
Participant 4									
Pretest 1	-11.13	-2.28	-3.1	-8.03	-2.93	-8.51	**-0.31**	-6.87	3.94
Pretest 2	-13.51	-9.22	-2.95	-10.56	**-0.75**	-8.56	-1.3	-9.22	8.47
Posttest 1	-14.89	**-0.82**	-1.67	-13.22	-2.19	-2.19	-9.4	-2.53	0.34
Posttest 2	-8.48	**2.84**	-7.45	-1.03	-4.48	-8.48	-1.96	-12.93	+8.45
Participant 5									
Pretest 1	-10.69	1.69	-14.45	3.76	-3.69	44.47	**79.74**	5.44	-9.13
Pretest 2	-7.29	**-1.24**	-10.51	3.22	-4.77	-13.35	-11.83	**-1.24**	-3.53
Posttest 1	-13.17	**13.11**	-2.51	-10.66	-1.75	-1.37	2.06	7.39	-9.14
Posttest 2	-11.41	3.93	-2.02	-9.39	**4.57**	2.01	-7.96	-2.21	+6.78
Participant 6									
Pretest 1	-9.51	**12.6**	3.79	-13.3	12.32	-8.7	188.24-	-----[12]	----[13]
Pretest 2	-13.82	**8**	0.79	-14.61	-2.48	-18.26	2.35	-9.75	7.27
Posttest 1	-19.87	11.33	-2.73	-12.56	1.19	**48.31**	-6.39	0.61	0.58
Posttest 2	-16.28	-1.15	-7.31	-8.97	-1.39	**22.06**	-5.02	-7.48	+6.09

Timing measurement results for Phrase 4 varied:

In comparing the IOI of Notes 23-24 to Notes 25-26: *Participants* 2 and 3 performed inconsistent increases and decreases in both pre and posttest performances. *Participants* 1 and 4 performed consistent expected decreases in speed in all pre and posttests with no improvements. *Participant* 5 performed with expected decreases in both posttests.

In comparing the IOI of Notes 26-27 to Notes 29-30: *Participants* 3, 4 and 6 performed increases in speed, in all pre and posttests, opposite to expected results. *Participant* 5 performed with one increase and one decrease in posttests. *Participants* 1 and 2 performed all pre and posttests with

[12] Data unreadable
[13] Data unreadable

expected decreases in speed. *Participan*t 2 performed both posttests with larger decreases in timing but lower than the 20 ms threshold to be audibly perceptible.

IOI measurements for Notes 25-26 and Notes 29-30: Measurements of the longest held note varied and was inconsistent for all participants in all tests.

Summary of results for *A Short Story*-Timing-HT

Unlike dynamics results, timing measurements were similar in both HT and RH results. In cases where the expected increases or decreases occurred, the number difference was under 20 ms.

Timing-A Short Story Phrases 1 & 3 RH

Table 20 shows the results of Phrase 1, RH, showing similar outcomes to Phrase 1, HT (Table 17).

Table 20

Timing-A Short Story Phrase 1 RH

Participant	Pretest-1	Pretest 2	Posttest 1	Posttest 2
Participant 1				
Slur 1	24.56	22.63	37.17	34.53
Slur 2	20.16	17.48	24.27	20.88
Slur 3	33.84	23.17	43.22	24.92
Decrease or increase	-9.28	-0.54	-6.05	+9.61
Participant 2				
Slur 1	44.65	57.53	43.87	36.81
Slur 2	28.61	29.79	31.38	27
Slur 3	15.54	20.84	14.65	20.1
Decrease or increase	+29.11	+36.69	+29.22	+16.71
Participant 3				
Slur 1	49.26	36.58	18.11	30.68
Slur 2	34.26	58.4	28.28	29.07
Slur 3	28.22	15.68	16.07	15.49
Decrease or increase	+21.04	+20.9	+2.04	+15.19

Participant 4				
Slur 1	18.56	20.77	20.83	18.47
Slur 2	28.81	17.1	31.52	15.96
Slur 3	25.8	16.92	32.74	18.65
Decrease or increase	-7.24	+3.85	-11.91	-0.18
Participant 5				
Slur 1	9.29	5.4	12.71	3.28
Slur 2	2.61	-1.54	1.07	-1.66
Slur 3	6.86	-1.33	1.46	1.84
Decrease or increase	+2.43	+6.73	+11.25	+1.44
Participant 6				
Slur 1	11.63	10.45	12.99	14.37
Slur 2	5.69	0.86	1.18	12.26
Slur 3	9.3	2.9	5.53	-4.43
Decrease or increase	+2.33	+7.55	+7.46	+18.8

Results for timing-RH are similar to timing-HT for Phrase 1: *Participants* 2, 3 5 and 6 perform all pre and posttests with increases in speed, opposite to expected results. *Participants* 1 and 4 show mixed results in either pre or posttest results with one significant higher number increase for *Participant* 4 in posttest 1. Overall, participants performed closer to expected results in HT performances for timing measurements. Although many results are similar between HT and RH performances (Table 21), three exceptions can be noted.

Table 21

Results: Timing, A Short Story, Comparison between HT, and RH performances-Phrase 1

Participant	Comparison between increases or decreases for each HT and RH performance			
	Pretest 1	Pretest 2	Posttest 1	Posttest 2
Participant 1				
HT	+14.51	+7.87	+22.45	+15.5
RH	-9.28	-0.54	-6.05	+9.61
Participant 2				
HT	+4.43	+25.76	+8.19	+22.9
RH	+29.11	+36.69	+29.22	+16.71
Participant 3				
HT	+0.27	+3.99	-7.29	-15.07
RH	+21.04	+20.9	+2.04	+15.19

Participant 4				
HT	+0.65	+3.14	+12.53	+14.05
RH	-7.24	+3.85	-11.91	-0.18
Participant 5				
HT	+14.63	-3.21	-4.19	+5.56
RH	+2.43	+6.73	+11.25	+1.44
Participant 6				
HT	-2.98	-22.75	-5.58	+3.16
RH	+2.33	+7.55	+7.46	+18.8

Participants 1 and 3 performed closer to expected results in HT performances. *Participant* 4 performed closer to expected in results in RH posttests. All other participants performed similarly in HT and RH performances. (Table 22).

Table 22

Timing-A Short Story Phrase 3 RH

Participant	Pretest 1	Pretest 2	Posttest 1	Posttest 2
Participant 1				
Slur 1	9.66	15.03	18.21	11.52
Slur 2	2.58	10.15	8.73	9.24
Slur 3	10.64	28.6	1.36	8.48
Decrease or increase	-0.98	-13.57	+16.85	+3.04
Participant 2				
Slur 1	27.23	23.82	20.9	24.46
Slur 2	7.52	13.28	9.97	15.37
Slur 3	6.6	10.29	7.96	-1.89
Decrease or increase	+20.63	+13.53	+12.94	+26.35
Participant 3				
Slur 1	23.74	27.97	12.35	17.99
Slur 2	22.57	10.18	6.92	12.8
Slur 3	-0.23	16.97	-7.14	0.11
Decrease or increase	+23.97	+11	+19.49	+17.88
Participant 4				
Slur 1	18.2	23.9	19.25	19.18
Slur 2	9.55	25.85	14.88	10.39
Slur 3	3.72	13.07	14.35	13.8
Decrease or increase	+14.48	+13.83	+4.9	+2.38
Participant 5				

Slur 1	7.46	7.51	3.01	5.96
Slur 2	4.84	-9.11	-2.81	-3.93
Slur 3	9.49	-6.38	2.82	4.73
Decrease or increase	-2.03	+13.89	+0.19	+1.23
Participant 6				
Slur 1	8.66	13.51	9.68	3.43
Slur 2	-1.95	-1.59	-0.-6	2.09
Slur 3	-2.37	-0.16	1.8	-1.56
Decrease or increase	+11.03	+13.67	+7.88	-4.99

As with Phrase 1, comparing HT and RH performances of Phrase 3, we would expect some similarities and some differences for some participants (Table 23).

Table 23

Results: Timing, A Short Story, Comparison between HT and RH performances-Phrase 3

Participant	Comparison between increases or decreases for each HT and RH performance			
	Pretest 1	Pretest 2	Posttest 1	Posttest 2
Participant 1				
HT	+52.43	+3.94	+9.81	-7.85
RH	-0.98	-13.57	+16.85	+3.04
Participant 2				
HT	+20.07	+2.39	+0.67	+6.11
RH	+20.63	+13.53	+12.94	+26.35
Participant 3				
HT	+2.46	-8.21	-10.04	-10.86
RH	+23.97	+11	+19.49	+17.88
Participant 4				
HT	-0.16	+2.96	-0.68	+2.4
RH	+14.48	+13.83	+4.9	+2.38
Participant 5				
HT	+4.69	-2.65	-0.95	+0.96
RH	-2.03	+13.89	+0.19	+1.23
Participant 6				
HT	+0.21	+0.36	-4.81	+7.21
RH	+11.03	+13.67	+7.88	-4.99

Table 23 shows a variety of results when comparing HT to RH performances. *Participant* 2 maintains opposite results in all pre and posttests (HT and RH). *Participants* 1 and 3 show closer

to expected results in HT posttest results compared to RH with some decreases. *Participants* 4 and 5 show HT pre and posttests to be mixed and RH results to be opposite to expected result. *Participant* 6 is the only participant to show expected and larger number differences in results for both HT and RH in at least on posttest.

Overall, HT and RH performances are similar for both Phrases 1 and 3.

Timing-A Short Story Phrase 2 RH

The same 3 outcomes were expected for RH results (Table 24) than in HT results (Table 18).

Table 24

Timing: A Short Story- Phrase 2 RH

Participant	Notes 8-9	Notes 9-10	Notes 10-11	Notes 11-12	Notes 12-13	Increase or decrease between Notes 8 and 13	Notes 13-14	Notes 14-15	Increase or decrease between Notes 13 & 15
Participant 1									
Pretest 1	-2.31	24.07	3.31	-10.12	**26.02**	-28.33	2.33	12.35	-10.02
Pretest 2	9.61	**28.06**	6.08	-2.87	26.43	-16.82	12.05	16.39	-7.34
Posttest 1	9.52	26.9	2.68	3.2	**27.95**	-18.43	6.89	20.32	-13.43
Posttest 2	-2.39	**40.6**	11.77	18.57	36.05	-38.44	7.47	16.07	-8.6
Participant 2									
Pretest 1	21.96	**38.92**	12.56	28.38	25.63	-3.67	20.58	14.4	-6.18
Pretest 2	18.32	**33**	13.96	17.86	25.66	-7.34	21.3	19.47	+1.83
Posttest 1	20.01	**23.13**	11.31	17.33	20.9	-0.89	17.78	13.09	+4.69
Posttest 2	**29.37**	14.83	11.2	21.01	**29.37**	0	28.46	22.28	+6.18
Participant 3									
Pretest 1	27.05	39.52	8.35	24.71	**67.59**	-40.54	22.57	27.44	-4.87
Pretest 2	31.63	33.1	27.6	35.3	**47.77**	-16.14	24.12	19.35	+4.77
Posttest 1	11.5	**28.78**	0.65	26.75	11.84	-0.34	4.21	14.21	-10
Posttest 2	8.69	25.85	13.7	20.85	**34.08**	-25.39	8.16	9.23	-1.07
Participant 4									

Pretest 1	18.03	24.39	13.96	24.74	**33.58**	-15.55	23.15	11.84	-11.31
Pretest 2	16.22	21.13	12.72	12.02	27.78	-11.56	**30.4**	8.87	-21.53
Posttest 1	23.29	19.08	14	19.08	**39.75**	-16.46	18.73	15.23	-3.5
Posttest 2	13.08	32.11	17.03	19.55	**42.16**	-29.08	15.6	19.01	+3.41
Participant 5									
Pretest 1	-7.71	5.24	0.59	-3.66	**15.36**	-23.07	-0.22	3.42	-3.64
Pretest 2	**6.88**	2.25	3.09	-0.7	**6.88**	0	7.09	1.83	+5.26
Posttest 1	2.04	3.98	1.26	-2.23	-6.11	+8.15	**5.53**	1.65	+3.88
Posttest 2	2.25	1.02	1.02	0.19	**11.74**	-9.49	2.46	4.73	-2.27
Participant 6									
Pretest 1	5.69	12.49	-2.8	-0.25	**32.86**	-27.17	6.12	6.54	-0.42
Pretest 2	-3.22	12.29	-2	6.58	**34.75**	-37.97	9.64	5.96	+3.68
Posttest 1	1.18	**14.86**	1.18	6.57	14.45	-13.27	4.7	5.33	-0.63
Posttest 2	12.88	16.68	-7.31	0.56	**23.58**	-36.46	-3.28	12.45	-15.73

Results for timing measurements in Phrase 2 varied:

In comparing the IOI of Notes 8-9 to Notes 12-13: All participants performed with decreases in speed as expected in all pre and posttests with one exception (*Participant* 5-Posttest 1). *Participants* 1 and 5 performed with a larger decrease in speed in posttest 2 both under the 20 ms threshold.

In comparing the IOI of Notes 13-14 to Notes 14-15: Results were varied. *Participant* 2 performed all pre and posttests with increases, opposite to expected results. *Participant* 1 performed all pre and posttests with expected decreases showing no improvement. *Participant* 6 performed pretests with inconsistent results but showed a larger decrease under the 20 ms threshold. *Participants* 3, 4 and 5 show improved results in at least one of the posttests again under the 20 ms threshold.

IOI measurements for Notes 12-13 varied: Out of 24 pre and posttests measurements, Notes 12-13 was the longest held note 14/24 measurements. No improvements can be seen in any of the posttests.

Timing-A Short Story Phrase 4 RH

Table 25 shows that RH results are similar to HT results (Table 19).

Table 25

Tone Lengthening: A Short Story- Phrase 4 RH

Participant	Notes 23-24	Notes 24-25	Notes 25-26	Increase or decrease Notes 23-24 and 25-26	Notes 26-27	Notes 27-28	Notes 28-29	Notes 29-30	Increase or decrease Notes 26 & 30
Participant 1									
Pretest 1	-17.45	13.32	2.09	-19.54	-12.89	-2.8	-1.82	**18.7**	-31.59
Pretest 2	-9.38	**16.12**	-4.5	-4.88	-14.09	-6.67	6.35	**16.12**	-30.12
Posttest 1	-7.85	7.42	-4.43	-3.42	-15.22	-8.38	10.05	**19**	-34.22
Posttest 2	-28.18	**17.34**	-5.42	-22.76	-22.11	13.29	-1.88	10.25	-32.36
Participant 2									
Pretest 1	15.54	**39.38**	-9.91	25.45	-4.48	14.62	16.46	17.38	-21.86
Pretest 2	9.61	**37.12**	4.79	4.82	-21.88	12.36	5.02	16.03	-37.91
Posttest 1	18.67	25.36	0.38	18.29	-24.46	8.85	15.54	**29.37**	-53.83
Posttest 2	15.19	14.1	-2.79	+17.89	-27.08	-0.43	2.47	**23.19**	-50.27
Participant 3									
Pretest 1	7.57	163*	10.29	-2.72	-10.75	22.77	13.41	**30.17**	-40.92
Pretest 2	**32.37**	16.97	3.4	25.97	-15.79	17.33	19.9	23.93	-39.72
Posttest 1	-5.11	10.14	-10.02	4.91	-1.15	**30.14**	0.32	5.74	-6.89
Posttest 2	2.61	6.55	-5.43	+8.04	2.49	2.97	-14.55	**16.2**	-13.71
Participant 4									
Pretest 1	13.79	**25.45**	10.25	3.54	-15.54	8.49	8.13	10.61	-26.15
Pretest 2	-1.28	**13.42**	-4.61	3.33	-13.77	0.47	0.47	5.72	-19.49
Posttest 1	7.52	**14.53**	-0.71	8.23	-9.64	6.12	4.72	8.57	-18.21
Posttest 2	4.83	**20.98**	6.44	-1.61	-13.6	-8.81	5.55	9.85	-23.45
Participant 5									
Pretest 1	-10.14	**13.34**	0.99	-11.13	1.19	7.26	11.72	-5.69	6.88
Pretest 2	-11.22	**14.03**	-2.17	-9.05	-3.92	1.41	8.14	2.25	-6.17
Posttest 1	-5.72	**12.9**	8.64	-14.36	2.3	2.82	-0.68	0.49	1.81

Posttest 2	-13.41	**22.04**	-3.73	-9.68	-2.97	4.32	8.03	7.61	-10.58
Participant 6									
Pretest 1	2.72	17.58	9.73	-7.01	19.42	9.97	6.54	**24.08**	-4.66
Pretest 2	**6.58**	5.76	-4.25	10.83	-9.76	-5.27	5.76	7.8	-17.56
Posttest 1	-5.46	**8.23**	-9.39	14.85	-3.66	-9.6	-10.02	-1.31	-2.35
Posttest 2	-4.43	**0.56**	-4.24	-0.19	-20.17	0.17	-9.81	-9.81	-10.36

Timing measurements results for Phrase 4-RH was participant specific:

In comparing the IOI of Notes 23-24 to Notes 25-26: *Participants* 2 and 3 performed opposite increases in speed for all pre and posttests. *Participant* 6 performed mixed results in pre and posttests. *Participant* 4 performed a decrease in posttest 2 showing a possible effect of the intervention. *Participants* 1 and 5 performed all pre and posts tests with expected decreases and a larger decrease number in one posttest.

In comparing the IOI of Notes 26-27 to Notes 29-30: *Participant* 5 performed with mixed results in pre and posttests. *Participants* 1, 2, 3, 4 and 6 played all pre and posttests with expected decreases in speed. *Participant* 1 and 2 show larger decrease numbers for both posttests. *Participant* 2 shows a higher than 20ms audible threshold showing a possible effect of the intervention.

Highest IOI number: *Participants* 3, 4, 5 and 6 show varied opposite results. *Participant* 2 shows a clear shift in the longest note in both posttests.

Summary for *A Short Story*- Timing

As with the dynamics' analysis, we can observe some participant specific outcomes in timing outcomes. To show an intervention effect, it was expected that posttests would maintain expected pretest decreases with higher IOI numbers and/or that posttests would change from

pretest increases to posttest decreases. Table 26 is divided by *Participant* and each column summarizes the total number of measurable expected posttest results for each parameter in each phrase. Only numbers where a baseline could be established were collected for this summary.

Table 26

Summary by participant of expected posttests outcomes-Timing A Short Story

Participant	Phrase 1	Phrase 3	Phrase 2	Phrase 4	Total expected posttests outcomes
Participant 1	HT-0 RH- 0	HT-0 RH- 0	HT-3 RH- 2	HT-0 RH-4	HT=3 RH=6
Participant 2	HT-1 RH- 0	HT-0 RH- 0	HT-0 RH-0	HT-2 RH-4	HT=2 RH=4
Participant 3	HT-0 RH-0	HT-0 RH- 0	HT-0 RH-1	HT-0 RH-0	HT=1 RH=0
Participant 4	HT-0 RH-0	HT-0 RH-0	HT-0 RH-2	HT-1 RH-1	HT=1 RH=3
Participant 5	HT-0 RH 0	HT-0 RH- 0	HT- 2 RH-0	HT-4 RH-1	HT=6 RH=1
Participant 6	HT-1 RH-0	HT-1 RH- 1	HT-0 RH-0	HT-0 RH-0	HT=2 RH=1

Table 27

Summary by participant of expected posttests outcomes with mixed pretest results-Timing A Short Story

Participant	Phrase 1	Phrase 3	Phrase 2	Phrase 4	Total expected posttests outcomes
Participant 1	HT-0 RH- 0	HT-0 RH- 0	HT-0 RH- 1	HT-1 RH-0	HT=1 RH=1
Participant 2	HT-0 RH- 0	HT-0 RH- 0	HT-1 RH-0	HT-0 RH-0	HT=1 RH=0
Participant 3	HT-0 RH-0	HT-2 RH- 0	HT-0 RH 0	HT-0 RH-0	HT=2 RH=0
Participant 4	HT-0 RH-2	HT-1 RH-0	HT-0 RH-2	HT-0 RH-0	HT=1 RH=4
Participant 5	HT-1 RH 0	HT-0 RH- 0	HT- 0 RH-0	HT-0 RH-1	HT=1 RH=1
Participant 6	HT-0 RH-0	HT-0 RH- 0	HT-0 RH-1	HT-0 RH-0	HT=0 RH=1

IOI measurements for *A Short Story* produced some expected results. However, all numbers were under the 20 ms threshold expect one (Phrase 4, *Participant* 2). *Participants* 1, 4. 5 and 6 show at least one expected posttest outcome for both HT and RH performances. *Participants* 2 and 3 show expected posttest outcomes in either HT or RH performances. Although the intention of the study was not to compare HT and RH performances, the analysis of the data in these two cases raises some questions regarding RH and HT performances. There seems to be a trend that is participant specific: *Participants* 3, 5 and 6 show more expected results in HT posttests; *Participant 1* show similar results in both hands; and *Participant* 2 shows stronger results in RH results.

Overall, most IOI numbers indicate that participants kept consistent metric timing. Although some variances in timing (in MIDI numbers only) showed participant specific increases and decreases, the trend seems to be that participants played with consistent timing in all pre and posttests.

3.1.3 Articulation-*A Short Story* HT

Articulation-Lifts between Phrases -HT

The results of the articulation measurements between each phrase are associated with the following rules and intervention activities:

Dalcroze rule: A lift should precede and follow all notes after the end of a melodic phrase

Dalcroze activities during intervention: The experience of the beginning and ends of musical phrases was practiced through movement and singing and drawing on paper. The teacher used both improvisational materials at the piano and the familiar 4 phrases from the *A Short Story* melody (Figure 1)

a) Lesson 2: Changing directions at a musical signal by the teacher, drawing rainbows, singing while drawing on the score
b) Lesson 3: Drawing the rainbow with a ball

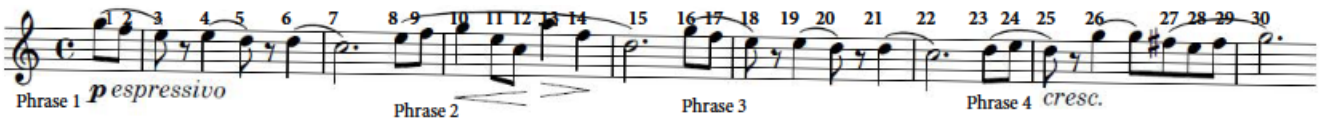


Figure 1. Excerpt from *A Short Story* illustrating the section of the musical score that was analysed.

Evidence of lifts between each phrase was measured by the Key Detached Time (KDT) between Notes 7-8, Notes 15-16 and Notes 25-26. It was expected that participants would detach sounds between these pairs of notes. In Table 28, articulation measurements between each pair is represented by a MIDI number. A positive number indicates that a detached sound (KDT) was played and a negative number indicates that a legato sound (Key Overlap Time or KOT) was played. The higher or lower numbers indicate the length of the KDT or the KOT. All three measurements were expected to be detached.

Table 28

Articulation-A Short Story: Lifts between Phrases-HT

Participant	Pretest 1	Pretest 2	Posttest 1	Posttest 2
Participant 1				
Notes 7-8	-290.5	-183.7	-142	**572.6**
Notes 15-16	-165.5	-38.4	-179.4	**420.9**
Notes 22-23	-8.5	-5.3	-2.1	-47
Participant 2				
Notes 7-8	**1172**	**963.6**	**603.6**	**365.3**
Notes 15-16	**751**	**601.4**	**602.5**	**1017**
Notes 22-23	**616.4**	**762.8**	**516**	**321.5**
Participant 3				
Notes 7-8	-53.4	-117.5	-79	**2.1**
Notes 15-16	**825.8**	**647.4**	**1027.7**	**590.8**
Notes 22-23	-57.6	-82.2	-104.7	**10.6**
Participant 4				
Notes 7-8	-37.3	**9.6**	**10.6**	-12.8
Notes 15-16	**544.8**	**513.8**	**773.5**	**581.1**
Notes 22-23	-26.7	-20.2	-18.1	-118.5
Participant 5				
Notes 7-8	-25.6	-37.3	-16	-14.9
Notes 15-16	-3.2	-3.2	**10.6**	-19.2

Notes 25-26	-8.5	-32	-16	**7.4**
Participant 6				
Notes 7-8	**2.1**	-53.4	-10.6	-36.3
Notes 15-16	**401.7**	**204**	**446.5**	**87.6**
Notes 25-26	**7.4**	-34.1	**7.4**	-12.8

Articulation results of lifts in HT performances between phrases show various results. *Participant* 2 shows maintained and consistent results for all pre to posttests with no evidence of intervention effect. *Participants* 4 and 6 show either mixed or opposite results with no evidence of intervention effect. *Participan*ts 1, 3 and show at least 2 detached pairs each in posttests, indicating a possible effect of the intervention.

Summary of results for *A Short Story*-Articulation HT

The possibility to analyse various other articulation measurements was limited for a few reasons: a) during the intervention period, each of the 3 Dalcroze lessons was only 60 minutes; b) in Dalcroze pedagogy, the teacher must continuously adapt to the needs of the students; and c) the goal of a Dalcroze class is the internalization of musical concepts. A detailed description of the lesson plans (Appendices I and J) shows that most of the classes focused on the dynamic qualities of phrasing. Activities in Lessons 2 and 3 incorporated the experience of feeling the beginnings and endings of phrases. No other concepts of articulation were addressed.

As with Dynamics results, comparing HT to RH for Articulation has revealed some interesting data. Table 29 shows participant specific results.

Table 29

Articulation-A Short Story: Lifts between Phrases-RH

Participant	Pretest 1	Pretest 2	Posttest 1	Posttest 2
Participant 1				
Notes 7-8	**291.6**	**336.5**	**300.2**	**272.4**
Notes 15-16	**248.9**	**219**	**224.3**	**186.9**
Notes 22-23	**263.8**	**199.7**	-11.7	**307.6**

Participant 2				
Notes 7-8	**213.6**	**189.1**	**138.8**	**303.4**
Notes 15-16	**298**	**287.3**	**266**	**271.3**
Notes 22-23	**215.8**	**169.8**	**206.1**	**202.9**
Participant 3				
Notes 7-8	-67.3	-121.7	**264.9**	**10.6**
Notes 15-16	**17.9**	**35.2**	**428.4**	**456.1**
Notes 22-23	-69.4	**371.7**	**318.3**	**249.9**
Participant 4				
Notes 7-8	**399.5**	-107.9	**298**	-83.3
Notes 15-16	**353.6**	**480.7**	**475.4**	**446.5**
Notes 22-23	**307.6**	**255.3**	**261.7**	**303.4**
Participant 5				
Notes 7-8	**287.3**	**347.2**	**309.8**	**367.5**
Notes 15-16	**269.2**	**267**	**317.3**	**440.1**
Notes 25-26	**430.5**	**352.5**	**393.1**	**444.4**
Participant 6				
Notes 7-8	-106.8	**52.3**	-19.2	**485.0**
Notes 15-16	**377.1**	**306.6**	**418.8**	**556.6**
Notes 25-26	**16**	**4.2**	**11.7**	**516**

Participants 2 and 5 maintain expected outcomes throughout pre and posttests with no evidence of intervention effect. *Participants* 1, 4 and 6 maintain expected outcomes for some posttests and mixed results for others. *Participant* 3 performed with expected outcomes in posttest performances for Notes 7-8 showing possible evidence of an intervention effect. When comparing HT to RH results, it is interesting to observe the difference in overall expected results in RH performances. *Participant* 2 is the only participant that played the same in both HT and RH performances. *Participants* 1, 3, 4, 5 and 6 all played most expected, detached results in pretest performances indicating that the control of articulation in HT performance may be more challenging that in RH performances.

3.2 Results for Lightly Row

3.2.1 Dynamics-HT

Dynamics-Lightly Row Phrase 1-HT

The results of the dynamic measurements of Phrase 1 are associated with the following rules and intervention activities:

Dalcroze rule: The ascending scale ought to be sung with a crescendo

Dalcroze activities during intervention: The experience of musical phrases with crescendo was practiced through movement and singing. Focused on the crescendo within the second half of the phrase towards the end of the phrase. The teacher used both improvisational materials at the piano and the familiar 5 phrases from the *Lightly Row* melody (Figure 2)

a) Lesson 1: Preparation (cymbals-phrase arch), Main exercise: painting by phrase teacher's improvisation (improv-dynamics large and small frames)-drawing phrase arch
b) Lesson 2: Teacher's improv: various rainbow drawings-height of phrases, Scalar passages. Main exercise: returning home
c) Lesson 3: Warm up, Preparation and Main lesson: Quick Reaction Game, (Rainbow)

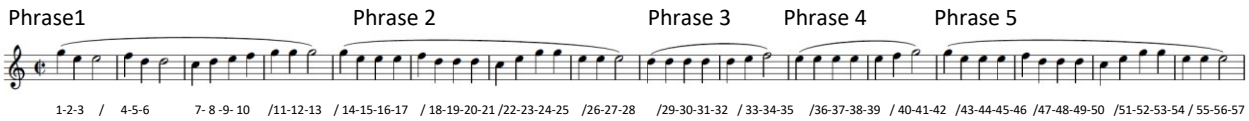


Figure 2. Excerpt from *Lightly* Row illustrating the section of the musical score that was analysed.

