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The Effects Of Learning By Rote With La-Based Minor Solmization On Memory Retention For Pre-College Piano Students

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THE EFFECTS OF LEARNING BY ROTE WITH *LA*-BASED MINOR SOLMIZATION ON MEMORY RETENTION FOR PRE-COLLEGE PIANO STUDENTS

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DEDICATION

For the students.

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ABSTRACT

The purpose of this study was to measure the accuracy and memorized outcome of subjects' performance who learned a piano piece by rote using *la*-based minor solmization compared to subjects who learned the identical piece using an intervallic reading approach with identified landmark notes. Ten pre-college piano students above nine years of age at the intermediate level and above participated in this quantitative quasi-experimental study. Five subjects, n=5, received the independent treatment (rote with *la*-based minor solmization), and the other five subjects, n=5, received the dependent treatment (intervallic reading approach with identified landmark notes). During the timespan of a three-week treatment period, the subjects learned a specified repertoire piece. The control subjects applied conventional reading approaches while the experimental group applied a rote approach with *la*-based solmization.

The Mann-Whitney U test was used to analyze the results, $p > 0.05$, suggesting that no statistical difference between the control and experimental groups existed. The research helped in ascertaining if learning by rote with a *la*-based minor solmization system aids memory retention and improves the musicality of a performance. Memorization was utilized as a measuring tool to assess the subjects' retention and confirmation of musical content. Memory criteria measured were note accuracy, rhythm accuracy, fingering, and fluency. Performance musicality was measured by rating the level of expressivity.

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INTRODUCTION

AUDIATION AT THE PIANO

Music learning theory, a music education learning model developed by Dr. Edwin E. Gordon, is an "explanation of how we learn music".[1] According to Gordon, everyone is born with music aptitude. Gordon believed music was best learned through a sequential process. The purpose of this process is to develop audiation. Audiation is the "hearing and comprehending in one's mind sound of music not, or may never have been, physically present".[2] Gordon states "although individual differences are manifest in the extent each student achieves in music, all students follow the same process when learning music appropriately. Thus, music learning theory outlines a process for learning music by explaining what students need to know at a particular level of learning to proceed sequentially in stepwise and bridging movement to more advanced levels."[3] Each level is necessary preparation for progression into the next.[4] According to Gordon, there are two general ways we learn music: discrimination learning and inference learning. Discrimination learning has five sublevels: aural/oral, verbal association, partial synthesis, symbolic association, and composite synthesis. At the aural/oral sublevel, listening to music is the aural process and performing music is the oral process.[5] At this

[1] Edwin Gordon, *Learning Sequences in Music* (Chicago: GIA, 2012), 25.
[2] Ibid., 389.
[3] Ibid., 25.
[4] Ibid., 26.
[5] Ibid., 79.

level, students begin to audiate and give internal meaning to content.[6] At the verbal association level, pitches and note duration are labeled using solmization and rhythm syllables. At the partial synthesis level, students are able to comprehend individual patterns of notes into a series of patterns. At the symbolic association level, students are taught to read and write familiar tonal and rhythm patterns. At the composite synthesis level, students read music in context and comprehension.[7] In inference learning, students are guided by the teacher to learn skills and tonal and rhythm patterns by teaching themselves.[8]

Current mainstream instructional piano series authors use a different learning sequence order that begins with reading before acquiring the appropriate aural readiness recommended by Gordon. These mainstream instructional piano series books emphasize reading using one or more of the following: pre-staff notation, landmark notes, and intervallic reading. Several, use pre-staff notation such as *The Music Tree,* and several, use an intervallic approach such as *Music Pathways*. *Piano Adventures* features pre-staff notation, intervallic reading, modified middle-C reading approach, and mnemonic devices. *The Music Tree* emphasizes intervallic reading approach with identified landmark notes.

The forementioned instructional piano series do not include audiation exercises. Any aural skills training that occurs in mainstream piano instruction series is typically included in supplementary books such as notespellers, theory, etc. Typically, piano method book authors begin with students reading on pre-staff notation- music written

[6] Ibid., 103.
[7] Ibid., 126.
[8] Ibid., 398.

without the lines and spaces of the music staff. Symbolic notation in preparation for reading standard piano music notation is visually oriented and is not based on sequential development of audiation.[9] In the intervallic reading approach, a single staff line is introduced to indicate a note stepping up or down an interval of a second. Next, two lines on the staff may be indicated to show skipped notes interval of a third. This gradual progression of adding staves will encourage students to eventually read notes on the grand staff. It is left up to the teacher as to whether audiation or solmization exercises are to be taught. Notable exceptions include *Music Moves for Piano* Series by Marilyn Lowe and the Yamaha Music Education System. These instructional series include more solmization than the average current mainstream piano methods.