Two amplitude measurement were taken in Phrase 1 to quantify dynamics: a) comparing the MIDI numbers of Notes 7 and 13; b) identifying an increase or decrease between both numbers. It was expected that Note 13 would have a higher amplitude number than Note 7 and that posttest performances would show a higher number than in pretests. In Table 30, the numbers in each column represent the amplitude number of each note. Increase and decrease differences between Notes 7 and 13 complete the note row.

Table 30

Dynamics: Lightly Row- Phrase 1 HT

Participant	Note 7	Note 8	Note 9	Note 10	Note 11	Note 12	Note 13	Increase or decrease between Notes 7 and 13
Participant 7								
Pretest 1	51	54	56	50	60	60	60	+9
Pretest 2	48	51	58	51	53	55	52	+4
Posttest 1	43	46	48	50	49	53	48	+5
Posttest 2	46	49	55	45	52	57	49	+3
Participant 8								
Pretest 1	66	66	65	58	67	68	66	0
Pretest 2	53	47	50	53	63	65	60	+7
Posttest 1	52	51	57	52	58	48	53	+1
Posttest 2	45	44	51	49	49	41	51	+6
Participant 9								
Pretest 1	52	59	57	53	57	56	58	+6
Pretest 2	56	61	57	51	63	59	65	+9
Posttest 1	62	61	58	57	71	60	68	+6
Posttest 2	58	59	56	57	70	71	66	+8

All pre and posttests yielded expected increases between Notes 7 and 13. Posttests did not show larger increase numbers.

Dynamics-Lightly Row Phrase 2-HT

The results of the dynamic measurements of Phrase 2 are associated with the following rules and intervention activities:

Dalcroze rules:
a) The ascending scale ought to be sung with a crescendo,
b) Every descending melody should be sung with a melody and
c) Every final note loses some of its sonority except when it is the final note of a crescendo.

Dalcroze activities during intervention: The experience of musical phrases with crescendo and decrescendo was practiced through movement and singing. Focus was on the crescendo and decrescendo within the second half of the phrase towards the end of the phrase. The teacher used

both improvisational materials at the piano and the familiar 5 phrases from the *Lightly Row* melody (Figure 2)

a) Lesson 1: Preparation (cymbals-phrase arch), Main exercise: painting by phrase teacher's improvisation (improv-dynamics large and small frames)-drawing phrase arch
b) Lesson 2: Teacher's improv: various rainbow drawings-height of phrases, Scalar passages. Main exercise: returning home
c) Lesson 3: Warm up, Preparation and Main lesson: Quick Reaction Game, (Rainbow)

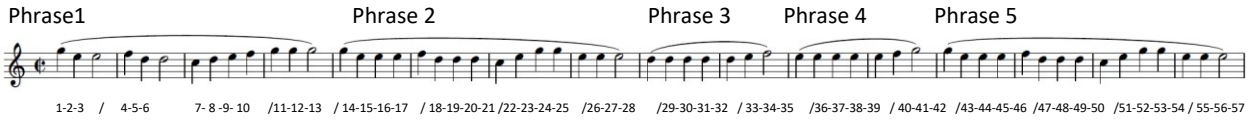


Figure 2. Excerpt from Lightly Row illustrating the section of the musical score that was analysed.

Four amplitude measurement was taken in Phrase 2 to quantify dynamics: a) comparing the MIDI numbers of Notes 22 and 24; b) comparing the MIDI numbers between Note 25 and Note 28 and c) identifying an increase or decrease between both pairs. It was expected that a) Note 24 would have a higher amplitude number than Note 22; b) that Note 28 would have a lower amplitude number than Note 25 and that c) posttest performances would show a larger increase number than in pretests. In Table 31, the numbers in each column represent the amplitude number of each note. Increase and decrease differences between Notes 22 and 24 and Notes 25 and 28 complete the note row of each section.

Table 31

Dynamics: Lightly Row-Phrase 2 HT

Participant	Note 22	Note 23	Note 24	Increase or decrease between Notes 22 and 24	Note 25	Note 26	Note 27	Note 28	Increase or decrease between Notes 25 and 28
Participant 7									
Pretest 1	53	48	51	-2	53	52	52	53	0
Pretest 2	49	51	47	-2	41	56	54	54	+13

Posttest 1	42	53	50	+8	44	44	53	44	0
Posttest 2	50	50	50	0	55	54	58	58	+3
Participant 8									
Pretest 1	66	65	66	0	64	65	63	64	0
Pretest 2	53	57	55	+2	54	55	51	61	+7
Posttest 1	45	52	54	+9	36	57	50	50	+14
Posttest 2	55	45	52	-3	43	46	47	55	+9
Participant 9									
Pretest 1	60	58	61	+1	56	55	55	65	+9
Pretest 2	63	67	59	-4	63	62	65	66	+3
Posttest 1	66	65	69	+3	68	68	58	65	-3
Posttest 2	61	63	67	+6	70	60	64	67	-3

Measurements between Notes 22 and 24 are mixed. Pretest results for *Participant* 8 are mixed in both pre and posttests. *Participant* 9 has mixed results in pretests and expected results in both posttests. *Participant* 7 shows consistent decreases in both pretests followed by on improved increase in posttest1 indicating a possible effect from the intervention with a unit difference of more than 4 numbers.

Measurements between Notes 25 and 28 were consistently opposite to expected results for *Participants* 7 and 8. *Participant* 9 shows consistent increases in both pretests and consistent decreases in both posttests indication a possible effect of the intervention with a larger than 4-unit difference between pre and posttest numbers.

Dynamics- Lightly Row Phrase 5-HT

Phrase 5 is identical to Phrase 2. The results of the dynamic measurements of Phrase 5 are associated with the same rules and intervention activities as in Phrase 2.

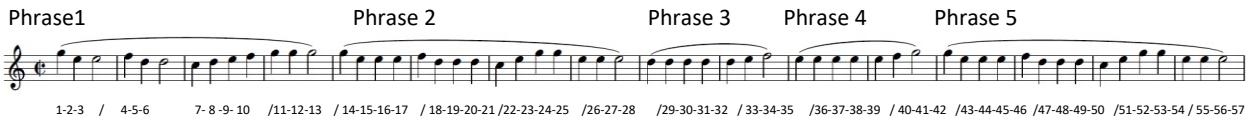


Figure 2. Excerpt from Lightly Row illustrating the section of the musical score that was analysed.

Four amplitude measurements were taken in Phrase 5 to quantify dynamics: a) comparing the MIDI numbers of Notes 51 and 53; b) comparing the MIDI numbers between Notes 54 and 57 and c) identifying an increase or decrease in amplitude between both compared pairs. It was expected that a) Note 53 would have a higher amplitude number than Note 51; b) that Note 57 would have a lower amplitude number than Note 54 and that c) posttest performances would show a larger increase number. In Table 32, the numbers in each column represent the amplitude number of each note. Increase and decrease differences between Notes 51 and 53 and Notes 54 and 57 complete the note row of each section.

Table 32

Dynamics: Lightly Row - Phrase 5 HT

Participant	Note 51	Note 52	Note 53	Increase or decrease between Notes 51 and 53	Note 54	Note 55	Note 56	Note 57	Increase or decrease between Notes 54 and 57
Participant 7									
Pretest 1	52	49	56	+4	42	52	55	45	+3
Pretest 2	47	56	52	+5	53	58	54	52	-1
Posttest 1	45	53	51	+6	50	53	52	51	+1
Posttest 2	45	50	52	+7	50	50	54	62	+12
Participant 8									
Pretest 1	57	64	60	+3	55	55	53	49	-6
Pretest 2	52	47	46	-6	49	47	43	46	-3
Posttest 1	61	53	58	-3	59	56	60	62	+3
Posttest 2	53	42	42	-11	38	55	52	47	-8
Participant 9									
Pretest 1	54	56	61	+7	59	67	67	70	+11
Pretest 2	63	66	61	-2	64	60	64	67	+3
Posttest 1	63	62	61	-2	60	66	68	71	+11
Posttest 2	60	66	71	+11	71	66	75	71	0

Measurements between Notes 51 and 53 are mixed. Pretest results for *Participant* 8 are mixed in pretests and opposite to expected results in both posttests. *Participant* 9 has mixed results in both pre and posttests. *Participant* 7 shows consistent and expected increases in both pre and posttests with larger amplitude scores for both posttests.

Measurements between Notes 54 and 57 show either opposite to expected results or inconsistent results in pre to posttests for *Participants* 7 and 9. *Participant* 8 shows a larger increase in posttest 2.

Dynamics- Lightly Row Phrase 3-HT

The results of the dynamic measurements of Phrase 3 are associated with the following rules and intervention activities:

Dalcroze Rules:

a) When the same note is sung several times, its repetition ought to be accompanied by a crescendo
b) The ascending scale ought to be sung with a crescendo

Dalcroze Classes: Focused on the crescendo within the second half of the phrase towards the end of the phrase

a) Lesson 1: Preparation (cymbals-phrase arch), Main exercise: painting by phrase teacher's improvisation (improv-dynamics large and small frames)
b) Lesson 2: Exploration of the lollipop drum-interrupted canon-especially the shorter phrases of Phrase 3 and Phrase 4
    a. Teacher's improv: various rainbow drawings-height of phrases
    b. Main exercise: returning home
c) Lesson 3:
    a. Warm up-pentatonic scale-move up and down
    b. Preparation and main lesson**:** quick reaction game, (rainbow)
    c. drawing on board the lengths of the phrases in LR
    d. Exercise: returning home

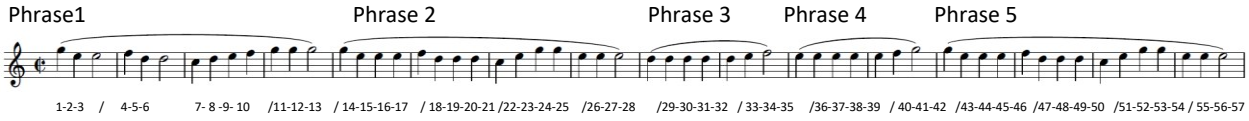


Figure 2. Excerpt from Lightly Row illustrating the section of the musical score that was analysed.

Four amplitude measurements were taken in Phrase 3 to quantify dynamics: a) comparing the MIDI numbers of Notes 29 to 33 and b) comparing the MIDI numbers of Notes 29 to 35 and c) identifying an increase or decrease between both compared pairs. It was expected that a) Note 33 would have a higher amplitude number than Note 29; b) that Note 35 would have a higher amplitude number than Note 29[14] and that c) posttest performances would show a larger increase number between each pair of numbers. In Table 33, the numbers in each column represent the amplitude number of each note. Increase and decrease differences between Notes 29 and 33 and Notes 29 and 35 complete the note row of each section.

Table 33

Dynamics: Lightly Row - Phrase 3 HT

Participant	Note 29	Note 30	Note 31	Note 32	Note 33	Increase or decrease between Notes 29 and 33	Note 34	Note 35	Increase or decrease between Notes 29 and 35
Participant 7									
Pretest 1	52	40	35	54	61	+9	65	54	+2
Pretest 2	52	55	47	51	55	+3	57	49	-3
Posttest 1	48	39	38	43	66	+18	56	53	+5
Posttest 2	50	54	43	55	54	+4	57	55	+5
Participant 8									
Pretest 1	67	65	57	63	68	+1	62	66	-1
Pretest 2	56	57	51	56	58	+2	58	55	-1
Posttest 1	61	59	48	62	63	+2	65	66	+5
Posttest 2	49	59	59	54	51	+2	63	49	0
Participant 9									
Pretest 1	64	59	64	67	68	+4	58	67	+3
Pretest 2	64	60	64	58	51	-13	43	60	-4
Posttest 1	74	63	67	68	67	-7	67	63	-11

[14] In the Dalcroze classes, the crescendo (increase in amplitude) was explored for the whole phrase (Notes 29-35) including the experience of the repeated notes towards the rising melody (Notes 33-35).

Posttest 2	67	63	69	67	70	+3	67	66	-1

Results for amplitude measurements are participant specific and vary.

For Notes 29-33: *Participan*t 9 shows mixed pre and posttest results. *Participant*s 7 and 8 show expected increases in all pre and posttests. *Participan*t 7 shows a larger amplitude variance in posttest 1, indicating a possible effect of the intervention.

For Notes 29-35: *Participant* 9 shows mixed results in pretests and decreases in both posttests, opposite to expected increases. *Participant* 7 shows mixed results in pretests but expected increases with higher amplitude numbers for both posttests. *Participa*nt 8 shows consistent decrease results in pretests with expected an improved amplitude score in one posttest showing a possible effect of the intervention.

Dynamics- Lightly Row Phrase 4-HT

The results of the dynamic measurements of Phrase 4 are associated with the same rules and activities than in Phrase 3.

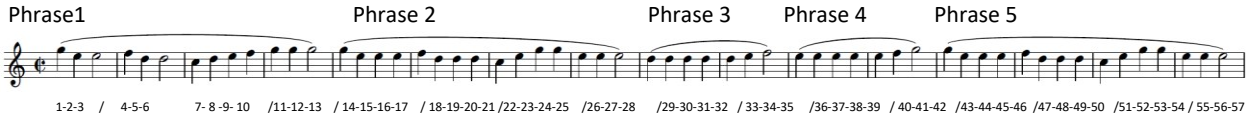


Figure 2. Excerpt from Lightly Row illustrating the section of the musical score that was analysed.

Four amplitude measurements were taken in Phrase 4 to quantify dynamics: a) comparing the MIDI numbers of Notes 36 to 40 and b) comparing the MIDI numbers of Notes 36 to 42 and c) identifying an increase or decrease between both pairs. It was expected that a) Note 40 would have a higher amplitude number than Note 36; b) that Note 42 would have a higher amplitude number than Note 36 and that c) posttest performances would show a larger increase between the

pairs of notes. In Table 34, the numbers in each column represent the amplitude number of each note. Increase and decrease differences between Notes 36 and 40 and Notes 36 and 42 complete the note row of each section.

Table 34

Dynamics: Lightly Row - Phrase 4 HT

Participant	Note 36	Note 37	Note 38	Note 39	Note 40	Increase or decrease between Notes 36 and 40	Note 41	Note 42	Increase or decrease between Notes 36 and 42
Participant 7									
Pretest 1	55	51	55	53	57	+2	57	60	+5
Pretest 2	56	56	52	54	56	0	54	58	+2
Posttest 1	54	51	52	50	48	-6	54	56	+2
Posttest 2	52	54	54	54	46	-6	53	55	+3
Participant 8									
Pretest 1	61	65	60	64	66	+5	63	64	+3
Pretest 2	52	57	54	52	58	+6	57	55	+3
Posttest 1	58	51	57	53	50	-8	64	65	+7
Posttest 2	54	52	54	51	50	-4	45	56	+2
Participant 9									
Pretest 1	63	50	52	44	47	-16	52	58	-5
Pretest 2	65	68	64	63	68	+3	63	68	+3
Posttest 1	66	64	68	69	67	+1	63	63	-3
Posttest 2	65	67	61	63	71	+6	50	69	+4

Results for amplitude measurements are participant specific and vary.

For Notes 36-40: *Participant*s 7 and 8 shows opposite to expected results in pre and posttests results. *Participant* 9 shows mixed results in pretests and expected results in posttests.

For Notes 36-42: *Participant* 9 shows mixed results in pre and posttests. *Participant*s 7 and 8 consistent increases in pre and posttests. *Participant* 8 shows a larger increase number in posttest 1 indicating a possible effect of the intervention.

Summary for Dynamics *Lightly Row*- HT

Two items of information can be noted for dynamic measurements with HT. In each phrase, only one performance showed a possible effect of the intervention that would be audibly perceptible. In most cases inconsistent pretests made any noticeable improvements in posttests to be suggestive. RH performances yielded similar results to HT but not consistently for each participant.

Results for RH Lightly Row Phrase 1. Table 35 shows the results of Phrase 1, RH showing similar outcomes to Phrase 1, HT (Table 27).

Table 35

Dynamics: Lightly Row - Phrase 1 RH

Participant	Note 7	Note 8	Note 9	Note 10	Note 11	Note 12	Note 13	Increase or decrease between Notes 7 and 11
Participant 7								
Pretest 1	49	54	52	49	53	51	51	+2
Pretest 2	53	51	57	52	54	44	54	+1
Posttest 1	48	41	52	49	57	64	61	+13
Posttest 2	48	52	53	49	59	58	60	+12
Participant 8								
Pretest 1	54	51	55	50	57	58	50	-4
Pretest 2	60	58	56	48	53	55	58	-2
Posttest 1	61	33	58	56	61	57	64	+3
Posttest 2	44	43	52	53	53	50	55	+11
Participant 9								
Pretest 1	59	52	54	45	60	65	61	+2
Pretest 2	46	51	46	42	49	57	54	+8
Posttest 1	58	55	52	55	44	50	48	-10
Posttest 2	45	48	45	44	49	50	44	-1

Similar results were observed between HT and RH performances for Phrase 1-Dynamics and were participant specific.

Participant 7: performed expected results in both HT and RH performances. RH posttests show larger increases in amplitude measurements indicating a possible effect of the intervention for both posttests.

Participant 8: performed expected posttest results in HT performances and increases in RH posttests indicating a possible effect of the intervention for both posttests.

Participant 9: performed expected results in all HT performances. RH performances show expected pretests increases and opposite than expected results in both posttests.

Results for RH Lightly Row Phrase 2

Table 36 shows the results of Phrase 2, RH showing similar outcomes to Phrase 2, HT (Table 30).

Table 36

Dynamics: Lightly Row - Phrase 2 RH

Participant	Note 22	Note 23	Note 24	Increase or decrease between Notes 22 and 24	Note 25	Note 26	Note 27	Note 28	Increase or decrease between Notes 25 and 28
Participant 7									
Pretest 1	47	48	50	+3	39	45	48	47	+8
Pretest 2	52	47	41	-11	42	54	51	50	+8
Posttest 1	49	50	50	+1	--[15]	49	41	41	--
Posttest 2	46	54	48	+2	55	41	51	54	-1
Participant 8									
Pretest 1	59	55	50	-9	54	54	55	52	-2

[15] Data corrupted

Pretest 2	50	48	55	+5	61	54	53	53	-8
Posttest 1	46	53	44	-2	35	44	51	54	+19
Posttest 2	44	41	38	-6	39	34	34	39	0
Participant 9									
Pretest 1	48	53	53	+5	47	51	49	49	+2
Pretest 2	47	52	50	+3	50	48	55	53	+3
Posttest 1	54	49	54	0	58	51	56	58	0
Posttest 2	52	55	50	-2	42	45	38	43	+1

Similar results were observed between HT and RH performances for Phrase 2-Dynamics and were participant specific.

For measurements between Notes 22-24: *Participant* 9 performed in both HT and RH with mixed pretests and expected posttests. *Participant* 8 performed with mixed increases and decreases in both pre and posttests. *Participant* 7 performed expected results in HT and RH posttest performances. HT posttests show an improved measurement.

For measurements between Notes 25-28: All participants played all pre and posttests with opposite or mixed results with two exceptions.: *Participant* 9 played both HT posttests with expected and improved results and *Participant* 7 performed one posttest with expected and improved results, showing a possible effect of the intervention.

Results for RH: Lightly Row -Phrase 5

Table 37 shows the results of Phrase 5, RH showing similar outcomes to Phrase 5, HT (Table 31).

Table 37

Dynamics: Lightly Row - Phrase 5 RH

Participant	Note 51	Note 52	Note 53	Increase or decrease between Notes 51 and 53	Note 54	Note 55	Note 56	Note 57	Increase or decrease between Notes 54 and 57
Participant 7									
Pretest 1	41	43	35	-6	47	50	53	54	+7
Pretest 2	41	56	54	+13	43	48	47	47	+4
Posttest 1	51	50	44	-7	51	50	49	62	+11
Posttest 2	39	51	54	+15	44	46	51	40	-4
Participant 8									
Pretest 1	41	53	45	+4	32	36	45	41	+9
Pretest 2	49	46	39	-10	46	44	52	45	-1
Posttest 1	57	50	52	-5	56	44	50	57	+1
Posttest 2	34	38	42	+8	27	36	36	25	-2
Participant 9									
Pretest 1	47	48	48	+1	54	53	55	58	+4
Pretest 2	20	49	57	+37	51	50	49	54	+3
Posttest 1	58	49	46	-12	50	56	66	60	+10
Posttest 2	54	58	51	-3	50	49	56	53	+3

Similar results were observed between HT and RH performances for Phrase 5-Dynamics and were participant specific.

For measurements between Notes 51-53: All participants performed with either mixed, expected or opposite than expected results in all pre and posttests in both HT and RH performances except for *Participant* 7 who played both HT posttests with larger increase indicating a possible effect of the intervention.

For measurements between Notes 54-57: All participants performed with either mixed, expected or opposite than expected results in all pre and posttests in both HT and RH performances with 2

exceptions: *Participants* 7 and 8 show one posttest with an improved decrease indicating a possible effect of the intervention.

Results for RH Dynamics: Lightly Row -Phrase 3

Table 38 shows the results of Phrase 3, RH showing similar outcomes to Phrase 3, HT (Table 32).

Table 38

Dynamics: Lightly Row - Phrase 3 RH

Participant	Note 29	Note 30	Note 31	Note 32	Note 33	Increase or decrease between Notes 29 and 33	Note 34	Note 35	Increase or decrease between Notes 29 and 35
Participant 7									
Pretest 1	47	31	47	46	45	-2	55	45	-2
Pretest 2	34	40	33	37	53	+19	57	54	+20
Posttest 1	32	41	37	38	51	+19	58	57	+25
Posttest 2	32	43	35	35	48	+16	56	56	+24
Participant 8									
Pretest 1	52	56	55	49	55	+3	62	60	+8
Pretest 2	51	47	53	51	49	-2	53	53	+2
Posttest 1	59	53	59	55	48	-11	58	60	+1
Posttest 2	25	41	46	52	55	+30	52	48	+23
Participant 9									
Pretest 1	48	37	39	42	47	-1	43	46	-2
Pretest 2	52	51	57	54	56	+4	58	57	+5
Posttest 1	55	54	55	54	62	+7	58	56	+1
Posttest 2	49	43	44	45	65	+16	63	63	+14

For Notes 29-33: For RH performances, all participants show mixed results in pretests and strong expected results in posttests.

For Notes 29-35: *Participants* 7 and 9 show mixed results in all RH pretests with expected results in all posttests. *Participant* 8 performed a significantly larger increase in posttests 2 showing a possible intervention effect.

Results for RH Dynamics- Lightly Row Phrase 4

Table 39 shows the results of Phrase 4, RH showing similar outcomes to Phrase 4, HT (Table 32).

Table 39

Dynamics: Lightly Row - Phrase 4 RH

Participant	Note 36	Note 37	Note 38	Note 39	Note 40	Increase or decrease between Notes 36 and 40	Note 41	Note 42	Increase or decrease between Notes 36 and 42
Participant 7									
Pretest 1	56	59	52	49	51	+5	44	56	0
Pretest 2	44	43	46	58	60	+19	55	60	+16
Posttest 1	46	36	50	42	57	+11	57	61	+15
Posttest 2	50	50	45	46	48	-2	50	60	+10
Participant 8									
Pretest 1	58	57	53	53	51	+7	53	56	-2
Pretest 2	49	47	57	50	55	+6	48	45	-4
Posttest 1	52	53	58	49	47	+5	57	61	+9
Posttest 2	44	40	45	54	55	+11	44	51	+7
Participant 9									
Pretest 1	52	43	52	44	49	-3	45	61	+9
Pretest 2	57	53	48	50	53	-4	48	64	+7
Posttest 1	61	54	57	52	54	-7	58	67	+6
Posttest 2	57	50	50	48	65	+8	52	73	+16

Measurements of Notes 36-40: All pre and posttests in all HT and RH performances show a combination of mixed, expected, and opposite results with no indication of intervention effect.

Two results in RH performance show an improved and larger increase for one posttest each for *Participants* 8 and 9.

Measurements of Notes 36-42: All pre and posttests in all HT and RH performances show a combination of mixed and expected results with two improved and larger increases for 3 RH posttests for *Participants* 8 and 9.

Summary for *Lightly Row* - Dynamics

To show an intervention effect, it was expected that posttests would maintain expected pretest increases or decreases with higher amplitude scores and/or that posttests would change from pretest increases to posttest decreases, or vice versa and be audibly perceivable with difference of at least 4-unit numbers. Table 40 is divided by *Participant* and each column summarizes the total number of measurable expected posttest results for each parameter. Only numbers where a baseline could be established were collected for this summary.

Table 40

Summary by participant of expected posttests outcomes-Dynamics Lightly Row

Participant	Phrase 1	Phrase 2	Phrase 5	Phrase 3	Phrase 4	Total expected posttests outcomes
Participant 7	HT- 0 RH- 1	HT-1 RH-1	HT-2 RH-1	HT- 1 RH- 0	HT-0 RH- 0	HT=4 RH=3
Participant 8	HT-0 RH- 2	HT-0 RH-0	HT-1 RH- 0	HT-1 RH-1	HT-1 RH-3	HT=3 RH=6
Participant 9	HT-0 RH-0	HT-2 RH-0	HT-0 RH- 0	HT-0 RH- 0	HT- 0 RH- 2	HT=2 RH=2

Amplitude measurements for *Lightly Row* produced some expected results and some indications of intervention effect. Although the intention of the study was not to compare HT and RH performances, the analysis of the data in these two cases show that both performance protocols produce similar results. *Participant* 8 shows a larger number of expected posttests outcomes in

the RH performances. The increase and decrease differences, were, although measurable with MIDI numbers, not large enough to be perceivably different.

The number of expected results in posttests when pretests were not consistent. Similar results are shown in mixed pretest results. Table 41 shows the number of expected outcomes in posttests when pretests were mixed. Only posttest results where the amplitude number shows an improvement (larger number) were compiled for this table.

Table 41

Summary by participant of expected posttests outcomes with mixed pretest results-Dynamics Lightly Row

Participant	Phrase 1	Phrase 2	Phrase 5	Phrase 3	Phrase 4	Total expected posttests outcomes
Participant 7	HT- 0 RH- 0	HT-0 RH-0	HT-0 RH- 1	HT-2 RH- 2	HT-0 RH- 0	HT=2 RH=3
Participant 8	HT-0 RH- 0	HT-1 RH-0	HT-0 RH- 2	HT-0 RH-1	HT-0 RH-0	HT=1 RH=3
Participant 9	HT-0 RH-0	HT-2 RH-0	HT-1 RH- 0	HT-3 RH- 0	HT- 2 RH- 0	HT=8 RH=0

Participants 7 and 8 performed at least the same number of expected outcomes in posttests when pretests were mixed. *Participant* 9 shows expected outcomes only in HT performances. Although these outcomes cannot be quantified for this study because the baseline was not clearly established, they do underline the inconsistencies of outcomes during the pretest performances.

3.2.2 Timing-HT

Timing- Lightly Row Phrase 1- HT

The results of the timing measurements of Phrase 1 are associated with the following rules and intervention activities:

Dalcroze rule: Choices in timing are related to dynamics

Dalcroze activities during intervention: The experience of equal timing and variances in timing were practiced with movement, rhythmic and singing activities. The teacher used both

improvisational materials at the piano and the familiar 5 phrases from the *Lightly Row* melody (Figure 2)

a) Lesson 1: Finger Cymbals, Walk/Gallop/Run, Singing, clapping and stepping rhythms
b) Lesson 2: Walk/Gallop/Run, Singing, clapping and stepping rhythms. All activities incorporate reactions to various speeds
c) Lesson 3: Interrupted Canon, Passing the ball in a circle, Drawing the rainbow with a ball

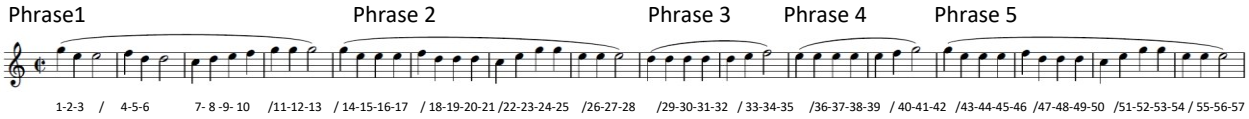


Figure 2. Excerpt from *Lightly Row* illustrating the section of the musical score that was analysed.

The timing measurements were calculated with the IOI (inter-onset interval) of each note. Because IOI is calculated from the onset of the 1st note to the onset of the 2nd note, the presentation of note identification is done in pairs (Notes 7-8, 8-9, 9-10 and 10-11). Table 42 shows decreases or increases in timing between Notes 7 and 13 which completes the row. Positive numbers equal longer held notes and negative numbers equal shorter held notes. It was expected that Notes 12-13 have a slightly higher IOI than Notes 7-8.

Table 42

Timing: Lightly Row Lightly Row- Phrase 1 HT

Participant	Notes 7-8	Notes 8-9	Notes 9-10	Notes 10-11	Notes 11-12	Notes 12-13	Increase or decrease between Notes 7 and 13
Participant 7							
Pretest 1	4.33	5.59	-6.39	9.37	-8.28	14.73	-10.4
Pretest 2	15.96	14.31	10.68	9.04	7.39	4.76	+11.2
Posttest 1	1.49	0.81	3.19	7.62	2.51	16.81	-15.32
Posttest 2	-7.23	5.27	-4.92	5.6	-3.94	1.33	-8.56
Participant 8							
Pretest 1	73.22	-11.8	-16.04	-15.74	-11.05	-13.32	+86.54
Pretest 2	-6.96	-9.46	-11.74	-17.55	-9.04	-12.57	+5.61

Posttest 1	12.03	17.16	13.26	0.81	16.92	4.22	+7.81
Posttest 2	12.83	-1.01	2.71	-1.63	5.6	3.95	+8.88
Participant 9							
Pretest 1	46.1	9.84	10.74	9.3	0.82	13.45	+32.65
Pretest 2	119.67	1.69	5.86	-1.09	-2.68	-6.85	+126.52
Posttest 1	3.67	8.21	0.48	2.53	13.67	4.58	-0.91
Posttest 2	13.92	1.35	17.42	5.27	7.12	11.45	-2.17

Results for TH-Phrase 1 are participant specific. *Participant* 8 shows consistent increases in timing for both pretests. *Participant* 7 shows mixed results in pretests and expected decreases in both posttests. *Participan*t 9 shows consistent increases in timing for all pretests and expected decreases of more than 20 ms in both posttests indicating a possible effect of the intervention.

Timing: Lightly Row Phrase 2- HT

The results of the timing measurements of Phrase 2 are associated with the same rules and intervention activities as Phrase 1. Timing measurements for Phrase 2 (Table 41) are presented in paired numbers as in Phrase 1. Decreases or increases in timing between Notes 22 and 28 complete each note row. It was expected that Notes 27-28 would have a larger IOI number than Notes 22-23. Table 43 presents timing measurements for Phrase 2, HT.

Table 43

Timing: Lightly Row - Phrase 2 HT

Participant	Notes 22-23	Notes 23-24	Notes 24-25	Notes 25-26	Notes 26-27	Notes 27-28	Increase or decrease between Notes 22-28
Participant 7							
Pretest 1	-1.98	-0.09	-5.44	0.23	1.49	1.49	-3.47
Pretest 2	-6.12	8.71	-9.08	-5.79	-3.48	-2.49	-3.63
Posttest 1	-11.11	2.17	-12.47	-5.32	-2.26	3.87	-14.98
Posttest 2	-12.16	8.56	-5.58	-2.62	-7.56	3.3	-15.46
Participant 8							
Pretest 1	100.3	-6.21	-5.6	3.93	2.12	1.66	+98.94

Pretest 2	17.75	-7.59	19.62	11.31	6.33	5.08	+12.67
Posttest 1	18.87	-3.34	0.81	5.2	-7	2.03	+16.84
Posttest 2	5.81	6.01	4.36	-4.73	-3.49	3.95	+1.86
Participant 9							
Pretest 1	8.58	7.86	6.42	9.48	7.5	---	--
Pretest 2	-7.44	-10.03	-13.8	-6.85	-0.69	-10.62	+3.18
Posttest 1	6.62	-13.16	8.21	-9.52	-4.52	9.12	-2.5
Posttest 2	-4.62	-2.77	-8.74	-9.15	-2.36	33.08	-37.7

Results for timing in Phrase 2 are participant specific. *Participant* 8 shows consistent increases in IOI speeds for all pre and posttests. *Participant* 9 shows inconclusive pretests and expected decreases in both posttests. *Participant* 7 shows expected decreases in all pre and posttests with larger than 20 ms IOI numbers in both posttests indicating a possible effect of the intervention.

Timing-Lightly Row Phrase 5- HT

The results of the timing measurements of Phrase 5 are associated with the same rules and intervention activities as Phrase 2.

Timing measurements for Phrase 5 are the same as Phrase 2. Decreases or increases in timing between Notes 51 and 57 complete each note row. Because Phrase 5 ends the piece, outcome expectations were different for Phrase 5 than for Phrase 2. It was expected that a) Note 57 would have a higher IOI number than Note 51 and that b) posttest decreases in speed would be larger than those in Phrase 2. Table 44 presents timing measurements for Phrase 5, HT.

Table 44

Timing: Lightly Row - Phrase 5 HT

Participant	Notes 51-52	Notes 52-53	Notes 53-54	Notes 54-55	Notes 55-56	Notes 56-57	Increase or decrease between Notes 51 and 57
Participant 7							
Pretest 1	-12.69	-13.01	-9.54	-1.03	-6.07	18.51	-31.2
Pretest 2	-21.27	-5.13	-15.34	-11.06	-7.76	7.39	-28.66
Posttest 1	-11.79	-8.73	-16.56	-11.11	-11.11	40.65	-52.65
Posttest 2	-10.52	-0.98	-4.6	1.98	-8.87	22.05	-32.57
Participant 8							
Pretest 1	106.8	-3.03	14.67	14.22	23.14	27.38	+79.42
Pretest 2	16.3	17.33	34.36	27.51	20.45	28.96	-12.66
Posttest 1	2.27	4.71	15.45	11.06	22.29	21.8	-19.53
Posttest 2	-12.59	-7.21	3.95	16.35	39.7	57.47	-70.06
Participant 9							
Pretest 1	-15.95	-19.02	1.37	0.28	20.85	8.76	-24.71
Pretest 2	-22.34	-21.55	-13.4	-7.25	-3.87	30.49	-52.83
Posttest 1	-19.29	-13.61	-15.2	-18.39	-12.7	-4.06	-15.23
Posttest 2	-5.86	-14.72	-10.8	-13.07	-9.36	-7.09	+1.23

Results for Phrase 5, timing results are participant specific. *Participant* 9 performed both pretests with expected significant decreases on speed. Posttest results are mixed. *Participant* 8 shows mixed pretest results and expected posttest results with a significant decrease in posttest 2. *Participant* 7 performed all pre and posttests with expected decreases in speed. Both posttests show a significant decrease indicating a possible effect of the intervention.

To measure if the decrease in Phrase 5 was larger than that of Phrase 2, Table 45 compares the increase or decrease numbers of each test for Phrases 2 and 5 for *Participants* 7, 8 and 9. The difference between each score completes the column. A negative number in the Difference row indicates a larger decrease in Phrase 5.

Table 45

Timing: Lightly Row - Comparing increases and decreases for Phrases 2 and 5 HT

Participant	Pretest 1	Pretest 2	Posttest 1	Posttest 2
Participant 7				
Phrase 2	-3.47	-3.63	-14.98	-15.46
Phrase 5	-31.2	-28.66	-52.65	-32.57
Difference	-27.73	-25.03	-37.65	-17.11
Participant 8				
Phrase 2	+98.94	+12.67	+16.84	+1.86
Phrase 5	+79.42	-12.66	-19.53	-70.06
Difference	-19.52	-25.33	-36.37	-71.06
Participant 9				
Phrase 2	--	+3.18	-2.5	-37.7
Phrase 5	-24.71	-52.83	-15.23	+1.23
Difference	-	-56.01	-12.73	+38.93

In comparing the numbers between Phrase 2 and Phrase 5 performances, *Participant* 9 shows inconclusive results for pretests and mixed results for posttests. *Participants* 7 and 8 show clear expected and larger decreases in all Phrase 5 pre and posttest performances with larger decreases in posttests. *Participant* 7 had consistent pretests and expected posttest decreases.

Timing: Lightly Row-Phrase 3- HT

The results of the timing measurements of Phrase 3 are associated with the same rules and intervention activities as Phrases 1 and 5. Timing measurements for Phrase 3 are the same as Phrases 1 and 5. Decreases or increases in timing between Notes 29 and 35 complete each note row. It was expected that a) Note 35 would have a higher IOI speed than Note 29 and that b) posttest decreases in speed would be higher than in pretests. Table 46 presents timing measurements for Phrase 3, HT.

Table 46

Timing: Lightly Row - Phrase 3 HT

Participant	Note 29-30	Note 30-31	Note 31-32	Note 32-33	Note 33-34	Note 34-35	Increase or decrease between Notes 29 and 35
Participant 7							
Pretest 1	3.38	3.38	-3.24	3.07	-7.97	3.07	+0.31
Pretest 2	-10.07	-2.16	-10.07	-1.83	-15.67	0.47	+10.54
Posttest 1	-9.41	0.47	-2.6	1.15	-3.28	4.21	-13.62
Posttest 2	-6.24	-2.62	-4.6	4.62	-14.46	5.27	-11.51
Participant 8							
Pretest 1	-2.12	1.36	1.51	-4.54	1.36	-12.41	+10.29
Pretest 2	-2.6	-1.36	7.78	5.5	-3.43	-1.36	-1.24
Posttest 1	4.96	-9.93	-12.62	-10.66	-2.85	-13.35	+18.31
Posttest 2	3.95	-9.28	4.15	4.36	4.77	-0.19	+4.14
Participant 9							
Pretest 1	60.89	8.58	1.91	-5.13	-7.29	-17.93	+78.82
Pretest 2	38.44	2.68	-2.88	-4.86	-93.25	14.01	+24.43
Posttest 1	4.12	-9.29	-1.33	10.03	5.94	6.17	-2.05
Posttest 2	-4.42	-12.86	-14.72	-2.15	-12.24	-5.24	+0.82

Results for timing-Phrase 3 are participant specific. *Participant* 8 shows mixed results in pretests and increases in both posttests. *Participan*t 9 shows consistent increases in both pretests. Posttest 1 shows an improved and expected decrease of more than 20 ms, a possible effect of the intervention. *Participant* 7 shows consistent increases in both pretests and expected decreases of more than 20 ms in both posttests indicating a possible effect of the intervention.

Timing- Lightly Row Phrase 4- HT

The results of the timing measurements of Phrase 4 are associated with the same rules and intervention activities as Phrases 1, 2, 3 and 5.

IOI measurements for Phrase 4 are the same as Phrases 1, 2, 3 and 5. Decreases or increases in timing between Notes 36 and 42 complete each note row. It was expected that a) Note 42 would have a higher IOI number than Note 36 and that b) posttest decreases in speed would be higher than in pretests. Table 47 presents timing measurements for Phrase 3, HT.

Table 47

Timing: Lightly Row - Phrase 4 HT

Participant	Note 36-37	Note 37-38	Note 38-39	Note 39-40	Note 40-41	Note 41-42	Increase or decrease between Notes 36 and 42
Participant 7							
Pretest 1	-6.71	-1.98	-9.23	-5.76	-16.16	-0.72	-5.99
Pretest 2	-7.43	-7.1	-11.06	-6.12	-6.77	-0.19	-7.24
Posttest 1	-6.68	-0.55	-11.45	-0.55	-2.94	-7.03	+0.35
Posttest 2	-12.16	-2.29	-15.45	1	-11.5	8.89	-21.05
Participant 8							
Pretest 1	-6.21	-2.88	3.02	1.96	-5.15	-6.81	+0.6
Pretest 2	-5.72	1.34	6.12	8.4	4.25	-10.08	+4.36
Posttest 1	-12.86	-5.3	-15.79	-11.4	-12.62	-10.91	-1.95
Posttest 2	-4.73	-9.49	-5.35	-13	-3.91	-22.3	+17.57
Participant 9							
Pretest 1	-21.72	-14.51	-16.31	-16.67	-11.62	-24.25	+2.53
Pretest 2	-1.09	-18.37	-13.2	-9.03	-3.67	-1.29	+0.2
Posttest 1	-18.16	-1.56	-13.38	-13.84	-12.02	-4.97	-13.19
Posttest 2	-18.63	-19.25	-15.54	-14.51	-13.89	-10.8	-7.83

Timing results for Phrase 4 are participant specific. *Participant* 8 performed both pretests with consistent increases with Posttest 1 shows an expected decrease. *Participant* 7 performed both pretests with consistent decreases. Posttest 2 shows a larger decrease number of more than 20 ms indicating a possible effect of the intervention. *Participant* 9 performed both pretests with consistent increases. Both posttests show expected decreases.

Summary for timing- *Lightly Row*

Summary of results for Lightly Row -Timing-HT

Unlike dynamics results, timing measurements were closer to expected results for HT performances. In both HT and RH performances where the intervention may have affected outcomes, they were participant specific and sporadic.

Timing- Lightly Row Phrase 1-RH

Table 48 shows that the RH performances show no improved decreases.

Table 48

Timing: Lightly Row - Phrase 1 RH

Participant	Notes 7-8	Notes 8-9	Notes 9-10	Notes 10-11	Notes 11-12	Notes 12-13	Increase or decrease between Notes 7 and 13
Participant 7							
Pretest 1	10.94	3.18	5.27	2.89	-15.6	16.01	-5.07
Pretest 2	10.91	10.59	1.77	-0.12	7.75	18.15	-7.24
Posttest 1	6.7	4.42	8.98	3.66	5.56	2.53	+7.17
Posttest 2	6.82	-2.51	-0.25	1.03	-7.01	8.43	-1.61
Participant 8							
Pretest 1	3.97	11.79	0.14	2.4	2.06	6.23	-2.26
Pretest 2	-3.68	1.45	-2.22	-6.62	-3.13	1.09	-4.77
Posttest 1	10.11	0.72	11.32	0.96	3.61	14.69	-4.58
Posttest 2	7.37	11.78	1.42	5.83	11.56	5.39	+1.98
Participant 9							
Pretest 1	154.41	25.54	19.73	11.43	8.94	11.64	+142.77
Pretest 2	16.39	13.03	9.42	6.32	8.9	4	+12.39
Posttest 1	88.39	17.33	27.25	4.58	18.04	6.24	+82.15
Posttest 2	17.22	-2.11	5.77	9.33	-2.36	11.88	+5.34

Measurements for timing-Phrase 1, RH yielded a variety of results and was participant specific. *Participants* 7 and 8 performed pretests with expected decreases and mixed posttest results. *Participant* 9 performed all pre and posttests with opposite increases.

Timing- Lightly Row Phrase 2-RH

As with Phrase 1, timing for RH results for Phrase 2, Table 49 shows a combination of results.

Table 49

Timing: Lightly Row - Phrase 2 RH

Participant	Notes 22-23	Notes 23-24	Notes 24-25	Notes 25-26	Notes 26-27	Notes 27-28	Increase or decrease between Notes 22-28
Participant 7							
Pretest 1	-4.57	-14.71	-6.06	4.38	-11.73	-6.36	+1.79
Pretest 2	-5.48	-4.85	-14.3	-3.59	-9.89	-4.22	-1.26
Posttest 1	3.28	-3.17	78.85	--	4.42	-10.76	+14.04
Posttest 2	-1.54	-6.37	-5.08	10.04	-10.23	0.71	-2.25
Participant 8							
Pretest 1	1.88	-6.99	-1.94	7.62	1.19	3.62	-1.74
Pretest 2	-0.75	0.9	8.61	2	2.92	3.29	-4.04
Posttest 1	16.14	-1.94	4.81	2.64	6.74	11.32	+4.82
Posttest 2	4.73	9.58	5.83	9.36	-6.74	2.52	+2.21
Participant 9							
Pretest 1	5	5.42	-0.39	4.38	0.02	-7.66	+12.66
Pretest 2	-4.26	-4.77	2.97	-13.81	0.13	-1.68	-2.58
Posttest 1	-1.79	2.7	17.57	-5.57	5.76	1.04	-2.83
Posttest 2	0.69	-13.04	11.37	-11.26	-1.6	11.37	-10.68

Measurements for timing-Phrase 2, RH yielded a variety of results and were participant specific. *Participants* 7 and 9 yielded mixed results in both pre and posttest performances. *Participant* 8 showed pretest expected decreases and posttest increases.

Timing: Lightly Row Phrase 5-RH

Table 50 shows that results are similar to HT performances.

Table 50

Timing: Lightly Row - Phrase 5 RH

Participant	Notes 51-52	Notes 52-53	Notes 53-54	Notes 54-55	Notes 55-56	Notes 56-57	Increase or decrease between Notes 51 and 57
Participant 7							
Pretest 1	-16.5	67.3	-2.48	-7.55	-5.46	12.43	-28.93
Pretest 2	-11.15	-1.38	-17.14	-5.48	-7.37	2.4	-13.55
Posttest 1	-6.59	-3.17	-3.93	-5.07-	8.22	8.22	-14.81
Posttest 2	-6.05	-10.87	0.07	4.44	-2.18	14.87	-20.92
Participant 8							
Pretest 1	14.57	-8.9	-2.29	-4.55	3.1	7.97	+6.6
Pretest 2	6.77	-2.58	2.74	-0.38	2	-1.3	+8.07
Posttest 1	-6.27	-10.37	-9.89	7.7	35.65	29.63	-35.9
Posttest 2	-1.45	-9.16	-3.87	18.84	18.62	26.33	-27.78
Participant 9							
Pretest 1	-4.75	-15.96	-7.24	6.45	-1.22	0.23	-4.98
Pretest 2	5.81	-6.84	2.19	-13.29	-0.13	-0.9	+6.71
Posttest 1	-21.86	-7.69	-11	-25.4	-16.19	-19.5	-2.26
Posttest 2	-5.41	-17.36	-3.38	-1.6	-0.33	8.57	-13.98

Measurements for timing-Phrase 5, RH yielded a variety of results and were participant specific. *Participant* 9 shows mixed pretest results and expected posttest decreases. *Participant* 7 shows expected decreases in all pre and posttests. *Participant* 8 shows increases in both pretests and expected and improved decreases of more than 20 ms in both posttests indicating a possible effect of the intervention.

In comparing the timing numbers between Phrases 2 and 5 RH performances (Table 51), *Participant* 9 shows mixed results in both pre and posttests. *Participants* 7 and 8 show clear expected and larger decreases in all pre and posttests with some numbers indicating a possible effect of the intervention.

Table 51

Timing: Lightly Row - Comparing increases and decreases for Phrases 2 and 5 RH

Participant	Pretest 1	Pretest 2	Posttest 1	Posttest 2
Participant 7				
Phrase 2	1.79	1.26	14.04	2.25
Phrase 5	28.93	13.55	14.81	20.92
Difference	-27.14	-12.29	-0.77	-18.67
Participant 8				
Phrase 2	1.74	4.04	4.82	2.21
Phrase 5	6.6	8.07	35.9	27.78
Difference	-4.86	-4.03	-31.08	-25.57
Participant 9				
Phrase 2	12.66	2.58	2.83	10.68
Phrase 5	4.98	6.71	2.26	13.98
Difference	+7.68	-4.13	+0.57	-3.3

Timing: Lightly Row-Phrase 3-RH

The same pattern of results is shown here in Table 52 for RH performances.

Table 52

Timing: Lightly Row Phrase 3 RH

Participant	Note 29-30	Note 30-31	Note 31-32	Note 32-33	Note 33-34	Note 34-35	Increase or decrease between Notes 29 and 35
Participant 7							
Pretest 1	-5.76	-7.25	-9.94	-1.59	-12.03	-13.22	+7.46
Pretest 2	-5.79	1.45	-10.52	-3.27	-13.67	5.86	-11.65
Posttest 1	-5.83	8.6	-0.89	5.56	3.28	1.01	-6.84
Posttest 2	8.75	8.43	-5.4	6.18	-6.05	4.57	+4.18
Participant 8							
Pretest 1	-0.2	1.71	1.01	6.23	0.32	-6.64	+6.44
Pretest 2	-0.2	6.77	8.97	12.09	4.76	1.27	-1.47
Posttest 1	1.44	1.92	-9.16	4.57	-3.62	-16.15	+17.59
Posttest 2	-7.4	0.54	-0.57	-1.01	2.08	-6.3	+1.1
Participant 9							

Pretest 1	-10.56	-13.68	-8.28	-3.92	-15.75	-6.41	-4.15
Pretest 2	-7.1	-0.13	-13.81	6.84-	-14.06	4	-11.1
Posttest 1	8.36	-12.65	-4.86	6.98	-8.4	3.4	+4.96
Posttest 2	-10.75	-11.52	-19.14	-4.4	-23.21	-1.35	-9.4

RH-Phrase 3 timing results show mixed or opposite results with no improved or expected results in posttests.

Timing: Lightly Row Phrase 4-RH

Phrase 4 RH results for timing are similar to HT results. Table 53 shows some improved and expected results.

Table 53

Timing: Lightly Row - Phrase 4 RH

Participant	Note 36-37	Note 37-38	Note 38-39	Note 39-40	Note 40-41	Note 41-42	Increase or decrease between Notes 36 and 42
Participant 7							
Pretest 1	-13.22	-10.24	-14.41	-2.78	-16.5	-6.06	-7.16
Pretest 2	-9.57	0.19	-11.78	6.18	-10.52	9.33	-18.9
Posttest 1	-6.97	-4.69	-2.41	-2.79	5.18	3.28	-10.25
Posttest 2	-3.79	6.82	-7.98	-5.08	-2.18	-2.51	-1.28
Participant 8							
Pretest 1	-10.11	-10.98	-14.64	-5.42	-5.77	-8.03	-2.08
Pretest 2	-0.38	6.77	0.35	5.31	8.97	-5.52	+5.14
Posttest 1	-7.48	-7.24	-9.16	-18.8	-10.85	-18.8	+11.32
Posttest 2	-11.81	-6.08	5.17	-2.11	-10.49	-7.62	-4.19
Participant 9							
Pretest 1	-13.47	-22.81	-11.39	-11.6	-14.51	-13.26	-0.21
Pretest 2	-15.35	-12.52	-15.87	-12.77	-13.81	-8.9	-6.45
Posttest 1	-15.25	-16.43	-16.43	-20.44	-11.23	-11.47	-3.78
Posttest 2	-10.75	-11.52	-19.14	-4.4	-23.21	-1.35	-9.4

Timing results for RH performances Phrase 4 were varied. *Participant* 8 shows mixed results in both pre and posttest performances. *Participants* 7 and 9 show consistent results and expected results for posttest results. *Participan*t 9 shows expected decreases.

Summary for *Lightly Row* -Timing

To show an intervention effect, it was expected that posttests would maintain pretest decreases with higher and audibly perceptible IOI numbers and/or that posttests would change from pretest increases to posttest decreases. Table 54 is divided by *Participant* and each column summarizes the total number of measurable expected and improved posttest results for each parameter in each phrase. Only numbers where a baseline could be established were collected for this summary.

Table 54

Summary by participant of expected posttests outcomes-Timing- Lightly Row

Participant	Phrase 1	Phrase 2	Phrase 5	Phrase 3	Phrase 4	Total expected posttests outcomes
Participant 7	HT- 0 RH- 0	HT-2 RH-0	HT-2 RH-0	HT- 2 RH- 0	HT-1 RH- 1	HT=7 RH=1
Participant 8	HT-0 RH- 0	HT-0 RH-0	HT-0 RH- 2	HT-0 RH-0	HT-1 RH-0	HT=1 RH=2
Participant 9	HT-2 RH-0	HT-0 RH-0	HT-0 RH- 0	HT-1 RH-0	HT- 2 RH- 1	HT=5 RH=1

Comparing timing results for HT and RH yielded participant specific results. *Participant* 8 has similar results. *Participant* 9 shows the double of posttest outcomes for HT performances and *Participant* 7 shows 5 expected outcomes for HT performances.

Timing measurements for *Lightly Row* produced some expected results and some indications of intervention effect. Although the intention of the study was not to compare HT and RH performances, the analysis of the data in these two cases show that both performance protocols produced varying results. *Participant* 7 shows a larger number of expected posttests outcomes in the HT performances. For posttests, the increase and decrease differences, were, although measurable with MIDI data, not large enough to be perceivably different.

The number of expected results in posttests when pretests were not consistent was similar to results in Table 54. Table 55 shows the number of expected outcomes in posttests when pretests were mixed. Only posttest results where the IOI number shows an improvement (larger number) were compiled for this table.

Table 55

Summary by participant of expected posttests outcomes with mixed pretest results-Timing- Lightly Row

Participant	Phrase 1	Phrase 2	Phrase 5	Phrase 3	Phrase 4	Total expected posttests outcomes
Participant 7	HT- 1 RH- 0	HT-0 RH-1	HT-0 RH- 0	HT-0 RH- 0	HT-0 RH- 0	HT=1 RH=1
Participant 8	HT-0 RH- 0	HT-0 RH-0	HT-2 RH- 0	HT-0 RH-0	HT-0 RH-1	HT=2 RH=1
Participant 9	HT-0 RH-0	HT-2 RH-2	HT-0 RH- 1	HT-0 RH- 0	HT- 0 RH- 0	HT=2 RH=3

3.2.3 Articulation- *Lightly Row* -HT

Articulation-Lifts between Phrases -HT

The results of the articulation measurements between each phrase are associated with the following rules and intervention activities:

Dalcroze rule: A lift should precede and follow all notes after the end of a melodic phrase

Dalcroze activities during intervention: The experience of the beginning and ends of musical phrases was practiced through movement and singing. The teacher used both improvisational materials at the piano and the familiar 5 phrases from the *Lightly Row* melody (Figure 2)

c) Lesson 2: Changing directions at a musical signal by the teacher, drawing rainbows, singing while drawing on the score
d) Lesson 3: Drawing the rainbow with a ball

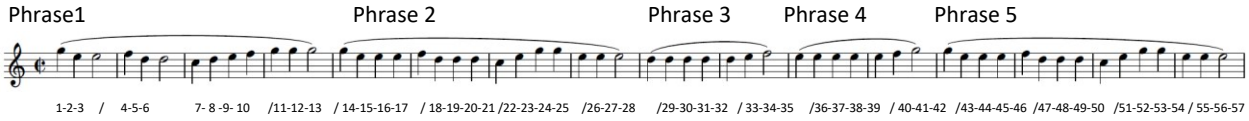


Figure 2. Excerpt from *Lightly Row* illustrating the section of the musical score that was analysed.

Evidence of lifts between each phrase was measured by the Key Detached Time (KDT) numbers between Notes 13-14, Notes 28-29 and Notes 35-36 and Notes 42-43. It was be expected that participants would detach sounds between these pairs of notes, showing an expected number. In Table 56, articulation measurements between each pair is represented by an expected or a negative number. An expected number indicates that a detached sound (KDT) was played and a negative number indicates that a legato sound (Key Overlap Time or KOT) was played. The higher or lower numbers indicate the length of the KDT or the KOT. Expected detached (expected) numbers are bolded.

Table 56

Articulation- Lightly Row: Lifts between Phrases-HT

Participant	Pretest 1	Pretest 2	Posttest 1	Posttest 2
Participant 7				
Notes 13-14	**347.2**	**331.1**	**301.1**	**297**

Notes 28-29	**57.6**	**212.6**	-27.7	**1.06**
Notes 35-36	**73.7**	**61.9**	**124.9**	**45.9**
Notes 42-43	**289.5**	**311.9**	**284.1**	**309.8**
Participant 8				
Notes 13-14	**553.4**	**325.8**	**477.5**	**479.7**
Notes 28-29	-69.4	**21.3**	**33.1**	-27.7
Notes 35-36	-126	-40.5	-25.6	-81.1
Notes 42-43	**465.8**	**494.6**	**274.5**	**290.5**
Participant 9				
Notes 13-14	**270.2**	**356.8**	**445.5**	**416.6**
Notes 28-29	**450.8**	-68.3	-86.5	**349.3**
Notes 35-36	-71.5	-75.8	-67.3	-88.6
Notes 42-43	**336.5**	**329**	**376**	**532**

The articulation results for HT performances between phrases show various results. *Participants* 8 and 9 shows consistent results between Notes 13-14 and Notes 42-43. *Participant* 7 shows consistent results for Notes 13-14, 35-36 and 42-43 showing no effect of the intervention.

Table 57 shows similar results than HT together measurements.

Table 57

Articulation- Lightly Row: Lifts between Phrases-RH

Participant	Pretest 1	Pretest 2	Posttest 1	Posttest 2
Participant 7				
Notes 13-14	**313**	**313**	**236.1**	**210.4**
Notes 28-29	**332.2**	-18.1	-92.9	-47
Notes 35-36	**246.7**	-54.4	-8.5	-53.4
Notes 42-43	**271.3**	**197.6**	**212.6**	**207.2**
Participant 8				
Notes 13-14	**721.1**	**634.6**	**419.8**	**330.1**
Notes 28-29	-119.6	-1.06	**38.4**	-71.5
Notes 35-36	-66.2	**37.3**	**35.2**	-89.7
Notes 42-43	**341.8**	**471.1**	**264.9**	**318.3**
Participant 9				
Notes 13-14	**395.2**	**195.5**	**409.1**	**352.5**
Notes 28-29	-89.7	**310.8**	-55.5	-40.5
Notes 35-36	-95	-87.6	-17	-75.8
Notes 42-43	**337.6**	**282**	**232.9**	**305.5**

All participants show consistent results for all pre and posttests for Notes 13-14 and Notes 42-43.

3.3 Summary of results for *A Short Story* and *Lightly Row*

Our research questions were: "Can we quantify the effect of Dalcroze Eurhythmics training on the musical expressivity of young novice students' performance at the piano after a short intervention? Can changes in timing and amplitude using MIDI data be audibly perceptible?" To answer these questions, and based on the results of our analysis, we have made some observations that have been categorized into the following themes: participant-specific outcomes, ratio of expected outcomes, relationship between dynamics and timing results.