According to Gordon, "Students learn two instruments: their audiation instrument and their actual music instrument. To make satisfactory progress in instrumental music, they first learn their audiation instrument as readiness for learning to play an actual music instrument."[10] The piano, or any other music instrument, is an external and secondary instrument of choice. The primary instrument musicians must develop is their audiation. Audiation is an internal skill that may be cultivated externally through singing before using an external secondary instrument. Singing while assigning solmization syllables to pitches is a tool to help develop musicians to internalize and memorize music.

[9] Seo-Kyung Ha, *Applications of Music Learning Theory to Beginning Piano Instruction* (Doctoral Dissertation, University of South Carolina, 2000), 3.

[10] Gordon, *Learning Sequences in Music*, 290.

CHAPTER ONE

SOLMIZATION ORIGINS AND SYSTEMS, PARTS OF THE STUDY, AND RELATED LITERATURE

1.1. Middle Ages

Solmization is the method of labeling pitches with mnemonic devices. A solmization system is not notation but rather, a method of aural rather than visual recognition.[11] The most common syllables used by Western cultures today are *do*, *re*, *mi*, *fa*, *sol*, *la*, and *si* (or *ti*) and derived from the Guidonian system attributed to Guido d'Arezzo.[12] In Middle Ages monastaries, the Guidonian system was used as a sight singing teaching aid. The Guidonian system used the syllables *ut*, *re*, *mi*, *fa*, *sol*, and *la* to indicate functional pitch rather than absolute pitch or fixed-*do*. [13] The most important feature of the Guidonian system was the consistent semitone located between *mi-fa* while other syllables were measured a whole tone apart.[14] Mutations, a process changing from one hexachord to the next, organized the thought process to pinpoint around an inner orientation.[15] A daily prayer to St. John the Baptist, *Ut Queant Laxis*, was used as the text

[11] Andrew Hughes and Edith Gerson-Kiwi. "Solmization." *Grove Music Online.* Accessed February 24, 2016. http://www.oxfordmusiconline.com.pallas2.tcl.sc.edu/subscriber/article/grove/music/26154?q=solmization&search=quick&source=omo_gmo&pos=1&_start=1#firsthit

[12] Don Michael Randel, *The Harvard Dictionary of Music*, 4th edition (Cambridge, MA: Harvard University Press, 2004): 793.

[13] Hughes and Gerson-Kiwi.

[14] Ibid.

[15] Ibid.

containing the acrostic syllables set to a hymn for teaching purposes formed the hexachord.[16]

Ancient China

Solmization was not purely a European activity or development but should also be recognized to have developments in ancient civilizations in the East. In medieval China during the Song dynasty (960-1279), a new notation called *kung-ch'e p'u*, a song notation that used ancient ideograms as sound symbols, was almost contemporary with the Guidonian system and is still in use to this day.[17] Northern China used a chromatic series of nineteen notes, thus bringing back fixed pitch while Southern China used a more traditional nine diatonic steps, a scheme similar to movable-*do*.[18]

Great Britain

Beginning most notably with Sarah Anna Glover, John Curwen, and John Spencer Curwen in the nineteenth century, solmization has changed considerably.[19] A system also based on movable-*do* was known as the Tonic Sol-fa system widely used in Britain.[20] Glover, Curwen, and Spencer Curwen originally promoted Tonic Sol-fa to aid beginner singers and children. Early practices included drilling random diatonic intervals on a tone ladder or vertical modulator to shape musically independent singers.[21] No staff was used; but rather, bars separated measures, and a system of dots, commas, and dashes

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[16] Ibid.
[17] Ibid.
[18] Ibid.
[19] Ibid.
[20] Ibid.
[21] Bernarr Rainbow and Charles Edwards McGuire, "Tonic Sol-fa." *Grove Music Online*. Accessed March 1, 2016: http://www.oxfordmusiconline.com.pallas2.tcl.sc.edu/subscriber/article/grove/music/28124?q=tonic+sol-fa&search=quick&pos=1&_start=1#firsthit

represented rhythm and meter.[22] It gained rapid popularity in the 1860s and later became the standard notation not only in Great Britain but also in Australia, Canada, America, and South Africa; in later stages, teachers revised the form in Switzerland, Germany, and Denmark.[23] American teachers finally rejected Tonic Sol-fa because the notation was untraditional.[24]