3.3.1 Participant-specific outcomes: Very few participants showed possible effects of the intervention with numbers that would be audibly perceptible in posttest performances. For *A Short Story, Participants* 2, 5 and 6 showed three audibly perceptible amplitude measurements overall, one timing measurement and two articulation measurements. Although not audibly perceptible, a higher number of expected outcomes were noted in MIDI numbers. Table 58 shows the total number of measurements that highlight expected results in all posttest performances for both HT and RH (dynamics, timing, and articulation combined) for each participant in *A Short Story.* The first number in each column is the total number of expected posttest outcomes and the second number is the total number of measurements for all phrases. The percentage number in the last column represents the total number of increases or decreases (in MIDI numbers only) in posttest outcomes per participant and has no statistical significance. It has been added to give a global sense of outcomes for each participant.

Table 58

Participant-specific overall posttest expected outcomes for A Short Story

Participant	Dynamics	Tone lengthening	Articulation	Total
1	5/36	9/36	2/6	16/78 (21%)
2	7/36	7/36	0/6	14/78 (18%)
3	2/36	1/36	3/6	6/78 (7.7%)
4	3/36	4/36	0/6	7/78 (9%)
5	8/36	7/36	2/6	17/78 (22%)
6	9/36	3/36	0/6	12/78 (15%)

For *Lightly Row*, *Participant 7* showed the highest number of audibly perceptible outcomes: five for amplitude measurement and five for timing measurements. *Participant* 8 performed four amplitude posttests that were audibly perceptible and one timing measurement that was above the 20ms threshold. Similar to results for *A Short Story*, Table 59 shows the total number of measurements that highlight inaudible but expected results in all posttest performances for both HT and RH (dynamics, timing, and articulation combined) for each participant in *Lightly Row*.

Table 59

Participant-specific overall posttest expected outcomes for Lightly Row

Participant	Dynamics	Tone lengthening	Articulation	Total
7	7/22	8/22	0/6	15/50 (30%)
8	9/22	3/22	1/6	13/50 (26%)
9	4/22	6/22	0/6	10/50 (20%)

Because numbers in Tables 58 and 59 varied significantly for each group between the lowest and highest percentage (7.7% to 30%), we compared the results to various variables such as students' teacher, age, years of Suzuki training and other musical training. Tables 60 and 61 show the variables for each participant with the number of total posttest expected outcomes. Participants have been placed in descending order from the greatest number of expected outcomes to the least number of expected outcomes for each group.

Table 60

Variables per participant for A Short Story

Participant	Total participant expected outcomes (Table X)	Teacher	Age	Years of piano Suzuki lessons	Other musical training
5	17	D	11	2 years	
1	16	A	10	3 years	1 year of violin and 1 year of guitar, both in group school programs
2	14	B	10	1.5 years	Music for Young children (younger) 2 years of traditional piano lessons
6	12	E	9	3 years	2 years of traditional piano lessons
3	6	C	7	2 years	Music for Young Children (2 years) -missed beginning of each Dalcroze class (between 20-30 minutes each time)
4	7	D	10	2 years	

Table 61

Variables per participant for Lightly Row

Participant	Total participant expected outcomes (Table X)	Teacher	Age	Years of piano Suzuki lessons	Other musical training

7	15	C	8	8 months	3 years of traditional piano lessons & 2 years of violin (currently in lessons)
8	13	A	7	1 year	
9	10	C	5	8 months	3 years of traditional piano lessons & 2 years of violin (currently in lessons)

No associations could be made between any of the variables and each participants' overall number of expected posttest outcomes. However, some observations may suggest an influence on certain outcomes. For example, *Participant* 3 who had the lowest number of expected posttest results, was also absent for the beginning of each class. *Participants* 3 and 9 both had lower scores in their respective groups and were also the youngest of their group. *Participant* 5, who had the highest number of expected outcomes was also the oldest participant in the *A Short Story* group. *Participant* 7 had the highest overall expected outcomes and audibly perceptible outcomes, was the oldest participant in the *Lightly Row* group. *Participants* 1, 7 and 2 all had prior traditional piano lessons before beginning Suzuki training. However, previous musical training does not consistently reflect on overall outcomes. No relation can be established between the participants' teacher or musical training. However, age could be a factor for expected outcomes.

3.3.2 Hands together and right-hand performances: Initially, only RH performances were to be analysed. However, the analysis of both HT and RH performances proved to enrich our data collection and results. A summary of our observations is presented below by musical parameter (dynamics, timing, and articulation) and by participant.

Dynamics by phrase

Dynamic measurements, by phrase, resulted in similar results for both conditions (26 for hands-together and 28 for right-hand). Although some phrases have more expected outcomes in either condition, no patterns or trends could be detected.

i) Dynamics by participant

Results show that for dynamics, an equal number of participants (4 and 4) had a higher number of expected outcomes in either hands-together or right-hand performances. One participant had an equal number in both conditions. However, for 5 of the participants, the difference between both conditions was more than double. Table 62 shows this difference.

Table 62

Dynamics by participant in both hands-together and right-hand conditions

Participant	Hands-together	Right-hand
1	5	0
2	5	2
5	2	6
6	3	6
8	3	6

Anecdotally, it would be expected that hands-together performances may be easier for Suzuki-trained students. All participants were performing the excerpt as part of their "review" repertoire. This means that hands together performances would have been integrated and "automatized" for some time. Within the context of this study, performances indicate a shared result between the two conditions. No antecedent research was found in current piano pedagogy literature to support advantages or disadvantages of hands-together or hands-separate performances.

Timing by phrase

Results show that for timing measurements, by phrase, the total number of expected outcomes was different in both conditions (28 for hands-together and 19 for right-hand). Although some phrases have more expected outcomes in either condition, the biggest difference was between *A Short Story* and *Lightly Row* right-hand performances. Table 63 shows the difference between results in both conditions.

Table 63

Timing-Overall expected posttest results in both hands-together and right-hand conditions

A Short Story-HT	A Short Story-RH	Lightly Row-HT	Lightly Row-RH
15	15	13	4

This discrepancy does not coincide with results for dynamics. Perhaps the age of the students in the *Lightly Row* group and their level of experience/proficiency would have an impact on their ability to control variances in timing. Sources in piano pedagogy suggest that the development of steady timing is acquired before variances and nuances in timing can be developed and executed (Jacobson, 2006). Brotz (1992) reports that age and gender could influence timing abilities for young students.

i) Timing by participant

Results show that for timing, an equal number of participants (4 and 5) had a higher number of expected outcomes in either hands-together or right-hand performances. For all 9 participants, the difference between both conditions was double or more. Table 64 shows this difference.

Table 64

Timing by participant in both hands-together and right-hand conditions

Participant	Hands-together	Right-hand
1	3	6
2	2	4
3	1	0
4	1	3
5	6	1
6	2	1
7	7	1
8	1	2
9	5	1

Participants 1, 5, 7 and 9 show the largest discrepancies between both conditions. Except for *Participant* 1, hands-together performances have a higher number of expected outcomes. These results vary from the participant-specific results for dynamics. For *Participants* 1, 5, 7 and 9, playing hands-together resulted in more control over nuances and variances of speed.

3.3.3 Relationship between dynamics and timing results: Analysis for the present study was divided into musical phrases. Each phrase had between 2 and 4 measurements relating either to dynamics or to timing. We were interested to find out if any relationships could be made between the expected posttest outcomes of dynamics and of timing. Two associations were made: a) dynamic and timing changes within the same phrase; and b) dynamic and timing changes for the same measurement within that phrase. Table 65 shows, by participant, which phrases showed a) changes in dynamics and timing and b) changes in dynamics and timing for the same measurement in the same phrase.

Table 65

Relationship between dynamics and timing expected posttest changes

Participant	Changes in timing and dynamics in the same phrase	Changes in timing and dynamics in the same measurement

1	3 changes in Phrase 2	2 changes in Phrase 2
2	2 changes in Phrase 4	0
3	0	0
4	2 changes in Phrase 4	0
5	1 changes in Phrase 4	0
6	1 change in Phrase 3	1 change in Phrase 3
7	1 change in Phrase 2 1 change in Phrase 3 1 change in Phrase 5	0 0 0
8	1 change in Phrase 4	1 change in Phrase 4
9	1 change in Phrase 4	1 change in Phrase 4

These small changes suggest that any relationship is improbable. It is also interesting to note that the five changes that correlated dynamic and timing measurement occurred with participants who did not show the most posttest changes in their respective groups for dynamics, timing and articulation or with participants who showed some audibly perceptible changes in posttests.

Chapter 4: Discussion

The purpose of this study was to investigate the link between Dalcroze training and the improvement of musical expressivity in piano performance with a young population of novice piano students. This was tested by measuring dynamics, timing, and articulation data collected in piano performances by each participant. A single-subject quasi-experimental design in which participants served as their own control took place at the University of Ottawa's School of Music in the Spring of 2019. Data was collected from six children from the *A Short Story* group and three children from the *Lightly Row* group. During the first part of the experiment, referred to as the *pretest phase,* the 9 participants performed their musical excerpt hands together and right hand only. Pretest 1 occurred one week before the intervention and Pretest 2 occurred immediately before the 1st Dalcroze lesson, which was part of phase 2: *the intervention phase*. During the intervention phase, participants received 3-60-minute Dalcroze lessons on 3 consecutive days by a certified and experienced Dalcroze teacher. During the 3rd and final part of the experiment, referred to as the *posttest phase*, participants performed the same excerpts with the same conditions as in the pretests. Posttest 1 occurred immediately after the 3rd Dalcroze lesson and Posttest 2 occurred 1 week after the intervention phase.

We hypothesized that evidence of an intervention effect on musical expressivity would be measurable after the Dalcroze lessons. We expected that some participants may perform some posttest phrases with audibly perceptible difference no smaller than 20ms in IOI for timing and changes no smaller than 4 units in MIDI numbers for key velocity. The results of the present study refute our hypothesis for all dynamics, timing, and articulation analysis. Although all participants showed some expected increases or decreases in timing and amplitude, very few changes were audibly perceivable. This meant that any expected results or any increases or decreases in timing

and amplitude could not be heard by the human ear. In cases where the changes were audibly perceivable, pretest measurements were inconsistent. Consequently, establishing a baseline, for many measurements was impossible. Although dubious, participants showed overall expected outcomes ranging between 7.7% and 30% (Tables 58 and 59) when considering all hands together and right-hand posttests combined. These numbers can be interpreted as low, aleatory, and inconsistent either within measurements of a particular phrase or within the same musical parameters (dynamics, timing, or articulation). In the case of certain participants *(Participants* 5, 6 and 7), the expected results (audible and inaudible) may point to some potential of effect. Our results align with the limited outcomes of other experimental studies when measuring the possible effects of Dalcroze Eurhythmics on various musical variables such as timing, melody, and rhythm (Berger, 1999, Crumpler, 1982, Joseph, 1982, Rose, 1995, Wang, 2008) with young children. Highlighted below is a summary of key considerations and themes that emerged from the results: limited outcomes in experimental design, transfer of skill, bimanual and unimanual motor control, consistency in testing musical parameters with young children, age of participants, the use of MIDI data for the measurement of musical expressivity and the relationship between musical parameters in measuring musical expressivity.

4.1 Limited outcomes for possible effects of Dalcroze Eurhythmics on musical variables with children

A large collection of philosophical, ethnological, theoretical, and pedagogical studies support the benefits of Dalcroze-based experiences to a deeper understanding of musical concepts as highlighted by Anderson (2010) and Mathieu (2011) in their reviews of literature. A limited number of experimental pretest/posttest design models have measured the possible effects of movement-based instruction on musical outcomes (Lewis, 1988, Kulmann, 1996) and only a few experimental studies have measured the possible effects of Dalcroze Eurhythmics on

musical outcomes with children (Berger, 1999; Crumpler, 1982; Joseph, 1982; Rose, 1995; Wang, 2008).

In measuring pitch, meter and interval discrimination with elementary age children, Berger (1999) found that after 7 months of weekly Dalcroze movement classes, no posttest improvement was measured for pitch discrimination or rhythmic competency but saw some improvement in meter competency compared to students in the control group. Crumpler (1982) measured how 1st graders could identify various melodic contours and pitch registers after 6 weeks of Dalcroze classes. Although the experimental group showed improved scores from pretests to posttests, no improvement was noted when comparing the experimental group's posttest scores to the control group's scores. Some Dalcroze-related experimental designs focusing on measuring rhythmic components show expected outcomes. In measuring beat competency, Joseph (1982) measured rhythmic movement and improvisation in a pre-posttest design with kindergarten children. Two experimental groups received 44 Dalcroze-based lessons over one year. One group focused on rhythmic movement and the second Dalcroze group added improvisation to the program. The control group received "traditional" music lessons. Posttest results show that the Dalcroze groups showed statistically significant improvements in their ability to recognize rhythmic patterns in unfamiliar music. In measuring beat competency, Rose (1995) shows positive posttest outcomes after a 32-week treatment period that was statistically significant for the Dalcroze experimental group compared to the control group with kindergarten to 2nd grade students. Participants were tested on several rhythmic subtests such as patting both hands, walking in place and playing rhythm sticks. However, pretest and posttest data were collected with different measurement tools: pretest data was collected using a jury-based video analysis and posttest data was collected with an individual rhythmic assessment test. Wang

(2008) had similar positive and significant outcomes in a large-scale study with 1000 6th-grade students in China. A pre-posttest design showed that the experimental (Dalcroze) group performed better than the control group on tests relating to steady rhythmic patterns and beats. Details on the methodology and the assessment tools are unavailable.

The three rhythmic studies (Joseph, 1982; Rose, 1995; Wang, 2008) had large groups of participants and the treatment periods lasted between 32 weeks to 52 weeks. We may consider that the improvement of rhythmic components with children who participate in Dalcroze classes at least once a week over several months is positive. However, some questions regarding methodology or assessment tools for each of these studies remains unanswered. For example, Rose used different assessment tools to measure outcomes: pretest data were collected with a jury perception tool within a group setting and posttest data were collected with an individual assessment tool. Joseph's thesis was unavailable for consultation and Wang's paper does not provide details regarding methodology or the assessment tools used. The three studies focusing on the effect of Dalcroze training on rhythmic components point towards positive outcomes albeit with inconsistent or unanswered questions regarding methodology. Additionally, outcomes of the aforementioned studies measure musical concepts differently than in our study. It is important to underline that our research attempted to measure the procedural knowledge in transferring acquired knowledge to an instrument rather than measuring improvements of particular musical tasks or perceptions of improvement of musical tasks. This difference may be a key factor to consider in future studies regarding transfer of skill.

4.2 Transfer of skill

Investigating the link between Dalcroze training and piano performance raises questions about the transfer of large motor skill acquisition to fine motor skill performances. Our results are comparable with other research studies measuring the "immediate" transfer of skills acquired in somatic practices such as Body Mapping or Alexander technique to piano performance. Overall, limited changes can be detected in performance outcomes after a series of short training sessions. Similar to the present study, Slade (2018) used MIDI technology to collect raw data for pitch, tempo, tone, and articulation when playing scales and arpeggios. No observable changes were detected for all these parameters. Wong (2015) measured the possible effect of one Alexander technique session to piano performance. She used rating scales with a jury panel to evaluate perceptions of change and found that although perceptions in body use were improved, posttest results relating to sound production remained insignificant.

Emile Jaques-Dalcroze believed that it is through the body that the mind and ear acquire musical knowledge (Jaques-Dalcroze, 1948, 1965). For this to happen, motor skill transfer needs to occur. Research in sports medicine has extensively studied the training and transfer of motor skills between similar tasks (Issurin, 2013). However, research in the measuring of large motor skills transfer to fine motor skills in musical performance is scarce. Only two studies were found that focus on measuring the ability to transfer skills from a movement-based approach to an instrument. The 1st study measured the ability of young students to transfer movement-based experiences to their instruments in reading tasks of duple and triple meter. Kulman (1996) reports that after 3 years of training in a movement-based approach[16] students did not show

[16] The Weikart method, created by Phyllis Weikart promotes the acquisition of beat and rhythmic competency through developmentally appropriate sequencing.

improved scores on meter performance assessment for music listening and music reading or with rating-scale results by a jury of music teachers on their instruments. The jury evaluated the students' recordings to measure if participants effectively communicated excerpts in duple or triple time. It is important to underline that the cognitive task of reading music was added to the motor task in this research. Perhaps if the measurements would have been based on performance rather than performance and reading, the results would have been different.

The 2nd study shares the specific relationship between Dalcroze training and the improvement of musical expressivity in piano performance. Melville Clark (2000) applies a qualitative research design to investigate the transfer of musical knowledge from Dalcroze activities to piano performance with university students. The goal of the study was to qualify the transfer of musical expressivity through observations by the researcher and interviews of participants. The researcher was the students' piano and Dalcroze teacher. Musical concepts such as tempo, beat, phrasing, dynamics, and articulation were identified as parameters for analysis. Another aspect of the study was to quantify the 1st and 2nd performances (pre and posttest) for the eight university-level participants with a blind jury rating-scale evaluation. Melville-Clark underlines that any statistical information should be used as a guide and not as a proof of difference (p. 61) because the sample size was too small to provide any statistical calculation. In comparing the pretest performance to the posttest performance, the jury panel evaluated that overall, the 2nd performance evaluation marks for the eight participants was higher between 4-6%. The author cautiously states that "the study seeks to only ascertain if there is some improvement in the expressive quality of performances following the activities and not to demonstrate that this improvement is radical" (p. 83). These results are quite different from ours: musical expressivity was quantified with a blind jury but supported by the qualitative nature of

the research design which included several months of Dalcroze lessons. Participants were invited to remember what they did during the Dalcroze classes and apply these concepts to their piano performances. In our study, we intentionally avoided providing participants with any prompting as not to influence their performances. Other differences in the quantification of data with our study include the number of pre and posttests in both studies, the age and experience of the participants and the personal relationship of the teacher/researcher with her students/participants.

All aforementioned studies relating to measuring improvements of musical parameters or measuring evidence of skill transfer use either rating scales, jury-based assessments, or MIDI data. Most experimental studies measuring changes with pre-posttest designs with rating scales or jury-based assessments report a higher number of positive outcomes than studies that have used MIDI data to measure musical parameters.

4.3 The use of MIDI data for the measurement of musical expressivity

The MIDI analysis of dynamics, timing and articulation for the present study resulted in small unit variances in most pre and posttests. The unit differences in the raw data for dynamics (Slade et al., 2019) was lower than 4 units (or 2 dB) and for timing (IOI) that was lower than the 20ms threshold to be audibly perceptive (Clark, 1989, Reep, 1999) were spotty at best. No two samples could be matched for comparison in one phrase. Slade (2018) had similar results when measuring velocity and tone with adult piano performers. In the case of the present study, the inability to support the MIDI analysis with jury-based blind testing subsequently limited our results. However, it does highlight the significance of investigating musical parameters based on sound production. Research in musical expression is wide-spread and multi-faceted. Much of the research methodologies are based on measuring tools that quantity the perceptions of movement or sound production (of the performer or the listener) or on the assessment of various musical

parameters based on rating scales. Measuring sound using MIDI technology is similar to using an fMRI: it opens the door to the analysis of what is actually happening as opposed to the perception of what people think is happening.

4.4 Bimanual and unimanual motor control

In our study participants performed the same musical excerpts for pretest and posttest performances. Initially only right-hand excerpts were to be used for analysis but questions regarding possible differences that may occur in a hands-together and right-hand performance instigated the analysis of both conditions to see if expected outcomes would be higher for either condition. For dynamics and timing, neither hands together or right-hand performance showed differences in pre or posttest outcomes. Articulation measurements were consistent with no improvements from pre to posttests except for 2 participants of the *A Short Story* group who showed expected results in posttest 2 in the HT performances. Anecdotally, it would be expected that hands-together performances may be easier for Suzuki-trained students. All participants were performing either *A Short Story* or *Lightly Row* as part of their "review" repertoire. We may expect that hands together performances would have been integrated and "automatized" for some time and consequently that the HT condition in the performances would have been stronger overall than RH performances. Some evidence of this was found in the HT performances of *Lightly Row*, where *Participants* 7 and 9 yielded much a greater number of expected (although inaudible) results in HT posttest performances. For the other phrases and parameters, our analysis saw mixed results in pre and posttests for both HT and RH performances. Results were participant-specific and measurement specific. For example, *Particip*ant 8 had the double number of expected outcomes for RH dynamics measurements compared to their HT outcomes

and *Participant* 5 had 3 times the number of expected outcomes for HT timing compared to their RH timing outcomes.

Research in the coupling and decoupling of motor skills in both hands suggests that each task is stimulated by separate controllers. Yokoi et al. (2017) found that no evidence of transfer could be found between learning a piano expert from hands together to hands separate or vice versa, supporting the hypothesis that unilateral and bilateral playing are separate skills. Very recent research in bimanual motor control supports the idea that decoupling a motor skill is difficult (van Vugt, F., & Altenmüller, E. 2019). Van Vugt and Altenmüller suggest that when playing scales hands together, the left hand was not as accurate as the right hand or hands together. When playing hands together, synchronicity in variances in speed show evidence that both manual and bimanual controllers are stimulated. Results of the present study may show some indication that playing hands together and right hand alone seem to be separate tasks. More importantly, our results may point to the possibility that automatized and practiced sequencing had an impact on our results. Perhaps measuring musical performances that were improvised or still being learned would yield in different outcomes.

4.5 Consistency in testing musical parameters with young children

It became clear in the data analysis stage that many measurements could not be compiled because of inconsistent pretest results and/or because of inaudible differences in both timing and dynamics. Analysis of inconsistent pretests shows that, for example, instead of two increases or two decreases in measurement, participants performed one expected and one opposite result. In some cases where the baseline could not be established, posttests showed expected increases or decreases with some audibly perceptible differences in timing and dynamics. In these cases, the suggestion of a possible intervention effect was possible but small or inconclusive. Previous

Dalcroze-related experimental research studies have noticed similar outcomes. Berger (1999) suggests that the higher scores in the pretest results of her study may be explained by participants having already had successfully acquired knowledge. She also suggests that sample size may have been a factor making statistical significance impossible. Crumpler's design (1982) showed much higher pretest scores in the control group resulting in no changes for this group. Consequently, pre and posttest results between the experimental group (Dalcroze class) and the control group showed no improvements. Lewis (1986) reports that measurements of performances varied greatly and only 4 out of the 12 music listening tests showed expected outcomes. She suggests that age may have been a factor in the ability to execute the skills being evaluated. These previous studies suggest that the age of participants may be an important consideration when measuring the acquisition of musical skill through movement-based learning. Interestingly, the issue of "inconsistencies" in results for these studies is similar to ours even if the assessment tools were different. The present study used MIDI data analysis and the Crumpler, Berger and Lewis studies used musical achievement assessment tools such as the Silver Burdett or the Colwell Music Achievement test.

4.6 The relationship between the musical parameters in measuring musical expressivity

Analysis for the present study was divided into musical phrases. Each phrase had between two and four measurements relating either to dynamics or to timing. We were interested to find out if any correlations could be made between the expected posttest outcomes of dynamics and of timing. We found that two levels of correlation could be made: a) dynamic and timing changes within the same phrase; and b) dynamic and timing changes for the same measurement within that phrase. Eight out of nine participants demonstrated changes in dynamics and timing within the same phrase but only 4 participants show a change in both

dynamics and timing simultaneously. The relationship between dynamics and timing in expressive performances has been studied in various research fields including music theory, psychology, and music education. Lerdahl & Jackendoff (1983) advanced theories explaining how music is “formulated in terms of rules of grammar”. The creation of computational models is based on these models and supports the connection between dynamics and timing variances based on rules of musical expression (Clark, 1989; Widner and Goebl, 2004; Reep, 1999; Friberg & Sundberg, 1999; Friberg, Bresin & Sundberg, 2006). Many of these expressive rules correlate with Mathis Lussy’s and Emile Jaques-Dalcroze’s ideas writings (Appendices J and K). We could suggest that within this study, some small evidence of this relationship can be observed but is extremely small and participant specific. Why these relationships may be in the same phrase but not in the same measurement may be explained by the length of training that was provided for the transference of acquired skills of movement-based learning to an instrument to occur. (Juntunen, M. & Hyvonen, L. 2004, Davidson, J. & Correia, J., 2011). We may also consider that the measuring of musical expressivity, especially in children is limited either because the data collection tools were incompatible or incomplete with either the population sample or in the possibility to quantify skill transfer.

Chapter 5: Limitations and Conclusion

The limitations of our study highlight various subjects and issues pertaining to its scope, data collection procedures, research design, and assessment tools when quantifying musical performance with young children. The scope of this study was small both in the number of participants and in the length of the intervention phase. As a somatic practice, Dalcroze Eurythmics provides practitioners and students with musical experiences in and through the body, encouraging reactions to musical stimuli through large motor skill activities. Emile Jaques-Dalcroze himself encouraged studying Eurhythmics over a long period of time. He believed that children should train in movement-based music classes for at least 2 years before commencing training on an instrument. In theory, this suggests that knowledge acquired through various movement-based activities would be transferred to another medium, in this case, the piano. Analysis of musical parameters such as dynamics, timing and articulation have successfully been used to measure musical expressivity with expert and adult pianists. We could hypothesis that children, especially the children in this study who have had limited experience in piano performance (less than 2 years of Suzuki training) would not be able to modify musical parameters that would be audibly perceptible. Additionally, we would suggest that the ability for these modified "nuances" to be transferred to an instrument after only 3 hours of exposure would be challenging and difficult. Our results suggest that using MIDI data to analyse musical expressivity with children has some limitations. The unit differences for amplitude and timing were not audibly perceptible making jury evaluations impossible. The outcome of the present study provide us with the following list of considerations:

1. Regarding the length of the study: A longer intervention period would be required. Somatic approaches such as Dalcroze Eurhythmics are intended to be experienced over a several years.
2. Regarding the age and number of participants: A study in which several age groups, including adults, may provide us with richer data on how various participants at various stages in their cognitive and physical development could consolidate concepts experienced in movement-based learning to be transferred to their instrument.
3. Regarding the use of MIDI data to measure musical expressivity with children: Research models using MIDI data to quantify musical parameters need to be explored further as a single measuring tool to determine what other factors could affect outcomes and how relevant this tool can be in measuring musical performance outcomes.
4. Regarding the inclusion factors: Maintaining participant inclusion factors related to similar musical training, age and the performance of a same musical excerpt ensures consistency. However, some consideration should be given to the musical excerpts to be performed at the instrument as procedural memory and motor memory may have an impact on the ability for movement-based knowledge to be transferred to a performance.
5. Regarding skill transfer: Little research has been done to quantify skill transfer for similar motor movements and even less in quantifying transferred skills from large motor skills to small motor skills. Investigation into other considerations such as the training of skill transfer from a cognitive or motor perspective may be helpful when considering the application of Dalcroze Eurhythmics training to performance at an instrument.

References

Abramson, R. (1998). Feel It! Rhythm games for All. Alfred Music

Abril, Carlos R. (2011). Music, Movement, and Learning. In R. Colwell and P.R. Webster (eds.) *MENC Handbook of Research on Music Learning* (pp. 92-129). Vol. 2. New York: Oxford University Press.

Alperson R. (1995). A qualitative study of Dalcroze Eurhythmics classes for adults (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 9603274).

Anderson, W. (2011). The Dalcroze approach to music education: Theory and applications. *General Music Today*, *26*(1), 27-33. doi:10.1177/1048371311428979

Araneda, C. (2019). *Applications of dalcroze philosophy to the royal conservatory of music curriculum of piano instruction* (Order No. 27615791). Available from ProQuest Dissertations & Theses Global. (2353044606). Retrieved from https://search-proquest-com.proxy.bib.uottawa.ca/docview/2353044606?accountid=14701

Bachmann, M. (1993). Dalcroze Today: An education through and into music. Oxford: New York.

Blesedell, D. S. (1991). *A study of the effects of two types of movement instruction on the rhythm achievement and developmental rhythm aptitude of preschool children* (Order No. 9134919). Available from ProQuest Dissertations & Theses Global. (303965385). Retrieved from https://search-proquest-com.proxy.bib.uottawa.ca/docview/303965385?accountid=14701

Boyle, J., & Radocy, Rudolf E., author. (1987). *Measurement and evaluation of musical experiences*.

Bradbury, D. & Mcgoech, J.A. (1937). The contribution of the Child Study Movement to Child psychology. Psychological Bulletin. 34(1), 21-38.

Brotz, T. (1992). Key-finding, Fingering, and Timing in Piano Performance of Children. *Psychology of Music*, *20*(1), 42–56. https://doi.org/10.1177/0305735692201004

Butke, M. (2014). Assessing expressive movement: Measuring student learning outcomes in the general music classroom. *General Music Today*, *27*(3), 23-27. doi:10.1177/1048371314525782

Caldwell, J. (1995). *Expressive singing: Dalcroze eurhythmics for voice*. Englewood Cliffs, N.J.: Prentice Hall.

Choksy, L., Abramson, R., Gillespie, A., Woods, D. (1986). *Teaching music in the twentieth century*. Englewood Cliffs, N.J.: Prentice-Hall.