France

Initially there was no contention for fixed and movable-*do* solmization until the late nineteenth century when the French fixed-system, the Galin-Paris-Chevé Method, was introduced to England.[25] Galin-Paris-Chevé Method was based on the figure-notation proposed by Jean-Jacques Rousseau in 1742 and later modified by Pierre Galin, Aimé Paris and his sister Nanine, and her husband Emile Chevé.[26] The main feature of the method was the use of notation of numbers one through seven, with one representing the major tonic. The systems allow for a three-octave range, marking different octaves with dots below or above the numbers. Accidentals are marked with an oblique stroke through the number. Students sang using solmization syllables instead of the numbers. Intonational accuracy was encouraged by using *points d'appui*, "preparatory notes to be

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[22] Michael L. Mark and Charles L. Gary, *A History of American Music Education.* 3rd edition. New York: Rowman & Littlefield Education, 2007, 190.

[23] Charles Plummeridge, "Schools." *Grove Music Online*. Accessed March 1, 2016: http://www.oxfordmusiconline.com.pallas2.tcl.sc.edu/subscriber/article/grove/music/43103

[24] Mark and Gary, 190.

[25] Brown, 2.

[26] Bernarr Rainbow, "Galin-Paris-Chevé." *Grove Music Online*. Accessed March 1, 2016: http://www.oxfordmusiconline.com.pallas2.tcl.sc.edu/subscriber/article/grove/music/10531

thought of, not sung".[27] Later, Zoltan Kodaly's Hungarian approach drew on his country's folksong tradition while combining principles of Curwen, hand signs, and the rhythmic language of the Galin-Paris-Chevé Method.[28]

1.2. Solmization Systems

Fixed-Do or Immovable-Do System Compared to Movable-Do System

In the fixed-*do* or immovable-*do* system, the musical alphabet letter C is always *do*, D is always *re*, E is always *mi*, and so forth. In the movable-*do* system, *do* is always the tonic in the major key and therefore "moves" depending on the key. In the movable-*do* system for minor keys, there are two branches currently used: *la*-based minor, which connects well to relative minor keys, and *do*-based minor, which connects well to parallel minor keys.

Movable- Do System: La-Based Minor VS. Do-Based Minor

The movable-*do* system has two variances when there is a modulation to the minor mode. *Do*-based minor is when tonic remains *do* and the pitches are chromatically altered to account for the change to harmonic minor mode (*mi* becomes *me*, *la* become *le*). *La*-based minor is when the relative key signature is adhered to and *la* is now the new tonic better associating to the relative major key.

1.3. Solmization and Piano Methods

A methodology for beginning piano students that guides the teacher to instruct using a solmization approach is *Music Moves for Piano* by Marilyn Lowe. It utilizes the principles of Dalcroze, Dan Pratt (founder of *Kindermusik*), Kodály, Orff, Suzuki, Taubman, and Gordon (founder of Music Learning Theory) in the piano lesson. *Music*

[27] Ibid.
[28] Plummeridge.

Moves for Piano series helps students learn "sound to notation" in order to guide them to become fluent musical performers. Some of the major concepts in this approach include: internalizing improvisation by using familiar patterns and songs, understanding rhythm through the basis of movement, singing songs and pitches to develop pitch sensitivity and audiation, obtaining a musical vocabulary through listening, and acquiring a deep understanding of rhythm, meter, tonality, harmony, style and form. All of the activities found in the series are designed towards enhancing audiation. From the beginning of lessons, students learn how to audiate the tonal center and understand rhythmic content through the context of meter while developing keyboard performance skills.

Keyboard Games, Books A and B, designed for children ages four to five, teaches students how to audiate and begin to develop their keyboard performance skills. Activities to accomplish these objectives include: singing songs, chanting rhythms, movement activities, improvising, playing short repertoire pieces and call-and-response. The accompaniment CD includes a recording of their performance pieces, tonal and rhythm patterns for students to echo and songs and chants to familiarize the student with a wide-range of musical vocabulary.

A large portion of the *Music Moves for Piano* series introduces keyboard skills and improvisation activities and becomes more complex because the student's audiation skill is now stronger and more advanced. The repertoire becomes increasingly difficult as the student acquires more skills for understanding musical notation. Students are playing on the full range of the piano, including both black and white keys. Many pieces have a complementing teacher accompaniment in the form of duet parts. Creative and

improvisation activities are an integral part of the series. A CD accompaniment for the student's performance pieces is also provided.