Clark, F. & Goss, L. (2000). The Music Tree: Time to Begin-A Plan for Musical Growth at the Piano. (vols. 1-4). Los Angeles, California: Summy-Birchard Inc.

Clarke, E. (1987). Levels of structure in the organization of musical time. Contemporary Music Review. 2(1), 211-238.

Comeau, G. (1995). *Comparing Dalcroze, Orff and Kodály: Choosing your approach to teaching music*. Vanier, Ont.: Centre franco-ontarien de ressources pédagogiques.

Daley, C. (2013). *Moved to learn: Dalcroze applications to choral pedagogy and practice.* Retrieved from ProQuest Dissertations & Theses Global. (ISBN No.: 978-0-494-96066-0).

Davidson, J. (2012). Bodily movement and facial actions in expressive musical performance by solo and duo instrumentalists: Two distinctive case studies. *Psychology of Music, 40*(5), 595-633.

Davidson, J. & Correia, J. (2011). Body Movement. In Parncutt, R. and MacPherson, G. (Eds) *The Science and Psychology of Music Performance: Creative Strategies for Teaching and Learning*. DOI: 10.1093/acprof:oso/9780195138108.001.0001

Dauphin, C. (2011). *Pourquoi enseigner la musique? propos sur l'éducation musicale à la lumière de l'histoire, de la philosophie et de l'esthétique* Retrieved from http://pumebookstore.ecwid.com/download/518180/a31e337c66fc5b0cec23d66e822cc1d7/9782760626683.pdf

Dewey, J. (1958). Art as experience. (Fonds Alphonse Lutz). New York: Capricorn Books

Ferguson, L. (2005). The Role of Movement in Elementary Music Education: A Literature Review. *Update: Applications of Research in Music Education, 23*(2), 23-33.

Findlay, E. (1971). *Rhythm and movement; applications of Dalcroze eurhythmics.* Evanston, Ill.: Summy-Birchard.

Friberg, A. (1991). Generative Rules for Music Performance: A Formal Description of a Rule System. *Computer Music Journal, 15*(2), 56-71.

Friberg, A. (1995a). Matching the rule parameters of Phrase arch to performances of “Träumerei”: A preliminary study. In Friberg, A., & Sundberg, J. (Eds.), Proceedings of the KTH symposium on Grammars for music performance May 27,1995 (pp. 37-44).

Friberg, A. (1995b). Matching the rule parameters of PHRASE ARCH to performances of "Träumerei": a preliminary study. STIMING-QPSR, 36(2-3), 063-070.

Friberg, A., & Sundberg, J. (1999). Does music performance allude to locomotion? A model of final ritardandi derived from measurements of stopping runners. Journal of the Acoustical Society of America, 105(3), 1469-1484.

Friberg, A., & Battel, G. U. (2002). Structural communication. In Parncutt, R., & McPherson, G. E. (Eds.), *The Science and Psychology of Music Performance: Creative Strategies for Teaching and Learning* (pp. 199-218). New York: Oxford University Press.

Friberg, A., Bresin, R. & Sundberg, J. (2006). Overview of the KTH rule system for musical performance. *Advances in Cognitive Psychology, 2*(2), 145-161.

Fritz, M. A. (1998). *A piano pedagogy of creative motion* (Doctoral dissertation) Available from ProQuest Dissertations & Theses Global. Retrieved from http://search.proquest.com/docview/304467449?accountid=14701. (Order No. 9913710).

Gell H. (1967). Music, Movement and the Young Child. Australiasian Publishing Company:Sydney,

Goebl, W., Dixon, S, Schubert, E. (2014). Quantitative Methods: Analysis, Audio Analysis, and Continuous Response Techniques. In Fabian, D., Timmers, R., & Schubert, E. (Eds). *Expressiveness in music performance: Empirical approaches across styles and cultures*. (pp. 221-239). Oxford: Oxford University Press.

Issurin, V. (2013). Training Transfer: Scientific Background and Insights for Practical Application. *Sports Medicine*, *43*(8), 675–675. Retrieved from http://search.proquest.com/docview/1492609294/

Jacobson, J.M. (1989). A Catalogue of Movement-Based Instructional Activities for Beginning Piano Students Correlated to "The Music Tree" Series by Frances Clarkand Louise Goss. (Unpublished Master's dissertation). The University of Oklahoma.

Jang, N. (2012). *A personal collection of piano repertoire and pedagogy: Based on and adapted from the work of Emile Jaques-Dalcroze*. (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. University of Washington (Ascension No. 3053516)

Jaques-Dalcroze E. (1906). Les gammes et les tonalités, les phrases et les nuances (Vols, 1-3). Lausanne : Sandoz, Jobin et Cie Retrieved from https://fr.scribd.com/document/360303606/3-Me-thode-Jacques-Dalcroze-Les-Gammes-et-les-tonalite-s-le-phrase-et-les-Nuances.

Jacques-Dalcroze, E (1920). *Rhythm, Music, and Education.* Oxford, England: Chatto & Windus. https://archive.org/index.php

Jaques-Dalcroze, E. (1948). Notes Bariolées. Genève : Jeheber.

Jaques-Dalcroze, E. (1965). Le rythme, la musique et l'éducation. Lausanne: Foetische.

Jaques-Dalcroze, E. (1976). *Eurhythmics, art, and education*. New York: Arno Press. Trans.

Jaques-Dalcroze, E. (1999). The Piano and Musicianship. Dalcroze Society: England. Excerpt from English translation of Eurhythmics, Art and Education. Chatto, 1930.

Joseph, A.S. (1982). *A Dalcroze Eurhythmics Approach to Music Learning In Kindergarten Through Rhythmic Movement, Ear-training And Improvisation* (Order No. 8314549). Available from ProQuest Dissertations & Theses Global. (303211596). Retrieved from https://search-proquest-com.proxy.bib.uottawa.ca/docview/303211596?accountid=14701

Juntunen, M. & Hyvonen, L. (2004). Embodiment in musical knowing: How body movement facilitates learning within Dalcroze Eurhythmics. *British Journal of Music Education*, (21), 199-214. doi:10.1017/S0265051704005686

Karlsson, J., & Juslin, P. (2008). Musical expression: An observational study of instrumental teaching. *Psychology of Music, 36*(3), 309-334.

Lehman, P. (1968). *Tests and measurements in music* (Foundations of music education series). Englewood Cliffs, N.J.: Prentice-Hall.

Lerdahl, F., & Jackendoff, Ray S. (1983). *A generative theory of tonal music* (The MIT Press series on cognitive theory and mental representation). Cambridge, Mass.: MIT Press.

Lewis, B. E. (1988). The Effect of Movement-Based Instruction on First- and Third- Graders' Achievement in Selected Music Listening Skills. *Psychology of Music*, *16*(2), 128–142. https://doi.org/10.1177/0305735688162003

Mason L. (1854). Musical letters from Abroad: Including detailed accounts of the Birmingham, Norwich, and Dusseldorf Musical Festivals of 1852. New York: Mason Brothers (archive.org)

Mason H. (1941). Lowell Mason: An appreciation of his life and works. (Papers of the Hymn Society of America). New York: Hymn Society of America.

Mathieu, L. (2010). Un regard actuel sur la Rythmique Jaques-Dalcroze. *Recherche en éducation musicale*, *28*, 17-27.

Mead, V. (1994). *Dalcroze Eurhythmics in Today's Music Classroom*. New York: Schott.

Meints, K. L. (2014). *The application of the kinesthetic learning theories of Emile Jaques-Dalcroze in conductor preparation coursework.* Retrieved from ProQuest Dissertations & Theses Global. (UMI No. 3628246).

Melville-Clark, P. (2000). Eurhythmics and Piano Performance: A Study to determine the benefits of applying Eurhythmic techniques to the preparation of piano works by undergraduate musicians. (Unpublished master's thesis). University of Southern Queensland.

Moore, S. (1992). *The writings of Emile Jaques-Dalcroze: Toward a theory for the performance of musical rhythm*. (Doctoral dissertation). Retreived from UMI Dissertation Services (Order No. 9301500)

Nalbandian, M. R. (1994). *Application of the Dalcroze philosophy of music education to the music major piano class*. (Doctoral Dissertation). Retrieved from ProQuest Dissertation&Theses Global. (UMI No. 9509385).

Orff , C.& Keetman, G. (1950-1954). Musik fur kinder (Orff-Schulwerk. Musik fur Kinder). Mainz: B. Schott's Sohne.

Papageorgiou, G. (2012). Hearing Through the Body: Expression and Movement in Music. (Doctoral Dissertation). Retrieved from: https://repository.royalholloway.ac.uk/items/2f76046e-dbb2-eb50-8421-08959d9b300b/8/. (UMI No. 100047435).

Pestalozzi, J. (1894). How Gertrude Teaches her Children: An Attempt to help Mothers to Teach their own Children and an account of the Method. (A report to the Society of the Friends of Education) Burgdorf.

Pierce, A. (2007). *Deepening musical performance through movement: The theory and practice of embodied interpretation* (Musical meaning and interpretation). Bloomington: Indiana University Press.

Repp, B. (1998). A microcosm of musical expression. I. Quantitative analysis of pianists' timing in the initial measures of Chopin's Etude in E major. *The Journal of the Acoustical Society of America, 104*(2 Pt 1), 1085-100.

Repp, B. (1999a). A microcosm of musical expression: II. Quantitative analysis of pianists' dynamics in the initial measures of Chopin's Etude in E major. *The Journal of the Acoustical Society of America, 105*(3), 1972-88.

Repp, B. (1999b). A microcosm of musical expression. III. Contributions of timing and dynamics to the aesthetic impression of pianists' performances of the initial measures of Chopin's Etude in E major. *The Journal of the Acoustical Society of America, 106*(1), 469-78.

Repp, B. H. (1999). Detecting deviations from metronomic timing in music: Effects of perceptual structure on the mental timekeeper. *Perception & Psychophysics*, *61*(3), 529–548. https://doi.org/10334099

Rose, S., & Sherbon, J. (1995). *The effects of Dalcroze eurhythmics on beat competency performance skills of kindergarten, first-, and second-grade children* (ProQuest Dissertations Publishing). Retrieved from http://search.proquest.com/docview/304230428/

Rubinoff, D. (2004). *Lessons in musical expression: The ideas of Mathis Lussy, Hugo Riemann and Émile Jaques-Dalcroze.* Unpublished manuscript.

Shenenberger, M. (2008). Using Dalcroze eurhythmics in the choral rehearsal. In M. Holt & J. Jordan (Ed.) *The school choral program* (pp. 533-558). Chicago, IL: GIA Publications.

Schnebly-Black & Moore. (2004). Rhythm: One on one Dalcroze Activities in the private music lesson. Alfred Van Nuys: CA.

Seitz, Jay A. (2005). Dalcroze, the Body, Movement and Musicality. *Psychology of Music, 33*(4), 419-435.

Slade, T., Russel, D., Comeau, G. (2018, December). *Just noticeable differences of sound intensity in piano tones in non-musicians and experienced pianists*. Poster presented at The Department of Speech Language Pathology, Faculty of Rehabilitation Medicine, University of Alberta

Todd, N. (1985). A Model of Expressive Timing in Tonal Music. *Music Perception, 3*(1), 33-57.

Urista, D. (2003). Beyond Words: The Moving Body as a Tool for Musical Understanding. *Music Theory Online, 9 (3).* Retrieved from*:* *http://www.mtosmt.org/issues/mto.03.9.3/mto.03.9.3.urista.html*

van Vugt, F., & Altenmüller, E. (2019). On the One Hand or on the Other: Trade-Off in Timing Precision in Bimanual Musical Scale Playing. *Advances in Cognitive Psychology*, *15*(3), 216–227. https://doi.org/10.5709/acp-0271-5

Walker, M.E. (2000). Movement and Metaphor: towards an Embodied Theory of Music Cognition and Hermeneutics. *Bulletin of the Council for Research in Music Education* (no 145), 27-42.

Wang, D.P. (2008). The quantifying analysis of effectiveness of music learning through the Dalcroze musical method.

Wells, H. (1900). The Child Study Movement. The Phrenological Journal and Science of Health 91870-1911). 109(2). 55.

Werner, T.(1988). Carl Orff Trans. Of Die Grossen Deutschen unserer Epoche. London: Schott.

Whiteside, A. (1997). *Abby Whiteside on piano playing.* Portland, Or.: Amadeus Press.

Widmer, G., & Goebl, W. (2004). Computational Models of Expressive Music Performance: The State of the Art. *Journal of New Music Research, 33*(3), 203-216.

Yokoi, A., Bai, W., Diedrichsen, J., & Yokoi, A. (2017). Restricted transfer of learning between unimanual and bimanual finger sequences. *Journal of Neurophysiology*, *117*(3), 1043–1051. https://doi.org/10.1152/jn.00387.2016

Appendix A

A selection of Dalcroze's rules of phrasing, nuance, meter and accentuation

Dalcroze's rules of phrasing, nuance, meter, and accentuation can be found in an un-systemized manner in his solfège books: *Les gammes et les tonalités, le phrasé et les nuances* (1907). The identification and systemization of these rules as presented below is the work of Stephen Moore (Moore, 1992): fifteen phrasing rules, thirteen rules of nuance and seven rules of accentuation. Each rule has been assigned a numeral reference.

Rules of phrasing

1. First rule of Phrasing: When a rhythmic group is exactly repeated, we ought to breathe or halt the breath before the repetition (the melodic succession can be different). The last note of the group ought to lose half of its value if it occurs on a weak beat

***2.: Second Rule of Phrasing**: Every final note of either a rhythm, a period, or a phrase is followed by a rest, breath, or a halt of the breath. Every final note loses some of its sonority, except when it is the final note of a crescendo.

3: Third Rule of Phrasing: A breath should precede and follow all notes sung after the end of a period or melodic phrase and those whose only goal is to complete the measure

4. Fourth Rule of Phrasing: When the same note is repeated once, there is a breath or a halt in the breathing between the note and its repletion. This rule overrules the rule 1 that states one ought to breath before the repetition of a rhythm. When it is the first note of a rhythm, a period of a phrase, it ought to be played staccato.

5: Fifth Rule of Phrasing: If a large interval (a fifth or a sixth) occurs following a series of notes that contain stepwise or small intervals, it is necessary to breath before the second note of that interval. This rule only applies to slow movements and is not used with the first notes of a piece.

7: Sixth Rule of Phrasing: If a series of conjunct notes (or small intervals) precedes a large interval of which the two notes constitute an isolated group at a feminine ending and are of longer duration than the preceding notes, it is necessary to breathe after the last note of the large leap.

***8: Seventh Rule of Phrasing**: When a group of notes, melodic or rhythmic, forming an upbeat, occur later in the course of a melody, they ought to be preceded by a breath or halt in breathing. This group is called the anacrusis.

***9: Eighth Rule of Phrasing**: When a series of notes of a certain value is terminated by a note with a much greater value, one can breathe after this note, or after the note of smaller value (feminine ending) that follows it.

10: Ninth Rule of Phrasing: One breathes after the first note of a measure or beat if it is followed by a large leap (interval of a fifth or more). Exception: we don't breathe if the two notes represent a feminine ending to a rhythm, period, or phrase.

11: Tenth Rule of phrasing: One makes a light halt of the breath between several groups of notes of which the first is long and the second is of shorter duration.

12: Eleventh Rule of Phrasing: One almost always breathes after those notes of a musical phrase that indicate repose (tonic) or semi-repose (dominant or sub-dominant).

13: Twelfth Rule of Phrasing: When a succession of notes of equal value (run- *groupetto*) is followed by a longer note, we take a breath, after this note.

***14: Thirteenth Rule of phrasing**: When a group of two notes consisting of a short note followed by a longer one is repeated, we take a breath before each repetition.

15: Fourteenth Rule of Phrasing: Groups of notes that occur only to complete a measure either with imitation (echo) or transition have to be preceded and followed by a breath.

***16: Fifteenth Rule of Phrasing**: If the notes of a melody form several groups having a symmetrical design (or nearly), one can separate them by a breath (or a halt of the breath)

Rules of nuance

The eleven rules of nuance relate to two questions of dynamic expression: "What is the appropriate dynamic articulation when there is a change of pitch? And "What is the articulation when pitch repeats?" (Moore, p. 111). In other words, it relates to gradation of loud and soft and how this affects speed (*accelerando and ritardando*). In Dalcrozian terms, this refers to gradation in tempo (*agogics*) and energy.

***17: First rule of nuance:** Every ascending melody ought to be sung (excluding exceptions) in a *crescendo*, an increase in sonority for each note. The ascending scale ought to be sung with a *crescendo*. Every descending melody ought to be sung (with exception) in a *decrescendo,* a decrease in sonority for each note. The descending scale ought to be sung with a *decrescendo.*

18: Second rule of nuance: Every note of a melody should not be marked with the same amount of intensity. For example, in every passage constructed with a very marked rhythmic formula, the nuances of *crescendo* and *decrescendo* ought to be weaker than if the rhythm of the piece were less pronounced.

19: Third rule of nuance: In an ascending passage, if a note is prolonged, it ought to participate in a general *crescendo*. If the following note is lower than the prolonged note, it should be sung with a *crescendo* followed by a *decrescendo.*

20: Fourth rule of nuance: When the same note is sung several times, its repetition ought to be accompanied by a *crescendo*.

21: Fifth rule of nuance: When a note is repeated several times leading to the return of the initial melody, the *crescendo* ought to be accompanied by a *rallentando*. Every repetition of a melodic rhythm, if it is found at the end of a piece, ought to be accompanied by a *rallentando* and, in slow movements, by a *diminuendo*. In a rapid movement, the repetition of a rhythm at the end of a piece can be accompanied by an *accelerando*.

22: Sixth rule of nuance: When a melodic and rhythmic group is repeated twice, it is necessary not only to breathe before the repetition but also to sing this repetition in a different nuance than that of its first occurrence. If the first were sung *forte,* then the second will be sung *piano* and vice versa.

***23: Seventh rule of nuance**: Every return of a melody sided by a preparation ought to be preceded by a *rallentando*.

24: Eighth rule of nuance: When a melody ends with a series of notes of the same duration, and the last notes of this series are of conjunct degrees, it is necessary that theses last notes be *staccato*. If these degrees precede the return of the melody, they ought to be accompanied by a *rallentando*.

25: Ninth rule of nuance: When a passage (with notes of the same duration) leads to the return of a melody whose initial notes are twice as long, the *rallentando* of the last notes of the passage ought to be such that they double in value.

26: Tenth rule of nuance: In a piece constructed with notes of unequal durations (dotted half, dotted quarter, dotted eighth), if one encounters a series of ascending notes of equal value, it is necessary to strongly mark each of these notes.

27: Eleventh rule of nuance: When a descending melodic passage leads to the return of a theme with a strong and powerful character, it is necessary to sing this passage with a *crescendo* despite the previous rule. When an ascending melodic passage leads to the (*pp*) theme, it is necessary to sing this passage with a *decrescendo*, despite the preceding rule.

28: Twelfth rule of nuance: Every series of isolated notes in measures containing rests and ending a piece, ought to be interpreted with a *rallentando* of silence.

***29: Thirteenth rule of nuance**: In a rhythm consisting of two slurred notes of the same duration and representing two different degrees, the two notes will be performed strong-weak. This derives from the rule that the last note of a rhythm loses its sonority (value). Consequently, even if the last note of a two-note slur occurs on a strong, or comparatively strong beat, it sufficiently loses its force to become the weaker of the two consecutive notes. On the contrary, if the two notes form a natural strong-weak group, the already weak note loses none of its sonority; it is rather the strong note that will be more stressed. In pieces of a light character, the last of the two slurred notes will be slightly *staccato.*

Rules of accentuation

The rules of accentuation pertain to situations of quick dynamic change and relate to rhythmic rather than metric accentuation (Moore, p. 126) and are based on two additional rules concerning meter: The bar line should be placed before the most accented note of a melodic phrase *and* Pathetic (rhythmic) accentuation can attenuate but not supplant metric accentuation. (Moore, p. 127)

***30: General rule**: When Dalcroze talks about phrasing, he states that the highest note in an ascending pattern will be sung the strongest, approached with a crescendo with each previous note increasing in volume. The highest note is considered metric if it occurs on the strong beat and pathetic if it occurs on a weak beat.

31: First rule of accentuation: When the last note of a measure (consequently weak) is tied to the first beat of the following measure, it ought to be strongly accented.

***32: Second rule of accentuation**: If a note placed on a weak beat is the first of a group, where the preceding notes occupy an entire beat of the measure, the first note of the group ought to be accented.

***33: Third rule of accentuation**: When a note is preceded and followed by a rest, it ought to be accented, even if it occurs on a weak beat.

34: Fourth rule of accentuation: When the first note of a measure has already been sung at the end of the preceding measure, it ought to be doubly accented.

***35: Fifth rule of accentuation**: The highest note of a descending rhythmic group ought to be strongly accented even if it occurs on a weak beat.

36: Sixth rule of accentuation: Any neighbor note or *appoggiatura* that is chromatically altered ought to be slightly accented, even if it occurs on a weak beat. The accentuation will be greater if the altered note is an upper neighbor.

***37: Seventh rule of accentuation**: An altered note that induced modulation must be accented even on a weak beat.

Source: Moore, S. (1992).

Appendix B

Butke's combined criteria for Grade 2 and Grade 6 *plastique animée*

Plastique rubric	**Unacceptable**	**Progressing**	**Satisfactory**	**Outstanding**
Rhythmic integrity	Incorrectly demonstrates beat, tempo, and rhythmic patterns	Demonstrates some inaccuracies in beat, tempo, rhythmic patterns	Demonstrates beat, tempo, rhythmic patterns clearly and consistently most of the time	Consistently and clearly demonstrates beat, tempo, rhythmic patterns throughout the performance
Instrumentation	Does not show the different instrumentation at all	As a group, lacks clarity showing the different instrumentation	As a group, sometimes shows the different instrumentation	As a group, clearly shows the different instrumentation
Legato/Staccato	Shows legato and staccato unclearly, or shows them in the wrong place	Shows legato and staccato inconsistently in terms of both articulation and placement	Usually shows legato and staccato in the appropriate places	Clearly shows legato and staccato in the appropriate places
Dynamics	Demonstrates few dynamic changes	Demonstrates some of the dynamic changes	Demonstrates most dynamic changes	Clearly demonstrates all dynamic changes
Appropriate creativity	Demonstrates no creativity in movement. Uses minimal body parts, similar movements at same height level	Demonstrates a few creative (personal and authentic) elements involving body parts, movement, and space	Demonstrates some creative elements involving body parts, movement, and space	Demonstrates many creative elements involving body parts, movement, and space
Expressivity	Rarely demonstrates flow, balance, extension, sensitivity. The quality of the movement does not match the quality of the sound	Inconsistently demonstrates flow, balance, extension, nuance. The quality of the movement sometimes matches the quality of the sound	Usually demonstrates flow, balance, extension, nuance. The quality of the movement usually matches the quality of the sound	Clearly demonstrates flow, balance, extension, nuance. The quality of the movement clearly matches the quality of the sound

Source : Butke, M. (2014).

Appendix C

Melville-Clark's evaluation statements (Melville-Clark, 2000)

These criteria are part of the "segmented approach" section of the author's evaluation tool. The statements represent five areas of expressive performance that were intended for the study: beat, tempo, phrasing, dynamics and articulation. The statements were selected in accordance with concepts that can be applied to the kinesthetic experience (p. 100) from the Dalcrozian perspective and then correlated to the Senior Music Syllabus (1995) of the Queensland Board of Secondary School Studies and the AMEB Syllabus objectives for Pianoforte examinations (1999).

1. The tempo is appropriate to the style of the piece;
2. The pulse is regular, consistent and has a good sense of continuity and flow;
3. The choice of tempo facilitates a sense of ease in the performance;
4. Rhythmic division is clearly maintained throughout the performance;
5. In nuances of tempo, the performer demonstrates the ability to recall the original tempo;
6. The nuances of tempo (accelerando/ritardando) are effectively graded;
7. The performance demonstrates an appropriate and effective use of crusic, anacrusic and metacrusic beat;
8. There is a developed sense of the vertical and horizontal flow of the meter;
9. The performance demonstrates clearly and effectively the points of relaxation and impetus in the music;
10. The line of the phrases is clearly demonstrated;
11. The phrasing shows a natural sense of flow;
12. The dynamics are appropriately contrasted;
13. Stronger dynamics passages are affected by the increased use of energy and weight;
14. The rhythm remains controlled during changes of dynamic energy;
15. The dynamic nuances are effectively graded;
16. Staccato and legato passages are clearly and effectively articulated;
17. Articulation is appropriate to the style and character of the piece;
18. The articulation adds interest and expression to the piece;
19. The articulation supports the line of the phrase

Source: Melville-Clark. P. (2000).

Appendix D

An Overview of KTH's rule system

Phrasing	**Parameters**
Phrase arch	Create arch-like tempo and sound level changes over phrases
Final ritardando	Apply a ritardando in the end of the piece
High loud	Increase sound level in proportion to pitch height
Micro-level timing	
Duration contrast	Shorten relatively short notes and lengthen relatively long notes
Faster uphill	Increase tempo in rising pitch sequences
Metrical patterns and grooves	
Double duration	Decrease duration ration for two notes with a nominal value of 2:1
Inégales	Introduce long-short patterns for equal note values (swing)
Articulation	
Punctuation	Find short melodic fragments and mark them with a final micropause
Score legato/staccato	Articulate legato/staccato when marked in the score
Repetition articulation	Add articulation for repeated notes.
Overall articulation	Add articulation for all notes except very short ones
Tonal tension	
Melodic charge	Emphasize the melodic tension of notes relatively to the current chord
Harmonic charge	Emphasize the harmonic tension of chords relatively to the key
Chromatic charge	Emphasize regions of small pitch changes
Intonation	
High sharp	Stretch all intervals in proportion to size
Melodic intonation	Intonate according to melodic context

Harmonic intonation	Intonate according to harmonic context
Mixed intonation	Intonate using a combination of melodic and harmonic intonation
Ensemble timing	
Melodic sync	Synchronize using a new voice containing all relevant onsets
Ensemble Swing	Introduce metrical timing patterns for the instruments in a jazz ensemble
Performance noise	
Noise control	Simulate inaccuracies in motor

Source: Friberg, A., Bresin, R. & Sundberg, J. (2006).

Accent rules	A local event that may have a subcategory and may have a variety of roles:	A phrasing (or grouping) accent: occurs at the beginning of a phrase
		A metrical accent: occurs at the start of an important metrical unit
		A Melodic accent: occurs at local peaks and valleys of a melody
		A harmonic accent: occurs at chord changes

Source: Friberg, A, & Bisesi, E. (2014).

Appendix E

Participant and parent questionnaire, Email Scripts, Letter of information, Consent, and debriefing forms

Participant Questionnaire

For research anonymity: Alpha-Numeric Code:

Participant Demographic form for:

Mélina Dalaire, master's student/Dalcroze research project in piano pedagogy, Piano Pedagogy Research Laboratory, U of Ottawa

This form is to be filled out by the participant during the first visit to the piano lab for the pre-test. It will be administered by the researcher.

Participant Information

Name :	
Age/year of birth	
Gender :	

Parent Information

Name:	
Email:	
Phone/text number:	

History of Piano Lessons ----------

How many years of Suzuki piano lessons have you had?	
What is the name of your current Suzuki teacher?	
At what age did you begin Suzuki piano lessons?	
Have you had any other type of private music lessons?	No Yes If yes, what kind:
Have you had any other type of group music lesson?	No Yes If yes, what kind: A) Orff B) Music for Young Children C) Kindermusik

	D) Dalcroze E) Other:_____
What is your current Suzuki book level?	
What is your current piece or pieces being studied at the lesson?	
Which of the following review piece or pieces are you practicing:	o A A Short Story o Happy Farmer o Lighly Row o Go Tell Aunt Rhody o Au Clair de la Lune o Musette o Ecossaise
On average, how many days a week do you practice the piano?	
On average, how long are your practices?	
Have you ever done any RCM exams? Or other conservatory exams?	No Yes If yes, which one(s):_____

Family's role in music education.

Does a parent or caregiver sit in on piano lesson?	Never Seldom Sometimes Often Always
Does a parent or caregiver help you with his/her piano practice?	Never Seldom Sometimes Often Always
Is a parent or caregiver involved in your musical education in any other way? Can you describe these activities?	

For Student (to be asked after the first pre-test and at the last post-test.) This answer will be videotaped instead of written.

Can you tell me what it means to play "musically"?

Questionnaire du parent et du participant

Pour l'anonymat de la recherche - Code alphanumérique :

Formulaire démographique du participant pour :
Mélina Dalaire, étudiante graduée/diplômée Dalcroze en pédagogie du piano, Laboratoire de recherche en Pédagogie du Piano, Université d'Ottawa

Ce formulaire doit être rempli par l'enfant et le parent au cours de la première visite dans le laboratoire de piano pour le prétest. Il sera administré par le chercheur.

Information du participant (enfant) :

Nom :	
Âge/année de naissance :	
Sexe :	

Information du parent :

Nom :	
Courriel :	
Numéro de téléphone :	

Historique des leçons de piano (destiné au participant, les parents peuvent aider à répondre)

Combien d'années de leçons de piano Suzuki avez-vous suivies?	
Quel est le nom de votre professeur Suzuki actuel ?	
À quel âge avez-vous commencé des leçons de piano Suzuki ?	
Avez-vous eu un autre type de leçon de musique privé?	Non Oui Si oui, quel type :
Avez-vous eu un autre type de leçon de musique de groupe?	Non Oui Si oui, quel type : A) Orff B) Musique pour les jeunes enfants C) Kindermusik D) Dalcroze E) Autre :_____
Quel est votre niveau actuel du livre de Suzuki?	

Quelle est la pièce que vous pratiquez actuelle ou quelles sont les pièces à l'étude?	
Identifiez la ou les pièces de révision que vous jouez:	o A A Short Story o Happy Farmer o Lightly Row o Go Tell Aunt Rhody o Au Clair de la lune o Musette o Ecossaise
En moyenne, combien de jours par semaine pratiquez-vous le piano ?	
En moyenne, combien de temps durent vos pratiques ?	
Avez-vous déjà fait des examens de la RCM? Ou d'autres examens du conservatoire ?	Non Oui Si oui, lesquels :

Rôle des parents dans l'éducation musicale (à compléter lorsque l'étudiant effectue le prétest)

Assistez-vous aux leçons de piano de votre enfant?	Jamais Rarement Parfois Souvent Toujours
Aidez-vous votre enfant avec sa pratique de piano?	Jamais Rarement Parfois Souvent Toujours
Participez-vous dans l'éducation musicale de votre enfant d'autre(s) manière(s)? Pouvez-vous décrire ses activités?	

Rôle des parents dans la pratique (pour les parents)

Y a-t-il d'autres éléments que vous souhaitez partager à propos de votre implication dans les leçons de piano ?

_____
_____
_____
_____
_____
_____

Pour les étudiants (peut être demandé après le premier prétest et lors du dernier post-test). Cette réponse va être filmée au lieu d'être écrite.

Pouvez-vous me dire ce que veut dire jouer « musicalement » ?

Email for Suzuki teachers

Dear_____,

My name is Mélina Dalaire and I am a Master's student at the University of Ottawa' School of Music. I am working under the supervision of my thesis advisor, Prof. Gilles Comeau at the Piano Pedagogy Research Laboratory.

My research pertains to the relationship between movement-based activities, more specifically Dalcroze-related activities and improvements in piano performance. I am seeking participants who are Suzuki-trained and are currently studying in either Suzuki book 1 or book 2.

I would like to meet with you and members of your organisation to present my project and answer any questions. Potential participants would only be contacted with your recommendation.

The attached letter of information will give you a more detailed explanation of the project and associated activities.

Thank you in advance for your interest,

Mélina Dalaire,

MA candidate,
UOttawa

Courriel pour les enseignants Suzuki

Cher_____,

Mon nom est Mélina Dalaire et je suis étudiante à l'Université d'Ottawa à l'École de Musique. Je travaille sous la supervision de mon directeur de thèse, prof. Gilles Comeau, au Laboratoire de Recherche en Pédagogie du Piano.

Ma recherche porte sur la relation entre les activités axées sur le mouvement, plus spécifiquement les activités Dalcroze, et l'amélioration des performances au piano. Je cherche des participants qui sont formés à Suzuki et qui étudient actuellement les morceaux du Livre Suzuki 1 ou livre Suzuki 2.

J'aimerais vous rencontrer ainsi que les membres de votre organisation pour présenter mon projet et répondre à vos questions. Les participants potentiels seraient contactés uniquement sous votre recommandation.

Ci-joint est annexée la lettre d'information qui vous donnera une explication plus détaillée du projet et des activités connexes.

Merci d'avance pour votre intérêt,

Mélina Dalaire,

Candidate MA,

Université d'Ottawa

Email to parents

Dear _____,

My name is Mélina Dalaire and I am a graduate student at the University of Ottawa' School of Music. I am working under the supervision of my thesis advisor, Prof. Gilles Comeau at the Piano Pedagogy Research Laboratory.

If you receive this email, your child's piano teacher has given me your name with your permission.

I am conducting a study investigating how movement-based activities could contribute to improvements in piano performance with young piano students.

In order to collect data for this study, I will be asking participants to come to the piano lab for a total of five times and to keep a very brief practice log at home. The attached letter of information will provide you with all the details pertaining to the chronology of events.

I am in search of a very specific group of participants: Suzuki-trained piano students between the ages of 5-11 years old. The inclusion and exclusion criteria are as follows:

Participants must:

- Be between the ages of 5 and 11
- Be actively taking piano lessons with a Suzuki-trained teacher
- Be learning pieces in either Suzuki Books 1 or 2
- Have one or two of the following pieces as a review piece:
    - A Short Story
    - Happy Farmer
    - Lightly Row
    - Go Tell Aunt Rhody
    - Au Clair de la Lune
    - Musette
    - Ecossaise
- Be fluent in either English or French
- Not have any of the following
    - Learning disability
    - Development disorder
    - Attention deficit disorder
    - Hearing deficiencies

Participants will be receive 3 free 60-minute Dalcroze lessons with an experienced Dalcroze teacher, a 20$ gift certificate from a local music store and a free tour of the Period Instruments Studio and the Piano Pedagogy Lab.

If you would be interested in helping me with my research, please email me back. I would be happy to answer any questions.

Many thanks,

Mélina Dalaire

MA candidate in Piano Pedagogy,
University of Ottawa.

Courriel aux parents

Cher _____,

Mon nom est Mélina Dalaire et je suis étudiante à l'Université d'Ottawa à l'École de Musique. Je travaille sous la supervision de mon directeur de thèse, prof. Gilles Comeau, au Laboratoire de Recherche en Pédagogie du Piano.

Si vous recevez ce courriel, c'est que le professeur de piano de votre enfant m'a donné votre nom avec votre permission.

Je mène une étude qui s'intéresse à l'impact des activités axées sur le mouvement sur l'amélioration de la performance au piano de jeunes élèves.

Afin de recueillir des données pour cette étude, je vais demander aux participants de venir au laboratoire de piano cinq fois ainsi que de pratiquer des sessions brèves à la maison. Ci-joint est annexée une lettre d'information qui vous fournira tous les détails concernant la chronologie des événements.

Je suis à la recherche d'un groupe spécifique de participants : des élèves de piano formés Suzuki, entre les âges de 5 à 11 ans. Les critères d'inclusion et d'exclusion sont les suivants:

Les participants doivent :

- Être âgés entre 5 et 11 ans
- Suivre activement des leçons de piano avec un professeur de formation Suzuki
- Apprendre des pièces dans le livre Suzuki 1 ou le livre Suzuki 2
    - Avoir une ou deux des pièces suivantes comme pièce de révision :
        - A Short Story
        - Happy Farmer
        - *Lightly* Row
        - Go Tell Aunt Rhody
        - Au Clair de la Lune
        - Musette
        - Ecossaise
- Parler couramment l'anglais ou le français
- Ne pas présenter une des conditions suivantes :
    - Trouble d'apprentissage
    - Trouble du développement
    - Trouble neurologique
    - Trouble déficitaire de l'attention
    - Déficience auditive

Les participants seront indemnisés avec trois leçons gratuites de Dalcroze ayant une durée de 60 minutes chacune, avec un professeur de la méthode Dalcroze. De plus, les participants recevront un certificat-cadeau de 20$ dans un magasin local de musique et un tour guidé gratuit du studio des instruments anciens du Laboratoire de pédagogie du piano.

Si vous êtes intéressé à m'aider dans mes recherches, s'il vous plaît veuillez répondre à ce courriel. Cela me ferait plaisir de répondre à vos questions.

Merci beaucoup,

Mélina Dalaire

Candidate MA en Pédagogie du Piano,

Université d'Ottawa.

Screening scenario text for telephone call to parents (exclusion and inclusion factors)

Hello_____!

This is Mélina Dalaire. We have communicated by email regarding the music and movement research project at the University of Ottawa. Thank you for taking the time to talk to me today. The goal of my call is to ensure that you understand the project and to verify if your child can participate based on a series of inclusion and exclusion criteria.

If you agree, I will ask you a series of questions.

Do you agree? Yes____ No_____ (*if no, the researcher will thank the parent for their time and eliminate the child's name/contact from the list of potential participants*)

Have you read the information letter? Yes_____ No_____(*If no, the researcher will read the letter to them)*

Do you have any questions about the project? Yes_____ No_____(*If yes, the researcher will answer any questions)*

As mentioned in the information letter, in order for your child to participate, _____(he/she) needs to satisfy some inclusion and exclusion criteria. I would like to go through these criteria with you today. I would need you to answer either yes or no to the questions. Do you agree?

Yes_____ No _____ (*If no, the researcher will thank the parent for their time and eliminate the child's name/contact from the list of potential participants*)

We are looking for children who fit the following criteria:
Is you child between 5 and 11 years old? Yes_____ No_____
Has your child been actively taking piano lessons with a Suzuki-trained teacher? Yes____No___
Is your child presently learning pieces in either book 1 or book 2? Yes_____No_____
Is your child practicing *one or two of the following pieces: A Short Story, Happy Farmer, Lightly Row, Go Tell Aunt Rhody, Au Clair de la Lune, Musette or Ecossaise?*? Yes_____ No____
Is your child fluent in either English or French? Yes_____No_____
Does your child have a diagnosed learning disability? Yes_____No_____
Does your child have a diagnosed development disorder? Yes_____ No____
Does your child have diagnosed ADD? Yes____No____
Does your child have diagnosed hearing deficiencies? Yes____No_____

Thank you for your time! Based on the information you have provided me, your child meets all the criteria and will be able to participate in the study. I will contact you shortly for the next steps. Have a good day!

Or

Thank you for your time! Based on the information you have provided me, some of the criteria are not fulfilled and your child will not be able to participate in this study. Thank you for your interest. Have a good day.

Texte du scénario pour l'appel téléphonique aux parents (facteurs d'exclusion et d'inclusion)

Bonjour_____ !

C'est Mélina Dalaire. Nous avons communiqué par courriel au sujet du projet de recherche sur la musique et le mouvement à l'Université d'Ottawa. Merci de prendre le temps de me parler aujourd'hui. L'objectif de mon appel est de m'assurer que vous compreniez le projet et de vérifier si votre enfant peut participer en fonction d'une série de critères d'inclusion et d'exclusion.

Si vous êtes d'accord, je vais vous poser une série de questions.

Vous êtes d'accord? Oui_____ Non_____ (*si non, le chercheur remerciera le parent pour son temps et retirera le nom ou le contact de l'enfant de la liste des participants potentiels)*

Avez-vous lu la lettre d'information? Oui____ Non_____ (*si non, le chercheur leur lire la lettre*)

Avez-vous des questions sur le projet? Oui____ Non_____ (*si oui, le chercheur va répondre aux questions)*

Comme mentionné dans la lettre d'information, pour que votre enfant participe, _____ (il/elle) doit satisfaire à certains critères d'inclusion et d'exclusion. J'aimerais passer en revue ces critères avec vous aujourd'hui. J'aurais besoin que vous répondiez soit oui ou non aux questions. Vous êtes d'accord?

Oui____ Non_____ (*si non, le chercheur remerciera le parent pour son temps et retirera le nom ou le contact de l'enfant de la liste des participants potentiels*)

Nous recherchons des enfants qui correspondent aux critères suivants:
Votre enfant a-t-il entre 5 et 11 ans? Oui____ Non_____
Votre enfant a-t-il pris des leçons de piano avec un professeur formé par Suzuki? Oui____ Non_____
Votre enfant est-il présentement en train d'apprendre des pièces dans le livre Suzuki 1 ou livre Suzuki 2?
Oui____ Non____
Votre enfant pratique-t-il *présentement une des pièces suivantes comme pièce de révision : Go Tell Aunt Rhody, Au Clair de la Lune, Musette or Ecossaise?* Oui_____ Non_____

Votre enfant parle-t-il couramment l'anglais ou le français? Oui____ Non_____

Votre enfant a-t-il un trouble d'apprentissage diagnostiqué? Oui____ Non_____
Votre enfant a-t-il un trouble de développement diagnostiqué? Oui____ Non_____
Votre enfant a-t-il un déficit de l'attention diagnostiqué? Oui____ Non_____
Votre enfant a-t-il des déficiences auditives diagnostiquées? Oui____ Non_____

Merci d’avoir pris le temps de répondre à mes questions. Selon les renseignements que vous avez fourni, votre enfant répond aux critères d’admissibilité et pourra participer à la recherche. Je communiquerai avec vous sous peu pour les prochaines étapes. Bonne journée.

OU

Merci d’avoir pris le temps de répondre à mes questions. Selon les renseignements que vous avez fourni, votre enfant ne répond pas aux critères d’admissibilité et ne pourra pas participer à la recherche. Je vous remercie pour votre intérêt! Bonne journée.

Letter of information

Title of the study: Dalcroze and piano performance

Principal Investigator: Mélina Dalaire
Master of Arts in Piano Pedagogy, graduate student
Faculty of Arts, University of Ottawa
Email: xxxxxxx@uottawa.ca

Supervisor : Professor Gilles Comeau
Director of the Piano Pedagogy Research Laboratory
Faculty of Arts, University of Ottawa
Email: xxxxxx@uottawa.ca

Invitation to participate: You are invited to participate in the abovementioned research study conducted by Mélina Dalaire. I am interested in research relating to the link between learning musical concepts through movement-based activities and how this knowledge could be transferred to playing the piano. I am recruiting active Suzuki-trained piano students to attend three free 60 minute Dalcroze classes and to record a very short musical excerpt on three separate occasions (15 minutes each).

Purpose of the study: The objective of this study is to investigate the possible relationship that may exist between a movement-based approach to musical understanding and how this understanding may transfer to a piano performance.

Participation: Participants must:

- Be between the ages of 5 and 11
- Be actively taking piano lessons with a Suzuki-trained teacher
- Be learning pieces in either Suzuki Book 1 or Suzuki Book 2
- Have one or two of the following pieces as a review piece
    - *A A Short Story*
    - Happy Farmer
    - Lightly Row
    - Go Tell Aunt Rhody
    - Au Clair de la Lune
    - Musette
    - Ecossaise
- Be fluent in either English or French
- Not have any of the following
    - Learning disability
    - Development disorder
    - Attention deficit disorder
    - Hearing deficiencies

Participation will include:

Come to the University of Ottawa's Faculty of Music for a total of five events AND practice at home.

> **Visit 1:** Fill in a questionnaire with parents (appendix/questionnaire) (15 minutes) and perform a specific musical excerpt that will be recorded on the Disklavier at the piano lab (10 minutes) (video recording for backup purposes). During this first visit you will be asked one question that will be videotaped for data collection purposes

At home during 1 week

a) Practice one or two review pieces for a duration of 3-5 minutes and do so three to four times a week for 1 week
b) Parents will monitor practice sessions and keep a log of what was done during these 3-5 minute sessions

Visit 2: At the end of 1 week, perform a specific musical excerpt that will be recorded on the Disklavier at the piano lab (10 minutes) and participate in the first of three free Dalcroze classes.

Visit 3 & 4: Participate in the second and third- 60 minute group Dalcroze class. At the end of the third class, participants will be asked to perform their musical exercpt or excerpts that will be recorded on the Disklavier at the piano lab (10 minutes). *A typical Dalcroze class is a movement-based experience in which participants would be required to move in a variety of ways (various speeds of walking, running, jogging, swaying, skipping, hopping, jumping, stomping, clapping, snapping fingers; explore body percussion, singing, manipulation of balls or scarves) in reaction to musical stimuli. In comparison to a phys ed class, the activities would be considered low impact*.

Visit 5: Perform one or two musical excerpts that will be recorded on the Disklavier at the piano lab (10 minutes) and hand in the practice log. This last visit will occur 1 week after the last Dalcroze class. During this visit, there will be a short debriefing session.

Benefits:

The teaching of a musical instrument is often approached as an intellectual activity, disregarding the pre-reflective and reflective stages of internalization. The results of this study will provide a foundation that links movement-based training and piano performance with a young population of novice piano students and equip teachers and researchers with more effective teaching methods. For participants, this is a chance to benefit from 3 free Dalcroze lessons and explore state-of-the-art equipment at the Piano Laboratory.

Risks: There is minimal risk for participants in the research.

a) Participants may experience slight anxiety when being individually recorded. They will be reassured that they may replay or practice as many times as they want in order to alleviate the anxiety that they may feel by being recorded.
b) Participants may feel some anxiety in a movement-based class. Participants will be re-assured that the Dalcroze class may present some challenges (coordination) and that they shouldn't feel discouraged if they have difficulty doing any of the activities. The movement-based activities are low risk, similar to a low impact phys ed class.
c) Participants may feel some anxiety in a group situation in which they do not know anyone else. They will be reassured by the researcher and the Dalcroze teacher that the learning environment is friendly, non-competitive and non-threatening.

Confidentiality and anonymity

All participant information and data collected in this study will remain strictly anonymous and confidential and are used for research purposes only. Only the primary researcher, Mélina Dalaire, her thesis supervisor, Prof. Gilles Comeau and authorized research members at the Piano Pedagogy Research Laboratory will have access to this data. Participants will only be identified through alphanumerical codes that will be used in place of names during analysis and publication. All collected data will be kept on secure computers under password protection inside the Piano Pedagogy Research Laboratory, which is lied and armed with security alarms when unoccupied. Access to all computers is strictly monitored by lab administration. The video data collected during the experimental sessions will only be used for the verification of events by the researcher and will not be used for data collection.

Conservation of data: All audio, video and MIDI data will be destroyed five years after the completion of this study.

Compensation: Participation in this study is strictly on a voluntary basis. However, participants will receive a 20$ gift certificate and a free guided tour of the Period Instruments studio at the Piano Pedagogy Research Lab.

Voluntary participation: Participation in this study is strictly voluntary and participants have the right to refuse to answer any questions or continue the sessions without fear of reprisal or ill treatment. Participants can choose to withdraw from the study at any time , either during and after the sessions, before and after the debriefing and have their data destroyed. Participants will receive the 20$ gift certificate even if they withdraw.

Information about the study results:

We would be pleased to share the results of this project with you. In order to receive a summary of the results, please contact the primary investigator, Mélina Dalaire.

If you have any questions with regards to the ethical conduct of this study, you may contact the Protocol Officer for Ethics in Research, University of Ottawa, Tabaret Hall, 550 Cumberland Street, Room 154, Ottawa, ON, K1B 6N5. Tel: 613-562-5387 or ethics@uottawa.ca.

If you have any questions or require more information about the study itself, you may contact the researcher. Please keep this form for your records.

Lettre d'information

Titre de l'étude : Dalcroze et performance au piano

Chercheur principal : Mélina Dalaire
Maîtrise ès arts en pédagogie du Piano, étudiante à la maîtrise
Faculté des Arts, Université d'Ottawa
Courriel : xxxxxxxx@uottawa.ca

Superviseur : Professeur Gilles Comeau
Directeur du Laboratoire de recherche pédagogie du piano
Faculté des Arts, Université d'Ottawa
Courriel : xxxxxxxx@uottawa.ca

Invitation à participer : Vous êtes invités à participer à l'étude, mentionnée plus haut, menée par Mélina Dalaire. Je suis intéressée par la recherche concernant le lien entre l'apprentissage musical par des activités axées sur le mouvement et comment cette connaissance pourrait être transférée dans l'exécution au piano. Je recrute des étudiants actifs dans la méthode Suzuki à participer à trois classes gratuites de Dalcroze de 60 minutes et d'enregistrer un court extrait musical à trois reprises (15 minutes chacun).

But de l'étude : L'objectif de cette étude est d'étudier la relation possible entre une approche axée sur le mouvement pour la compréhension musicale et comment cette compréhension peut être transférée à une performance de piano.

Participation : Les participants doivent :

- Être âgés de 5 à 11 ans
- Prendre activement des leçons de piano avec un professeur Suzuki
- Être dans l'apprentissage de pièces du livre 1 ou du livre 2 Suzuki
- Avoir une ou deux des pièces suivantes comme pièces de révision :
  - A A Short Story
  - Happy Farmer
  - Lightly Row
  - Go Tell Aunt Rhody
  - Au Clair de la Lune
  - Musette
  - Ecossaise
- Parler couramment anglais ou français
- Ne pas avoir l'un des éléments suivants :
  - Trouble d'apprentissage
  - Trouble du développement
  - Trouble déficitaire de l'attention
  - Déficience auditive

La participation inclura :

Venir à la faculté de musique de l'Université d'Ottawa pour un total de cinq séances ET pratiquer à la maison.

Visite 1 : Remplir un questionnaire avec les parents (annexe/questionnaire) (15 minutes) et jouer un ou deux extrait musicaux qui seront enregistrés sur le Disklavier au laboratoire de piano (10 minutes) (enregistrement vidéo à des fins de sauvegarde). Au cours de cette première visite, une question qui sera enregistrée sur bande vidéo à des fins de collecte de données sera posée.

À la maison pendant 1 semaine :

a) Pratiquer un ou deux pièces spécifiques pour une durée de 3 à 5 minutes, et ce, de trois à quatre fois par semaine pendant une semaine
b) Les parents surveilleront les pratiques et tiendront un journal de bord de ce qui a été fait au cours de ces sessions de 3-5 minutes

Visite 2 : À la fin de une semaine, jouer le ou les extraits musicaux spécifiques qui seront enregistrés sur le Disklavier au laboratoire de piano (10 minutes) et participer dans le premier de trois cours Dalcroze de 60 minutes.

Visites 3 & 4 : Participer dans le deuxième et troisième des cours de groupe Dalcroze d'une durée de 60 minutes chacune. À la fin de la troisième classe, les participants joueront leurs extraits musicaux qui seront enregistrés sur le Disklavier au laboratoire de piano. *Une classe de Dalcroze est une expérience axée sur le mouvement dans lequel les participants doivent bouger de différentes façons (différentes vitesses de marche, course, jogging, balancement, sauter, piétiner, frapper, claquer des doigts; explorer les percussions du corps, chanter, manipuler des balles et des foulards) en réaction à un stimulus musical. En comparaison avec un cours d'éducation physique, les activités sont considérées à faible impact*.

Visite 5 : Jouer un ou deux extraits musicaux spécifiques qui seront enregistrés sur le Disklavier au laboratoire de piano (10 minutes) et remettre le journal de bord au chercheure. Cette dernière visite aura lieu une semaine après la dernière classe de Dalcroze. Au cours de cette visite, il y aura une brève séance de débriefing.

Avantages :

L'enseignement d'un instrument de musique est souvent abordé comme une activité intellectuelle, ignorant les stades pré réflectifs et les stades réflectifs de l'internalisation. Les résultats de cette étude fourniront une base mettant en relation la formation axée sur le mouvement et la performance au piano avec une jeune population d'étudiants débutants au piano ainsi que d'équiper les enseignants et les chercheurs avec des méthodes d'enseignement plus efficaces. Pour les participants, c'est une

chance de bénéficier de 3 leçons gratuites de Dalcroze et d'explorer l'équipement de pointe au Laboratoire du Piano.

Risques : Il y a un risque minime pour les participants à la recherche.

a) Les participants peuvent éprouver une anxiété légère lorsqu'ils sont enregistrés individuellement. Ils seront assurés qu'ils peuvent recommencer ou se pratiquer autant de fois qu'ils le souhaitent afin d'atténuer l'anxiété pouvant être ressentie au cours de l'enregistrement.
b) Les participants peuvent ressentir une certaine anxiété dans une classe axée sur le mouvement. Les participants seront assurés que la classe Dalcroze peut présenter certains défis (coordination) et qu'ils ne devraient pas se sentir découragés s'ils éprouvent de la difficulté en effectuant l'une des activités. Les activités axées sur le mouvement représentent un faible risque, similaire à un faible impact en classe d'éducation physique.
c) Les participants peuvent éprouver une certaine anxiété dans une situation de groupe dans lequel ils ne connaissent pas les autres individus. Ils seront assurés par le chercheur et le professeur de Dalcroze que l'environnement d'apprentissage est amical, non compétitif et non menaçant.

Confidentialité et anonymat :

Toutes les informations des participants et les données recueillies dans le cadre de cette resteront strictement confidentiels et anonymes et sont uniquement utilisés à des fins de recherche. Seulement le chercheur principal, Mélina Dalaire, son directeur de thèse, prof. Gilles Comeau et les membres de recherche autorisés au Laboratoire de recherche en Pédagogie du Piano auront accès à ces données. Les participants seront uniquement identifiés par des codes alphanumériques qui remplaceront les noms au cours des analyses et de la publication. Toutes les données recueillies seront enregistrées sur les ordinateurs sécurisés sous la protection de mots de passe à l'intérieur du Laboratoire de recherche en Pédagogie du Piano, protégé par des alarmes de sécurité lorsqu'il est inoccupé. L'accès à tous les ordinateurs est strictement surveillé par l'administration du laboratoire. Les données vidéo collectées pendant les sessions expérimentales ne seront utilisées que pour la vérification des résultats par le chercheur et ne seront pas utilisées pour la collecte de données.

Conservation des données : Toutes les données audios, vidéo et MIDI seront détruites cinq années après la fin de cette étude.

Compensation : La participation à cette étude se fait uniquement sur une base volontaire. Toutefois, les participants recevront un certificat-cadeau de 20$ à un magasin local de musique et un tour guidé du studio des instruments anciens du Laboratoire de recherche en pédagogie du piano.

Participation volontaire : La participation dans cette étude strictement volontaire et les participants ont le droit de refuser de répondre à n'importe quelles questions ou le droit de continuer les séances sans crainte de représailles ou de mauvais traitements. Les participants peuvent choisir de se retirer de l'étude à tout moment, soit avant ou après les séances expérimentales, soit avant ou après la séance de débriefing et par conséquent, avoir leurs données détruites. Les participants recevront le certificat-cadeau de 20$ même s'ils décident de se retirer de l'étude.

Informations sur les résultats de l'étude

Nous serions heureux de partager les résultats de ce projet avec vous. Afin de recevoir un résumé des résultats, veuillez communiquer avec le chercheur principal, Mélina Dalaire.

Si vous avez des questions au sujet de l'éthique de cette étude, vous pouvez communiquer avec un agent du Bureau d'éthique et d'intégrité de la recherche, Université d'Ottawa, Tabaret Hall, 550 rue Cumberland, salle 154, Ottawa, ON K1B 6N5. Tél : 613-562-5387 ou ethics@uottawa.ca .

Si vous avez des questions ou désirez plus d'informations sur l'étude elle-même, vous pouvez contacter le chercheur. S'il-vous-plaît, gardez ce formulaire pour vos dossiers.

PARENTAL CONSENT FORM, CHILD ASSENT FORM

For parent or guardian of child participants:

I, _____, confirm that I have read and understood the information presented in the letter of information, and have discussed this master's thesis project with my child to make sure she/he is interested in participating. I understand that data collection will include audio and video recordings. I understand that my child is under no obligation to participate, and that she/he has the right to withdraw from the study at any point, for any reason and keep the compensation. By signing this form I confirm that my child meets the criteria for participation as described and acknowledge the risks of participation as they have been described.

There are two copies of the letter of information and the consent form one of which is mine to keep.

_____ _____

Signature of parent or guardian Date

_____ _____

Signature of researcher Date

The supervisor for this project is Prof. Gilles Comeau. If for any reason you request to contact him, his coordinates are provided below.

Supervisor:

Prof. Gilles Comeau
Room 204, 50 Perez Hall, University of Ottawa Ottawa Canada K1N 6N5
6135625800(2704)

Children's Assent Form

Welcome to the Piano Laboratory! We will ask you to do a few different things as part of your visits. First, you will fill in a questionnaire with your parent/guardian. You will come and visit us 5 times in total. During 4 of these visits, you will be asked to perform a small part of one or two songs that you already know on a very cool grand piano that records your playing! On 3 of your visits, you will be participating in a group lesson in a large room, doing lots of movement activities. At any time during this activity, you can stop for a break, or completely stop and end the activity and leave the study and still receive your 20$ gift certificate and a free visit to our Period Instruments studio!

It is entirely up to you to decide whether to participate in my project or not.

Do you agree to participate in this project? YES ____ NO _____

There are two copies of the letter of information and the consent form on e of which is mine to keep.

Child's signature: _____

_____ _____

Signature of researcher Date

The supervisor for this project is Prof. Gilles Comeau. If for any reason you request to contact him, his coordinates are provided below.

Supervisor:

Prof. Gilles Comeau
Room 204, 50 Perez Hall, University of Ottawa Ottawa Canada K1N 6N5
6135625800(2704)

FORMULAIRE DE CONSENTEMENT PARENTAL, FORMULAIRE DE CONSENTEMENT DE L'ENFANT

Pour le parent ou le tuteur de l'enfant participant :

Je, _____, confirme avoir lu et compris les renseignements présentés dans la lettre d'information et je confirme avoir discuté de ce projet de thèse de maitrise avec mon enfant et m'être assuré qu'il/elle est intéressé(e) à participer. Je comprends que la collecte de données comprendra des enregistrements audio et vidéo. Je comprends que mon enfant n'est pas dans l'obligation de participer, et qu'il/elle a le droit de se retirer de l'étude à tout moment, pour quelque raison que ce soit, et de conserver la compensation. En signant ce formulaire, je confirme que mon enfant répond aux critères de participation tels que décrits et je reconnais les risques liés à la participation, tels qu'ils ont été décrits dans la lettre d'information.
Il y a deux copies de la lettre d'information et du formulaire de consentement, dont l'une d'elles est conservée dans mes dossiers.

_____ _____

Signature du parent ou du tuteur Date

_____ _____

Signature du chercheur Date

Le superviseur de ce projet est le prof. Gilles Comeau. Si, pour quelque raison que ce soit, vous désirez le contacter, ses coordonnées sont fournies ci-dessous.

Superviseur :
Prof. Gilles Comeau
Salle 204, 50 Perez Hall, Université d'Ottawa, Ottawa, Canada, K1N 6N5
613-562-5800 (2704)

Formulaire de consentement pour les enfants

Bienvenue au laboratoire du Piano! Nous te demanderons de faire quelque chose de différent dans le cadre de vos visites. Tout d'abord, tu vas remplir un questionnaire avec ton parent/tuteur. Tu nous rendras visite 5 fois au total. Au cours de 4 de ces visites, on te demanderas de jouer une petite partie d'une ou deux chansons que tu connais déjà sur un piano très cool qui t'enregistre! Pour 3 des visites, tu participeras à une leçon de groupe dans une grande salle ou te feras des activités liées au mouvement. À tout moment au cours de cette activité, tu pourras arrêter pour une pause, ou complètement arrêter et mettre fin à l'activité et quitter l'étude et tout de même recevoir ton certificat cadeau de 20$ et un tour guidé du studio des instruments d'époque au laboratoire de recherche en pédagogie du piano.

Il est entièrement à vous de décider de participer à mon projet ou non.

Acceptez-vous de participer à ce projet ? OUI ____ NON _____

Il y a deux copies de la lettre d'information et du formulaire de consentement, dont l'une d'elles est conservée dans mes dossiers.

Signature de l'enfant : _____

_____ _____

Signature du chercheur Date

Le superviseur de ce projet est le prof. Gilles Comeau. Si, pour quelque raison que ce soit, vous désirez le contacter, ses coordonnées sont fournies ci-dessous.

Superviseur :
Prof. Gilles Comeau
Salle 204, 50 Perez Hall, Université d'Ottawa, Ottawa, Canada, K1N 6N5
613-562-5800 (2704)

Debriefing and consent form: Dalcroze and piano performance

Thank you for agreeing to participate in this study! The general purpose of this research is to explore if there is a relationship between learning musical concepts with movement and if that experience can be transferred to the piano.

Participants: We invited children between the ages of 5-11, who are actively taking piano lessons with a Suzuki-trained teacher, that are currently studying repertoire in either Suzuki Book 1 or Suzuki Book 2 book and are playing one or two of the following pieces (*A Short Story, Happy Farmer, Lightly Row, Go Tell Aunt Rhody, Au Clair de la Lune, Musette or Ecossaise*) to participate.

Partial Disclosure: You were told in the information letter that this study was designed to investigate the possible relationship that may exist between a movement-based approach to musical understanding and how this understanding may transfer to a piano performance.

Full disclosure: The present research will be measuring **only one aspect** of the performances: musical expressivity. During the course of the data collection, participants were asked to perform parts of one or two pieces. The results will provide us with information about if and how the musical phrasing was influenced by the Dalcroze classes that you attended.

Voluntary participation: Participation in this study is strictly voluntary and participants have the right to refuse to answer any questions or continue the sessions without reprisal or ill treatment. Participants can choose to withdraw from the study at any time up until the debriefing session is complete. Consequently, their data will not be included in the study. Participants will receive the 20$ gift certificate and a guided tour of the Period instruments's Studio, even if they withdraw.

Thank you for your participation in this study. If you have further questions about the study, please contact Mélina Dalaire (main researcher) at xxxxxxxx@uottawa.ca. In addition, if you have any concerns about any aspect of the study, you may contact my supervisor:

Prof. Gilles Comeau

Room 204, 50 Perez Hall, University of Ottawa Ottawa Canada K1N 6N5

6135625800(2704)

Additional Reading:

https://www.dalcroze.ch/english/what-is-eurhythmics/

https://www.researchgate.net/publication/264159569_The_Dalcroze_Approach_to_Music_Education_Theory_and_Applications

Post-debriefing consent/assent forms

I, _____, confirm that I have read and understood the information presented in the debriefing letter, and have discussed the details of full disclosure with my child to make sure she/he is willing for his/her data to be included in the study. I understand that my child is under no obligation to participate, and that she/he has the right to withdraw from the study at any point, for any reason and keep the compensation. By signing this form I confirm that my child is willing to have their data included in the study.

There are two copies of the letter of information and the consent form one of which is mine to keep.

_____ _____

Signature of parent or guardian Date

_____ _____

Signature of researcher Date

The supervisor for this project is Prof. Gilles Comeau. If for any reason you request to contact him, his coordinates are provided below.

Supervisor:

Prof. Gilles Comeau

Room 204, 50 Perez Hall, University of Ottawa Ottawa Canada K1N 6N5

6135625800(2704)

Debriefing Children's Assent Form

Thank you for coming to this final meeting! I wanted to let you know that I really appreciate all your time and hope you enjoyed playing on the Disklavier and the Dalcroze lessons. I also hope you enjoy the 20$ gift certificate.

It's important that you know the exact reason for this study: I want to measure if and how the Dalcroze lessons may have influenced how you planned your phrasing at the piano.

Now that you know exactly what the project is about, it is entirely up to you to decide whether you accept to have your information available for our study.

Do you agree to have your data used for this research? YES ____ NO _____

There are two copies of the letter of information and the consent form one of which is mine to keep.

Child's signature: _____

_____ _____

Signature of researcher Date

Débriefing et formulaire de consentement: Dalcroze et performance au piano

Merci d'avoir accepté de participer à cette étude! L'objectif général de cette recherche est d'explorer s'il existe une relation entre l'apprentissage des concepts musicaux en lien avec le mouvement et si cette expérience peut être transférée au piano.

Participants: Nous avons invité des enfants âgés de 5 à 11 ans, qui suivent activement des leçons de piano avec un professeur formé dans la méthode Suzuki, qui étudient actuellement le répertoire soit du livre Suzuki 1 ou du livre Suzuki 2 et qui joue une ou deux des pièces suivantes : *A Short Story, Happy Farmer, Lightly Row, Go Tell Aunt Rhody, Au Clair de la Lune, Musette or Ecossaise*.

Divulgation partielle: Vous avez pris connaissance, dans la lettre d'information, que cette étude a été conçue pour étudier la relation possible entre une approche basée sur le mouvement à la compréhension musicale et comment cette compréhension peut être transférée à une performance au piano.

Divulgation complète: La présente recherche ne mesurera **qu'un aspect** des performances: l'expression musicale. Au cours de la collecte de données, les participants ont été invités à interpréter une section de une ou deux pièces. Les résultats nous fourniront des informations sur l'influence des classes de Dalcroze assistées par les participants, soit si elles ont influencé le phrasé musical et si oui, comment.

Participation volontaire: La participation à cette étude est strictement volontaire et les participants ont le droit de refuser de répondre à toute question ou de poursuivre les sessions sans représailles ni mauvais traitements. Les participants peuvent choisir de se retirer de l'étude à tout moment jusqu'à ce que la séance de débriefing soit terminée. S'ils se retirent, leurs données ne seront pas incluses dans l'étude. Même s'ils se retirent de l'étude, les participants recevront un certificat-cadeau de 20$ et un tour guidé gratuit du studio des instruments d'époque du laboratoire de recherche en pédagogie du piano.

Merci de votre participation à cette étude. Si vous avez d'autres questions concernant l'étude, veuillez communiquer avec Mélina Dalaire (chercheuse principale) : xxxxxxxxx@uottawa.ca. De plus, si vous avez des inquiétudes au sujet d'un aspect de l'étude, vous pouvez communiquer avec mon superviseur:

Prof. Gilles Comeau

Salle 204, 50 Perez Hall, Université d'Ottawa, Ottawa, Canada, K1N 6N5

613-562-5800 (2704)

Lectures supplémentaires :

https://www.Dalcroze.ch/English/ what's-is-rythmique/

https://www.ResearchGATE.net/publication/264159569_The_Dalcroze_Approach_to_Music_Education_Theory_and_Applications

Formulaire de consentement post-débriefing

Je, _____, confirme avoir lu et compris les renseignements présentés dans la lettre de débriefing et avoir discuté des détails de la divulgation complète avec mon enfant afin de s'assurer qu'il/elle est prêt(e) à inclure ses données dans l'étude. Je comprends que mon enfant n'est pas tenu de participer et qu'il a le droit de se retirer de l'étude à tout moment, pour quelque raison que ce soit, et de conserver la compensation. En signant ce formulaire, je confirme que mon enfant accepte d'inclure ses données dans l'étude.

Il y a deux copies de la lettre d'information et du formulaire de consentement, dont l'une d'elles est conservée dans mes dossiers.

_____ _____

Signature du parent ou du tuteur Date

_____ _____

Signature du chercheur Date

Le superviseur de ce projet est le prof. Gilles Comeau. Si, pour quelque raison que ce soit, vous désirez le contacter, ses coordonnées sont fournies ci-dessous.

Salle 204, 50 Perez Hall, Université d'Ottawa, Ottawa, Canada, K1N 6N5

613-562-5800 (2704)

Formulaire de consentement débriefing pour les enfants

Merci d'être venu à cette dernière réunion! Je voulais vous dire que j'apprécie vraiment tout votre temps passé avec moi et j'espère que vous avez apprécié de jouer sur le Disklavier et d'avoir fait les leçons de Dalcroze. J'espère aussi que vous apprécierez le certificat-cadeau de 20$.

Il est important que vous sachiez la raison exacte de cette étude: je veux mesurer si les leçons de Dalcroze peuvent avoir influencé la façon dont vous avez planifié votre phrasé au piano et si oui, de quelle façon.

Maintenant que vous savez exactement le sujet du projet, c'est à vous de décider si vous acceptez de rendre vos informations disponibles pour notre étude.

Acceptez-vous que vos données soient utilisées pour cette recherche? OUI ___ NON ___

Il y a deux copies de la lettre d'information et du formulaire de consentement, dont l'une d'elles est conservée dans mes dossiers.

Signature de l'enfant: _____

_____ _____ Signature du chercheur Date

Appendix F

Logbook directives

Dear participant: You will be provided with a logbook for the duration of the experimental period (Dates: TBD). The following directives should be followed rigorously. You will be asked to bring back the completed logbook on the day that will come in for the final performance/measurement at the UOttawa Piano Pedagogy Laboratory once all experimental conditions have been met.

Procedure

Beginning of log entries: The day you will visit the Piano Pedagogy Piano Lab for the first time will be the beginning date for log entries.

Frequency of practices: You will review one or two of the following pieces: (*A Short Story, Happy Farmer, Lighy Row, Go Tell Aunt Rhody, Au Clair de la lune, Musette or Ecossaise*) for a maximum of 3-4 days during the week and for a duration of 3-5 minutes each time. This means that you will review this piece for a minimum of 3 days and a maximum of 4 days per week. You may choose which days are most convenient for you.

Content of each practice session/data entry: Each 3-5 minute practice session of *your selections* should include the two following activities

a) reviewing the entire piece or pieces hands separate;

b) reviewing the entire piece or pieces hands together;

Your parent can help you with the timing of your sessions and to make sure that you entered the data correctly in the logbook.

Data entry in the logbook should also include:

a) any of your comments or reactions;

b) in which order the two conditions were met (hands together and hands separately);

c) how many times you reviewed each of two conditions

Your parent or caregiver is NOT to intervene or coach you during the practice of your pieces. The parent's role will be limited to ensuring that the piece or pieces are practiced 3-4 times for the week and for a duration of 3-5 minutes. The date and duration of each practice session of *your selection or selections* needs to be recorded in the logbook.

Confidentiality: All names will remain anonymous in accordance with ethics rules of conduct of UOttawa.

Directives du journal de bord

Chers parents : Je vous remercie pour votre participation à cette étude. Un journal de bord vous sera fourni pour la durée de l'expérience (dates : TBD). Les directives suivantes doivent être suivies rigoureusement. Il vous sera demandé de rapporter le journal de bord complété le jour où votre enfant viendra pour sa dernière performance à l'Université d'Ottawa au Laboratoire en Pédagogie du Piano, et ce, dès que toutes les conditions expérimentales seront remplies.

Procédure

Début des entrées de journal : Le jour où votre enfant et vous visiterez le Laboratoire en Pédagogie du Piano pour la première fois sera la date de début pour les entrées du journal.

Fréquence des pratiques : Il sera demandé à votre enfant de réviser une ou deux des pièces suivantes *(A Short Story, Happy Farmer, Lightly Row, Go Tell Aunt Rhody, Au Clair de la Lune, Musette ou Ecossaise*) pour un maximum de 3-4 jours par semaine et pour une durée de 3 à 5 minutes à chaque fois. Cela signifie que votre enfant doit pratiquer cette pièce un minimum de 3 jours et un maximum de 4 jours pendant la semaine. Vous pouvez choisir quels jours vous conviennent le mieux.

Contenu de chaque entrée de données de session/pratique : Chaque séance d'essais de 3 à 5 minutes de *vos sélections musicales* devrait inclure ce qui suit. Les parents devront être présents afin de prendre des notes dans le journal de bord. La saisie de données dans le journal de bord devrait confirmer que les deux conditions suivantes ont été examinées en plus du nombre de répétitions pour chacune.

a) réviser la pièce ou les pièces les mains séparées;

b) réviser la pièce ou les pièces les mains ensemble ;

La saisie de données dans le journal de bord doit également inclure:

a) des commentaires ou des réactions des enfants;

b) dans quel ordre les deux conditions ont été remplies (les mains séparément et ensemble);

c) combien de fois l'enfant a réalisé chacune des deux conditions

Les parents sont priés de ne PAS intervenir ou *coacher* leur enfant au cours de la pratique. Le rôle du parent se limitera à faire en sorte que la pièces ou les pièces soient pratiquées 3 à 4 fois pendant la semaine et pour une durée de 3 à 5 minutes. La date et la durée de chaque séance de pratique doivent être inscrites dans le journal de bord.

Confidentialité : Tous les noms des participants resteront anonymes conformément aux règles d'éthique de conduite de l'Université d'Ottawa.

Logbook/journal de bord

Participant : _____

Day 1 : (insert date)	**Name of piece**	**Hands seperate/was it done and how many repetitions**	**Hands together/was it done and how many repetitions**	**Total time spent reviewing each piece today**
	A:			
	B:			
Comments/reactions: **Which order were the pieces performed: A & B OR B & A (circle the appropriate answer)**				
Day 2 (insert date)	**Name of piece**	**Hands seperate/was it done and how many repetitions**	**Hands together/was it done and how many repetitions**	**Total time spent reviewing each piece today**
	A:			
	B:			
Comments/reactions: **Which order were the pieces performed: A & B OR B & A (circle the appropriate answer)**				
Day 3 : (insert date)	**Name of piece**	**Hands seperate/was it done and how many repetitions**	**Hands together/was it done and how many repetitions**	**Total time spent reviewing each piece today**
	A:			
	B:			

Comments/reactions:

Which order were the pieces performed: A & B OR B & A (circle the appropriate answer)

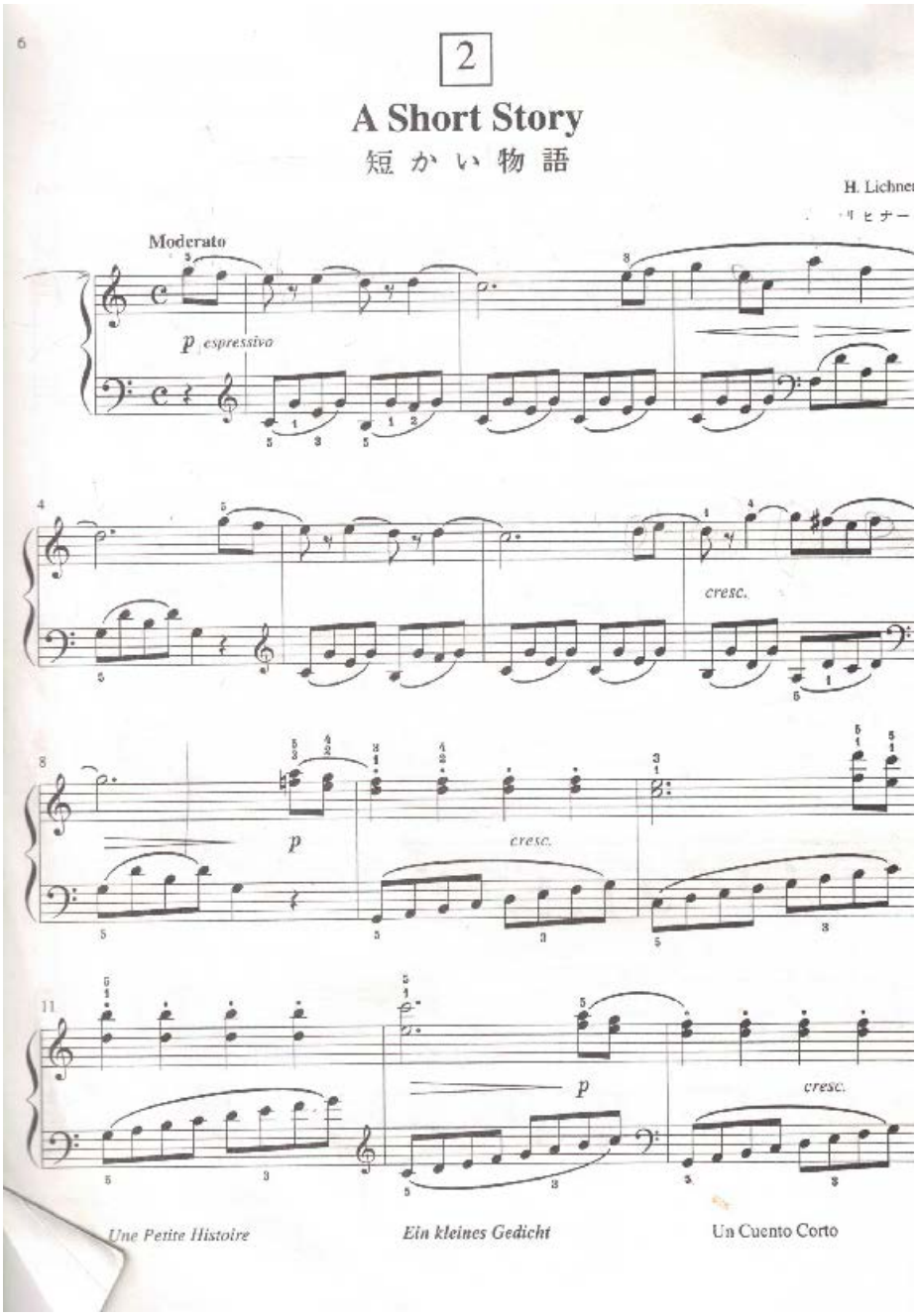
Day 4 (insert date)	**Name of piece**	**Hands seperate/was it done and how many repetitions**	**Hands together/was it done and how many repetitions**	**Total time spent reviewing each piece today**
	A:			
	B:			

Comments/reactions:

Which order were the pieces performed: A & B OR B & A (circle the appropriate answer)

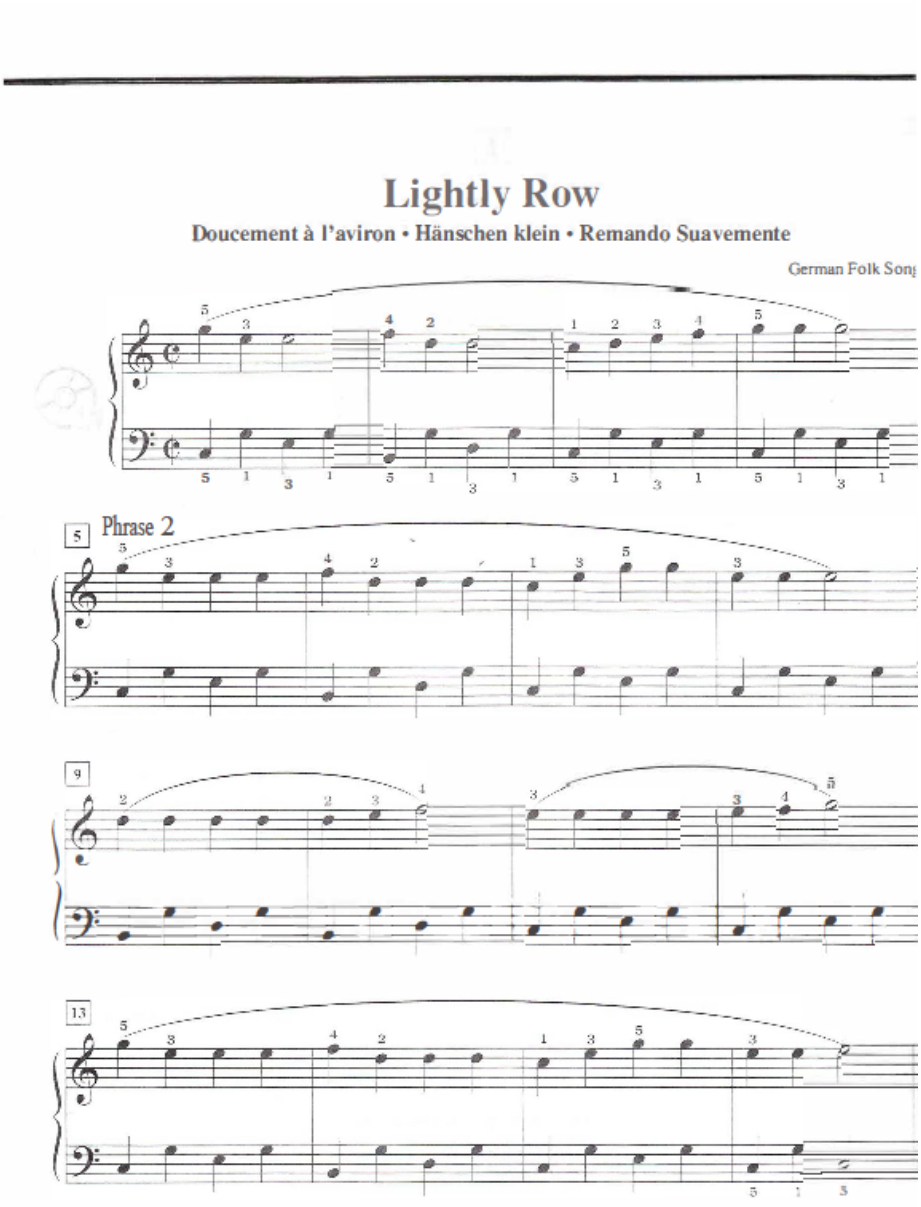
Appendix G

Short Story Score



Appendix H

Lightly Row Score



Appendix I

Dalcroze Lessons for *A Short Story*

The Dalcroze teacher prepared the lessons before the interventions and then reviewed the videos of the lessons. The following is the teacher's revised lesson plans with annotations from the researcher (in squared boxes). All activities relating directly with *A Short Story* explored the following qualities of the phrases:

Exploration of the anacrusic phrase, the various phrasing qualities: **Phrase 1 and 3:** 3-note-slurs going towards decrescendo with same speed, **Phrase 2,** with a crescendo towards the highest note, with a slight decrescendo from the C to the A and then a decrescendo and **Phrase 4** with A crescendo and a slight accelerando towards the end of the phrase.

First Lesson for Old Students May 24, 2019
Materials: piano, finger cymbal, name tag
Students have to wear comfortable clothes and grip socks (or bare foot)

Warming up "Hello song"

Can you stand in semi-circle near the piano?
Listen

Song
Hello Hello How are you?
Hello Hello Happy music time.

Let's sing together.

Teacher chooses one of student's repeated gesture and students repeat it with sing.
Introducing all of students' name

What's your name? My name is Jihye.
What is her name? Everybody, can you repeat? Her name is Jihye.

Teacher accompanies various music.

***Goals**: This warmup exercise is to get to know students, bring students into their bodies and voices*

Preparation
Exploring finger cymbal.
Plays finger cymbal while sitting in a circle

Let's listen!
Can you count how long the cymbal ring?
Can you show me the duration of the sound? are you ready your hand?
If you don't have the sound, you cannot move.
Can you show me the duration of the sound?
We are going to the music land.
Now music will tell you how you move.

Can you show me how music moves?

Goal: *Exploration of relationship between pulse and phrase with one held sound*

Teacher's improvisation
Walk-gallop-walk-run-walk-gallop-slow walk.
Teacher's instruction

Be careful not to bump with your friend!
Don't touch friend's body!
When music starts new phrase, can you change the direction?

Goal*: Reacting to the beginning and ending of a phrase with improvised music through movement*

Main exercise

Painting by sound with dynamics and *nuance*[17]

We are going to paint together. Did you see?
How can you paint? Can you show me?
Let's paint together.

Teacher's improvisation with dynamics and nuance.

Good job!
If you paint long and large frame, how can you do that?
Can you show me? you can walk.

Painting by phrase (with dynamics and nuance)

Teacher's improvisation with dynamics and nuance.

You can use more space.

Goals: Reacting to various types of improvised phrases by painting movement through space

Gradually integrate "*A Short Story***"** (long, short and anacrusic phrase)

Sing (*A Short Story*) and show the phrase
Sing inside inner hearing and show the phrase
Sing (syllable and name of pitch or lalala). Student can choose
Sing and clapping the rhythm
Sing and stepping.
Can you imagine piano?
Let's **play the piano** together! (air piano)

Goal*: transfer of previous phrase experience to the 4 phrases of A Short Story-length in relation to the rhythmic values in each phrase-Pre-reflective stage* [18]

Conclusion

What did you learn today? Anybody tell me?

Song "Good bye song"

[17] Nuance relates to the gradation of loud and soft and its effects on speed (acceleration and ritardando) (Moore, 1992)

[18] **Pre-reflective**: the 1st of a 3-part stage of acquiring skills and understanding through doing and 'understanding' through the body (see Juntunen, 2004) Second stage: reflective (providing a meaning within a context) and third stage: conceptual (attaching a symbol towards literacy)

Let's sing together
Good bye Good bye Good bye Good bye
Good bye Good bye Good bye Good bye Good bye
High five with the teacher

***Goal**: Review and verbalize concepts of phrase exploration and phrase lengths-reflective stage*[19]

Second Lesson for Old Students May 25, 2019

Materials: piano, elastic band, name tag
Students have to wear comfortable clothes and grip socks (or bare foot)

Warming up Tapping the knee
Teacher gives musical signal; students change and tap the other part of their body.
Walk and change the direction by teacher's musical signal

***Goal:** Warming up the body and reaction to various signals*

"Hello song"
Can you stand in semi-circle near the piano?
Listen!
Hello Hello How are you?
Hello Hello Happy music time.
Let's sing together.

***Goal**: This warmup exercise is to get to know students, bring students into their bodies and voices*

Preparation
Students walk and teacher chose one of the students' walk.
We are not fish

***Goal**: Experience in space management*

Locomotor skills: **teacher's improvisation** with different kind of phrase and nuance.
Now music will tell you how you move.
Can you show me how music moves?

Teacher's instruction
Be careful not to bump with your friend!

[19] Pre-reflective: the 1st of a 3-part stage of acquiring skills and understanding through doing and 'understanding' through the body (see Juntunen, 2004) Second stage**: reflective** (providing a meaning within a context) and third stage: conceptual (attaching a symbol towards literacy)

Don't touch friend's body!

Teacher's improvisation

Walk-gallop-walk-run-walk-gallop-slow walk.

***Goal**: reaction exercise. Students experience how various speeds and dynamic ranges influence quality of movement with improvised music through movement*

Main exercise

Draw the rainbow-Phrases of *A Short Story*

Common phrase -Short phrase (2 note slur) -Long phrase -Common phrase- Long phrase

Drawing rainbow and making the sound properly[20].
Teacher plays the piano and students draw the rainbow.
Teacher shows *A Short Story*'s each of phrases on the board.
One student draws phrases and the other students sing at the same time.
Teacher gives the score to students[21]
Students draw phrases on the score and sing at same time-check this

***Goal:** Experiencing various phrase lengths and then exploring more specifically the 4 phrases from A Short Story with movement, solfège and using the score*

Movement with an elastic band for phrase exploration

Make a circle with a teacher.
Give students an elastic band.
Students explore a little bit with a elastic band.

Can we go backward?

Can we come back to the circle?

Teacher goes to the piano and play.

Music will tell you when you go backward.

They will try one after the other.
Teacher gives number to students.

Can you tell me your number?

When I say your number, you can move.
Teacher goes to piano and plays (gradually integrating A *A Short Story*, with variations) with dynamics, long and short phrase, anacrusic phrase.
Teacher shows various way to move with a elastic band.

[20] « properly » refers to the making sounds that "match" the quality of movement with pitches in the score

[21] Pre-reflective: the 1st of a 3-part stage of acquiring skills and understanding through doing and 'understanding' through the body (see Juntunen, 2004) Second stage: reflective (providing a meaning within a context) and third stage: **conceptual** (attaching a symbol towards literacy)

Goal: *Movement-based experience of various phrase lengths with a A Short Story and improvised music*

Conclusion

What did you learn today? Anybody tell me?
What is rainbow in music?

Discuss about the phrase: lengths, form[22] and feelings (happy, sad, images), relation to sentence structure

Listen! "Good bye song"

Let's sing together
Good bye Good bye Good bye Good bye
Good bye Good bye Good bye Good bye Good bye

Third Lesson for Old Students May 26, 2019

Materials: piano, ball, hand drum, rhythm stick, name tag
Students have to wear comfortable clothes and grip socks(or bare foot)

Warming up "Hello song"

Can you stand in semi-circle near the piano?
Listen

Song
Hello Hello How are you?
Hello Hello Happy music time.
Let's sing together.
Make a circle
Go forward 4 steps and go backward 4 steps

Experience Interrupted canon

Introduce own name with 4 beats and the others repeat
Interrupted canon with clapping and make a sound
Experience various sound
Improvisation

Goals*: These warmup exercises are to get to know students, bring students into their bodies and voices with more complex challenges built from previous 2 classes. Focus: disassociation, cooperation*

Preparation

Locomotor skills: **teacher's improvisation** with different kind of phrase and nuance.

[22] Relates to the arch quality of the phrases, including that an anacrusic phrase begins with a "preparation"

Now music will tell you how you move.
Can you show me how music moves?
Teacher gives musical signal students change the direction.
Teacher plays various types music
Teacher asks students how do you feel?

Movements explored: Walk-gallop-walk-run-walk-gallop-slow walk.

Goa*l: Experience in space management, reaction to various types of music through various movements and quality of movements*

Main exercise- Pass the ball by Anacrusic phrase

Make a circle.
Put the ball in their left hand.
Each one has a ball.
Let's bounce the ball.
Teacher plays music for bouncing.
We can also pass the ball by Anacrusic phrase.
Bounce-pass-bounce-pass-bounce-pass

Goal*: Keeping an equal tempo within a phrase*

When you hear "A A Short Story", you draw rainbow with your ball.
Teacher shows all of *A Short Story* phrases on the board
Bounce-pass-draw-bounce-draw-pass-bounce-pass
Can you clap for left hand?
Can you clap for right hand?
Teacher vs Students.
Two by two.
Play song with hand drum and rhythm stick.
Teacher and students experience together with one group doing melody rhythm, the other on left hand eight note subdivisions
Can you imagine playing the piano on your lap?
*Let's play **"A A Short Story"** but we don't sing(Inner Hearing).*

Goal: *Experiencing the rhythmic values of A Short Story with the expected dynamics and nuance of the 4 phrases within a regular pulse*

Conclusion
What did you learn today? Anybody tell me?

Listen! "Good bye song"

Let's sing together
Good bye Good bye Good bye Good bye
Good bye Good bye Good bye Good bye Good bye

Appendix J

Dalcroze Lessons for *Lightly Row*

The Dalcroze teacher prepared the lessons before the interventions and then reviewed the videos of the lessons. The following is the teacher's revised lesson plans with annotations from the researcher (in squared boxes). All activities relating directly with *Lightly Row* explored the following qualities of the phrase: long and short phrases, phrase arch, beginning and ending of phrases and the dynamic differences between the two short phrases. One variation in tempo was explicitly explored: rit. at the end of phrase 4. Articulation variations were explored with phrase changes and smooth sound production was explored with contrasts.

First Lesson for Young Students May 24, 2019
Materials: piano, finger cymbal, name tag
Students have to wear comfortable clothes and grip socks (or bare foot)
Warming up "Hello song"

Can you stand in semi-circle near the piano?
Listen

Song
Hello Hello How are you?
Hello Hello Happy music time.

Sing with hand gesture (pointing the pitch)
Teacher chose one of student's body gesture and repeat it and sing at same time.
Introducing all of students' name

What's your name? My name is Jihye.
What is her name? Everybody can you repeat? Her name is Jihye.

Preparation
Locomotor skills: teacher's improvisation with different length of phrase and nuance.

Now we are going to music land, so music will tell you how you move.
Can you show me how music moves?

Teacher's instruction

Be careful not to bump with your friend!
Don't touch friend's body!

Teacher's improvisation: Go and stop, various locomotor movements in space: Walk-gallop-walk-run-walk-gallop-slow walk.

Goal: *Reacting to various types of improvised music through movement*

Exploring the finger cymbal
Back in a circle, sitting down
Teacher plays finger cymbal

Let's listen!
Can you show me the duration of the sound?
Can you use you're the other part of your body? (arm, leg, head at so on)
If you don't have the sound, you cannot move.

Students analyzing the sound of the finger cymbal.

Goal: *exploration of note length from beginning to end of sound*

Main exercise: Painting by vocal sound
Showing the pitch length with voice and physically (phrase arch)

We are going to paint together. Did you see?
How can you paint? Can you show me?
Let's paint together.

Teacher's improvisation with dynamics and nuance.

Good job!
If you paint long and large frame, how can you do that?
Can you show me?

Painting by phrase (with dynamics and nuance)

Teacher's improvisation with dynamics and nuance.
You can use more space.

Goal: *exploring various phrases through space and movement by changing directions*

Gradually interact **Lightly Row**(long and short phrase)

Do you know this song?
Let's sing with lalala!

Teacher sing **Lightly Row**
Circle activity

Let's sing with name of the pitch! Sol-mi-mi
Can you clap the rhythm of Lightly Row?

Movement activity

Can you step the rhythm of Lightly Row? (change the direction at the beginning of phrase)

Circle Activity

Can you imagine piano?
*Let's **play the piano** together! (air piano)*
Which finger is first? play only right hand, left hand and both hands (if you can)
Can you say the finger number?
533,422,1234555

533342221355333
2222234
3333345
533342221355333.
Can you sing and play air piano? with teacher's music.

***Goal**: Explore the melody of Lightly Row with fingerings in various ways while singing*

Play various types music (change tempo, articulation, dynamics, and etc)

Music tells you how to dance

***Goal:** Reacting to various types of music through movement. Exploration of space, energy and quality of various movements with improvised music.*

Conclusion

Students come together to say goodbye and "see you tomorrow"

Listen!

Song

"Good bye song"

Goal: Connect with students and wrap up.

Second Lesson for Young students May 25, 2019

Materials: piano, white board maker (or chalk depends on the board)
for each students: green round foothold, "Lightly Row" score, hand drum, name tag
Students have to wear comfortable clothes and grip socks (or bare foot)

Warming up
Explore a Lollipop drum
Play the drum various ways
Experience interrupted canon
"Hello song"

Let's sing with play the drum

Song
Hello Hello How are you?
Hello Hello Happy music time.

***Goal**: Explore various textures of hitting the drum/dynamics with reactions to the teacher's musical signals*

Introducing all of students' name

What's your name? My name is Jihye.

What is her name? Everybody can you repeat? Her name is Jihye.
Various levels of pitch demonstrated with singing and accompanied with hand gestures

Goal: *Warming up body, voice through appropriate reactions to singing*

Preparation

We are going to the music land.
Can you become a fish or a turtle?

React to improvised music by being a fish (on feet-flowing) or turtle (on the ground-chordal and slow) in the ocean through movement in space. Stopping when music stops

Follow the teacher (Demonstration with students)-following cues and beginning and stopping

Locomotor skills: **teacher's improvisation** with different length of phrase and nuance.

Now music will tell you how you move.
Can you show me how music moves?

Teacher's improvisation
Addition of skipping and spin
fish-turtle-fish-turtle-skip-turtle-skip-walk-run-turtle-spin

Goal: Preparing students to react to various qualities of sound with their bodies.

Come back to song.: interact "Lightly Row" Children sing and teacher shows the phrase arches, changing directions for each phrase

Sing the "Lightly Row"
Draw the rainbow

Draw various rainbow with sounds
Draw the rainbow with "Lightly Row"
Sing "Lightly Row" and express each of phrases
Student sing "Lightly Row" and the other students draw phrases.
Step the Lightly Row" rhythm with sing, when music starts new phrase, change the direction.
Step and draw rainbow with scalar passages in space-long and short

Goal*: Explore the quality and height of phrase arch for 4 phrases of Lightly Row-long and short phrases*

Plastique animée

Can you hold friend's hand?
Let's go to right side!

<u>song</u>

Sol-mi-mi, fa-re-re, do-re-mi-fa-sol-sol-sol (right)
Sol-mi-mi-mi-fa-re-re-re-do-mi-sol-sol-mi-mi-mi (left)
re-re-re-re-re-mi-fa (in and soft) mi-mi-mi-mi-mi-fa-sol (out and loud)
Sol-mi-mi-mi-fa-re-re-re-do-mi-sol-sol-mi-mi-mi (free movement)
What do you want to do at last phrase?
you can move freely, but you have to come back to circle at finish.

Goal: *explore the beginning and ending of phrases by changing directions or movement. Dynamics of phrase 3-two short phrases*

Main exercise
Return to home by end of phrase
Teacher gives a foothold to each of students. "Here is your home."
Individual activity
You can go, but you have to return to home at the end of phrase

Teacher draws *Lightly Row* phrases on the board
How many Phrases do you see?

Goal: *phrasing, towards, conceptualization of phrasing*

Group activity
A student goes to the B's home and B can go to the other's home by phrase
Teacher gives score to students
Paint phrases on the score while singing
How many rainbows did you find in the score?
Can you imagine playing the piano?
Teacher plays piano musically, and same time students can play air piano the melody of *Lightly Row*
Conclusion
Goodbye song

Third Lesson for Young students May 26, 2019
Materials: piano, white board maker (or chalk depends on the board)
for each students: "Lightly Row" score, name tag
Students have to wear comfortable clothes and grip socks (or bare foot)
Warming up
While the teacher counts 1 to 8, students make a circle.

"Hello song"
Can you stand in semi-circle near the piano?
Let's sing with me.
Song
Hello Hello How are you?

Hello Hello Happy music time.

Make a circle and stand up

When teacher sings Pentatonic descending and ascending, students move up and down in a circle, holding hands
Experiencing Interrupted canon with voice
Using name motive
Exploring drum
Interrupted canon
Teacher gives drum to students
Play the drum musically
Play the drum various way(articulation, rhythm, dynamic)
A student plays own improvisation and the other students repeat after A student

***Goal**: Warmup body and voice for movement activities-particularly crescendo and decrescendo*

Preparation

Locomotor skills: **teacher's improvisation** with different lengths of phrase and nuance.

Now music will tell you how you move.
Can you show me how music moves?

Listen to musical cue to change directions

Teacher's instruction

Be careful not to bump with your friend!
Don't touch friend's body!

Teacher's improvisation

Walk-gallop-walk-run-hop-walk-gallop-slow walk-walk-hop

Listen to musical cues to change directions and quality of movements
Come back to song.: interact "Lightly Row"

Quick reaction game with dynamics

Can you clap the "Lightly Row"?
Teacher gives vocal signal and musical signal to students.
Clap-step-clap-both by phrase.
Students sing a song without sound (inner-hearing).

***Goal:** Integration of phrase lengths with students*

Main exercise

Being a statue.
Teacher tells a A Short Story to students.
Teacher gives musical signal students change the direction
A sunny day we went to the park.
There were various status.

A rabbit statue, a ballerina statue and a robot statue.
Have you seen a statue?
Rabbit statue
Horse statue
Ballerina statue
Mario statue
When they heard sound, they could move, but when they didn't hear sound, they could not move.
Could you be a statue? being a statue (individual movement)

Students move and stop (become a statue) by teacher's improvisation.
Gradually interact "*Lightly Row"*
Lightly Row quick reaction game with hand and feet
By teacher's vocal signal
Bouncing the ball-on the strong beat
Say bounce –catch and movement at same time
when you hear *Lightly* Row", can you draw the rainbow?

Goal: Quick reaction to legato sound of *Lightly* Row (Rainbow) in contrast to strong rhythmic music (bouncing the ball)

Dynamics quick reaction game: grand butterfly and baby butterfly

Goal: *quick reaction to loud and soft: variations of loud and soft for the long phrases. 2 small phrases are first soft and then loud*

Listen and discussion (dim. and rit.)

Goal*: the rit. at the end of the song*

Can you imagine playing the piano on your lap?
Let's play **"Lightly Row"** but we don't sing.
Teacher plays piano musically, and at the same time students play without sing.

Appendix K

Comparative Chart of the in-score musical events with correlational Dalcroze rules, MIDI parameters, Dalcroze lesson and expected results for *A Short Story*

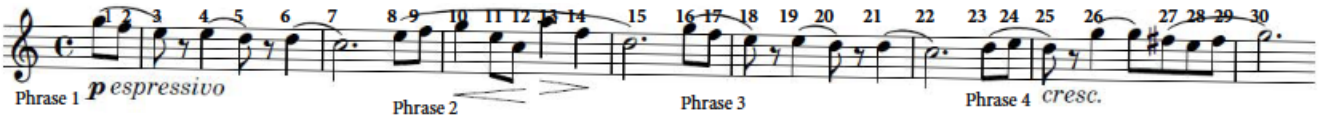


Figure 1. Excerpt from *A Short Story* illustrating the section of the musical score that was analysed.

Musical Phrase	**Analysis**	**MIDI-generated musical parameter**	**Dalcroze lesson Exercise (Appendix __)**	**Related Dalcroze Rule (Appendix A)**	**Expected results for MIDI**
Phrases 1 & 3	The large musical phrase from the one-beat anacrusis to the end of the phrase Notes 1-7 Notes 16-22 The structure of phrases 1 & 3 is based on 3 2-note slurs with eighth notes dividing each slur.	**Amplitude** (dynamics) readings from the mean score of all notes to measure the dynamic range of the 3 slurs	**Lesson 1: Main exercise-painting by sound** **Lesson 2: Main exercise-draw the Rainbow, elastic band exercise** **Lesson 3: Main exercise, Ball exercise**	**1st rule of nuance:** Every descending melody ought to be sung (with exception) in a *decrescendo*, a decrease in sonority for each note. The descending scale ought to be sung with a *decrescendo*.	The overall dynamics level of the larger phrase should go down.
Phrases 1 & 3	The large musical phrase from the one-beat anacrusis to the end of the phrase Notes 1-7 Notes 16-22 The structure of phrases 1 & 3 is based on 3 2-note slurs with eighth notes dividing each slur.	**Timing:** Mean score measurements of timing between the 3 slurs within phrase 1 & 3	**Lesson 1: Preparation: exploring finger cymbals, Main exercise (Gradually integrate A Short Story segment)** **Lesson 2: Warming up Main exercise-Draw the Rainbow & Elastic Band** **Lesson 3: Interrupted canon Pass the ball**	**Dalcroze principle of Timing**: A distinction should be made between the "notated timing" and the "actual timing" Dalcroze believed that: "tempo should be in a constant state of rubato" (Moore, p. 171). All rules pertaining to manipulation of timing relate to breath and movement. Choices in timing are related to context and to rules of nuance. (dynamics)	When the melodic line goes down, a slight decreasing tempo concurrently with decreased pitch sequences should occur.

Musical Phrase	Analysis	MIDI-generated musical parameter	Dalcroze lesson Exercise (Appendix __)	Related Dalcroze Rule (Appendix A)	Expected results for MIDI
Between phrases	The end of one phrase and the beginning of the next phrase occurs in the score between: Notes 7- 8 Notes 15- 16 Notes 22 -23	**KDT (Key detached time)** Evidence of letting go of the notes between each large phrase	**Lesson 1: Main lesson: sing and stepping, changing directions** **Lesson 2: Main lesson: draw the rainbow with movement through space and changing directions, with chalk on board, with the voice and on individual scores with fingers and pencils** **Lesson 3: Main lesson: draw phrase with ball and change directions when phrase changes, as a group and individually**	**3rd rule of phrasing:** "A breath should precede and follow all notes sung after the end of a period or melodic phrase and those whose only goal is to complete the measure"	If lifts occur between two large musical phrases, they should be heard.
Phrase 2	The large musical phrase from the one-beat anacrusis (notes 8-9) to note 15	**Amplitude:** (dynamics) readings from the mean score of notes 8-15 to measure the dynamic range of the phrase arch Notes were grouped by ascending or descending movement for measurement: notes 8-13 notes 13-15 Note 13 would be the strongest note	**Lesson 1: Main exercise-painting by sound** **Lesson 2: Main exercise-draw the Rainbow, elastic band exercise** **Lesson 3: Main exercise, Ball exercise**	**1st rule of nuance:** Every ascending melody ought to be sung (with exception) in a *crescendo*, an increase in sonority for each note. Every descending melody ought to be sung (with exception) in a *decrescendo*, a decrease in sonority for each note. The descending scale ought to be sung with a *decrescendo*. Accentuation Rule 5: The highest note of a descending rhythmic group ought to be strongly accented even if it occurs on a weak beat.	The overall dynamic levels of the larger phrase should go up to the highest pitch and then go down to the last pitch The amplitude of the highest pitch will have the highest amplitude score in comparison to all other notes of the second large musical phrase.

Musical Phrase	Analysis	MIDI-generated musical parameter	Dalcroze lesson Exercise (Appendix __)	Related Dalcroze Rule (Appendix A)	Expected results for MIDI
Phrase 2	The large musical phrase from the one-beat anacrusis (notes 8-9) to note 15	**Timing:** readings from the mean score of notes 8-15 to measure the timing between each note	**Lesson 1: Preparation: exploring finger cymbals, Main exercise (Gradually integrate segment)** **Lesson 2: Warming up Main exercise- Draw the Rainbow & Elastic Band** **Lesson 3: Interrupted canon Pass the ball**	**Dalcroze principle of Timing**: A distinction should be made between the "notated timing" and the "actual timing" Dalcroze believed that: "tempo should be in a constant state of rubato" (Moore, p. 171). All rules pertaining to manipulation of timing relate to breath and movement. Choices in timing are related to context and to rules of nuance. (dynamics)	When the melodic line goes up, a slight increase in tempo should occur. The highest pitch of the of the phrase should have a longer mean score When the melodic line goes down, a slight decrease in tempo should occur.
Phrase 4	The large musical phrase from the one-beat anacrusis to the end of the phrase Notes 23-30	**Amplitude:** (dynamics) readings from the mean score of notes 23-30 to measure the dynamic range of the phrase arch Notes were grouped into 2 events and in accordance with composer's markings notes 23-26 notes 26-30	**Lesson 1: Main exercise-painting by sound** **Lesson 2: Main exercise-draw the Rainbow, elastic band exercise** **Lesson 3: Main exercise, Ball exercise**	**1st rule of nuance:** Every ascending melody ought to be sung (with exception) in a *crescendo*, an increase in sonority for each note. Every descending melody ought to be sung (with exception) in a *decrescendo*, a decrease in sonority for each note. The descending scale ought to be sung with a *decrescendo*. Accentuation Rule 5: The highest note of a descending rhythmic group ought to be strongly accented even if it occurs on a weak beat. **2nd rule of phrasing** Every final note loses some of its sonority, except when it is the final note of a crescendo	An amplitude increase is expected between notes 23-25 to note 26 A crescendo is expected towards note 30.
Phrase 4	The large musical phrase from the one-beat anacrusis to the	**Timing:** readings from the mean score of notes 23-30 to measure the	**Lesson 1: Preparation: exploring finger cymbals, Main exercise**	**Dalcroze principle of Timing**: A distinction should be made	The two highest pitches of the of the phrase should have a longer mean scores

Musical Phrase	Analysis	MIDI-generated musical parameter	Dalcroze lesson Exercise (Appendix __)	Related Dalcroze Rule (Appendix A)	Expected results for MIDI
	end of the phrase-Notes 23-30	timing between each note	**(Gradually integrate A Short Story segment)** **Lesson 2: Warming up Main exercise- Draw the Rainbow & Elastic Band** **Lesson 3: Interrupted canon Pass the ball**	between the "notated timing" and the "actual timing" Dalcroze believed that: "tempo should be in a constant state of rubato" (Moore, p. 171). All rules pertaining to manipulation of timing relate to breath and movement. Choices in timing are related to context and to rules of nuance. (dynamics)	because of their rhythmic values and because of The tempo would be steady in this phrase[23]

[23] "If a person were to walk at a normal pace where each step was symbolized by a quarter note, a certain degree of space would be covered by each step. The person could maintain the same tempo or rate of speed for each quarter note but take larger steps requiring more force" (Moore, p. 80)

Appendix L

Comparative Chart of the in-score musical events with correlational Dalcroze rules, MIDI parameters, Dalcroze lesson and expected results for Lightly Row

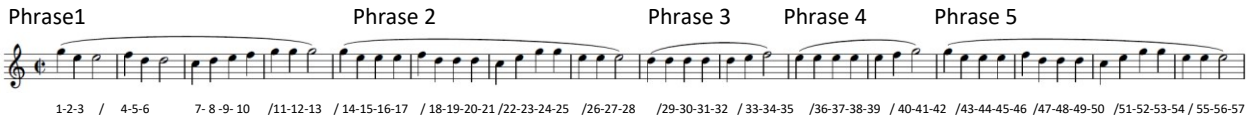


Figure 2. Excerpt from Lightly Row illustrating the section of the musical score that was analysed.

Phrase	**Analysis**	**MIDI-generated musical parameter**	**Dalcroze lesson Exercise (Appendix L)**	**Related Dalcroze Rule/principle (Appendix A)**	**Expected results for MIDI**
Phrase 1	The crescendo between notes 7 and 11.	**Amplitude:** (Dynamics) Comparing the raw MIDI velocity numbers	**Lesson 1:** Preparation (cymbals-phrase arch), Main exercise : painting by phrase teacher's improvisation (improv-dynamics large and small frames) **Lesson 2**: Teacher's improv: various rainbow drawings-height of phrases, Scalar passages Main exercise: returning home **Lesson 3 :** Warm up, Preparation and main lesson **:** quick reaction game, (rainbow)	**1st rule of nuance:** "The ascending scale ought to be sung with a crescendo….every descending melody ought to be sung (with exception) in a *decrescendo*, a decrease in sonority for each note. The descending scale ought to be sung with a *decrescendo*.	Notes 1-6 would be expected to maintain the same dynamic range. A crescendo would be expected between notes 7 and 11.
Phrase 1	The large musical phrase from notes 1 to 13. The structure of the phrase is built on two parts: Notes 1-6 Notes 7-13	**Timing:** Timing mean score measurements of timing between all notes in phrase 1.	The tempo remained consistent for phrase 1 in all activities, in all 3 lessons, when Lightly Row was sung, played and done through movement	**Dalcroze principle of Timing**: A distinction should be made between the "notated timing" and the "actual timing" Dalcroze believed that: "tempo should be in a constant state of rubato" (Moore, p. 171). All rules pertaining to manipulation of timing relate to breath and movement. Choices in timing are related to context and to	Notes 1-13 should have a consistent speed

Phrase	Analysis	MIDI-generated musical parameter	Dalcroze lesson Exercise (Appendix L)	Related Dalcroze Rule/principle (Appendix A)	Expected results for MIDI
				rules of nuance. (dynamics)[24]	
Change of phrase 1-2, 2-3, 3-4, 4-5	**T**he end of one phrase and the beginning of the next phrase occurs in the score between notes 13-14, 28-**29, 35-36, 42-43**	**KDT**: (Key detached time). Evidence of letting go of the notes between each large phrase	**Lesson 1**: Main exercise (painting), Painting by vocal sounds, Circle exercise, **Lesson 2**: preparation, plastique, main exercise Lesson 3: Preparation, Main lesson	**3rd rule of phrasing:** "A breath should precede and follow all notes sung after the end of a period or melodic phrase and those whose only goal is to complete the measure"	If lifts occur between two large musical phrases, they should be heard.
Phrase 2 and Phrase 5	-The crescendo between notes 22 and 24 and the decrescendo between notes 25 and 28 -The crescendo between notes 51 and 53 and the decrescendo between notes 54 and 57	**Amplitude:** (Dynamics) Comparing the raw MIDI velocity numbers	**Lesson 1:** Preparation (cymbals-phrase arch), Main exercise : painting by phrase teacher's improvisation (improv-dynamics large and small frames) **Lesson 2**: Teacher's improv: various rainbow drawings-height of phrases Main exercise: returning home, Scalar passages **Lesson 3 :** Warm up, Preparation and main lesson **:** quick reaction game, (rainbow)	1st rule of nuance: "The ascending scale ought to be sung with a crescendo….every descending melody ought to be sung (with exception) in a *decrescendo*, a decrease in sonority for each note. The descending scale ought to be sung with a *decrescendo*. **Second Rule of Phrasing** Every final note of either a rhythm, a period, or a phrase is followed by a rest, breath, or a halt. Every final note loses some of its sonority except when it is the final note of a crescendo.	A crescendo would be expected between notes 22-24 and a decrescendo would be expected between notes 25 and 28. A crescendo would be expected between notes 51 and 53 and the decrescendo between notes 54 and 57
Phrase 2	The large musical phrase from notes 14-28. The structure of the phrase is built on two parts: Notes 14-21 Notes 22-26	**Timing:** Timing mean score measurements of timing between all notes in phrase 2.	The tempo remained consistent for phrase 2 in all activities, in all 3 lessons, when *Lightly Row* was sung, played and done through movement	**Dalcroze principle of Timing**: A distinction should be made between the "notated timing" and the "actual timing" Dalcroze believed that: "tempo should be in a constant state of rubato" (Moore, p. 171). All rules pertaining to manipulation of timing relate to	Notes 14- 28 should have a consistent speed

[24] "The person could maintain the same tempo or rate of speed for each quarter note but take larger steps requiring more force" (p. 80. Moore)

Phrase	Analysis	MIDI-generated musical parameter	Dalcroze lesson Exercise (Appendix L)	Related Dalcroze Rule/principle (Appendix A)	Expected results for MIDI
				breath and movement. Choices in timing are related to context and to rules of nuance. (dynamics)	
Phrase 3	The short musical phrase from notes 29-35	**Amplitude:** (Dynamics) Comparing the raw MIDI velocity numbers	**Lesson 1:** Preparation (cymbals-phrase arch), Main exercise : painting by phrase teacher's improvisation (improv-dynamics large and small frames) **Lesson 2**: Exploration of the lollipop drum-interrupted canon-especially short phrases relating to P3 an dP4 Teacher's improv: various rainbow drawings-height of phrases Main exercise: returning home **Lesson 3 :** Warm up-pentatonic scale-move up and down Preparation and main lesson **:** quick reaction game, (rainbow) -drawing on board the lengths of the phrases in LR	**1st rule of nuance:** "The ascending scale ought to be sung with a crescendo….every descending melody ought to be sung (with exception) in a *decrescendo*, a decrease in sonority for each note. The descending scale ought to be sung with a *decrescendo.* **4th rule of nuance** When the same note is sung several times, its repetition ought to be accompanied by a crescendo	A crescendo would be expected between notes 29-35
Phrase 3	The short musical phrase from notes 29-35.	**Timing:** Timing mean score measurements of timing between all notes in phrase 3.	The tempo remained consistent for phrase 3 in all activities, in all 3 lessons, when *Lightly Row* was sung, played and done through movement	**Dalcroze principle of Timing**: A distinction should be made between the "notated timing" and the "actual timing" Dalcroze believed that: "tempo should be in a constant state of rubato" (Moore, p. 171). All rules pertaining to manipulation of timing relate to breath and movement. Choices in timing are related	Notes 29-35 should have a consistent speed

Phrase	Analysis	MIDI-generated musical parameter	Dalcroze lesson Exercise (Appendix L)	Related Dalcroze Rule/principle (Appendix A)	Expected results for MIDI
				to context and to rules of nuance. (dynamics)	
Phrase 4	The short musical phrase from notes 36-42.	**Amplitude:** (Dynamics) Comparing the raw MIDI velocity numbers	**Lesson 1:** Preparation (cymbals-phrase arch), Main exercise : painting by phrase teacher's improvisation (improv-dynamics large and small frames) **Lesson 2**: Exploration of the lollipop drum-interrupted canon-especially short phrases relating to P3 an dP4 Teacher's improv: various rainbow drawings-height of phrases Main exercise: returning home **Lesson 3 :** Warm up-pentatonic scale-move up and down Preparation and main lesson **:** quick reaction game, (rainbow) -drawing on board the lengths of the phrases in LR	**1st rule of nuance:** Every descending melody ought to be sung (with exception) in a *decrescendo*, a decrease in sonority for each note. The descending scale ought to be sung with a *decrescendo*. **4th rule of nuance** When the same note is sung several times, its repetition ought to be accompanied by a crescendo	A crescendo would be expected between notes 36-42
Phrase 4	The short musical phrase from notes 36-42.	**Timing:** Timing mean score measurements of timing between all notes in phrase 4	The tempo remained consistent for phrase4 in all activities, in all 3 lessons, when *Lightly Row* was sung, played and done through movement	**Dalcroze principle of Timing**: A distinction should be made between the "notated timing" and the "actual timing" Dalcroze believed that: "tempo should be in a constant state of rubato" (Moore, p. 171). All rules pertaining to manipulation of timing relate to breath and movement. Choices in timing are related to context and to rules of nuance. (dynamics)	Notes 36-42 should have a consistent speed