Yamaha Music Education System (YMES) is another methodology that focuses on rote learning for the four- and five-year old student during the first two years of music study (Junior Music Course or JMC). JMC curriculum includes singing songs with lyrics, singing solmization, playing keyboard repertoire, rhythm ensembles, keyboard exercises, music appreciation, transposition, and harmonization. New repertoire pieces are taught using the following model: first and foremost, listen, then sing, play, and read. According to YMES, "Children are taught from the inside out, rather than the outside in", [29] meaning that the music is internalized first through listening rather than decoding the score, as is common in traditional reading methodologies.

Fixed-*do* is employed because it reinforces ear training in conjunction with keyboard activities. Students memorize pitches by listening, singing, playing at the keyboard, and finally reading the pitch on the grand staff. A variety of solfège activities are completed at any given lesson. YMES teachers devote fifteen to twenty minutes of a typical hour class to solmization sessions. This emphasis on ear training through solfege singing is based on evidence that the hearing ability of this age group develops most rapidly. By the end of the two-year study, students have built a large vocabulary of solmization through singing and playing through the keys of C Major, G Major, F Major, D Minor, and A minor.

[29] *Parents Take Note: A Parent Education Tool for YMES Teachers & Administrators*, CD-ROM (Yamaha Corporation of America, 2007), 7.

In the JMC curriculum, reading is the final stage. The symbolic representation of the music is presented last, confirming what the student has heard, sung, and played. The aim is to have students naturally absorb music as a language; the approach is continual exposure. Children are expected to read music in "good time" combined with "good guidance."[30] Since students are not expected to read during the early years of music study, sight-reading is not a topic until the third or fourth year of lessons (Junior Extension Course). While JMC curriculum does not include sight-reading, JMC reading activities may include, but are not limited to, reading the contour of the notes (correlating the shape of a melody with the pitches), discrimination reading (identifying a symbol or pattern from several symbols or patterns and discerning difference versus sameness), imitation of a teacher's reading of notes or rhythms, tracking or pointing to the notes while singing in tempo, utilizing the magnetic grand staff board, and workbook assignments.

1.4. Purpose of the Study

The purpose of this study was to measure the accuracy and memorization outcome of subjects who learned playing a piece by rote using a *la*-based minor solmization compared to subjects who learned the identical piece using an intervallic reading approach with identified landmark notes**.** The research was completed to determine if learning by rote with a *la*-based minor solmization system would aid in memory retention and/or improve the musicality of a performance. Memorization was utilized as a measuring tool to assess the subjects' retention and confirmation of musical

[30] Ibid., 97.

content. Memory criteria measured were note accuracy, rhythm accuracy, fingering, and fluency. Performance musicality was measured by rating the level of expressivity.

Current mainstream instructional piano series authors often included lyrics to encourage singing; however, "solmization singing is not heavily used in beginning piano teaching compared to other instruments or general music classes."[31] To date, no researcher has compared the effects of *la*-based minor solmization acquisition and memory retention and performance musicality applied in piano studies.

1.5. Research Questions

The following research questions guided this study:

1. Was there a significant difference between the experimental and control groups' note or key accuracy in memorized performances?
2. Was there a significant difference between the experimental and control groups' rhythm accuracy in memorized performances?
3. Was there a significant difference between the experimental and control groups' dynamic expressiveness in memorized performances?
4. Was there a significant difference between the experimental and control groups' fingering in memorized performances?
5. Was there a significant difference between the experimental and control groups' fluency in memorized performances?
6. Can *la*-based minor solmization be an applicable tool to piano pedagogical works?

[31] Yu-Jane Yang, *The Effects of Solmization and Rhythmic Movement Training on the Achievement of Beginning Group Piano Students at the Elementary School Level* (PhD Dissertation, University of Michigan, 1994), 19.

1.6. Study Limitations

This study was limited to *la*-based minor solmization memory retention in pre-college piano students. Additionally, the music selected was in a minor tonality and was consistent in both groups. The experimental group learned the repertoire by rote by singing movable-*do* with a *la*-based minor solmization system while the control group used intervallic reading approach with identified landmark notes. Furthermore, the subjects' hand span did not require any movement beyond a five-finger pattern hand span.

1.7. Related Literature

There are a number of sources and studies germane to the proposed research.

Research about the Importance of Singing

Empirical research has alluded to the importance of singing: "Perhaps the most compelling conclusions derived by other researchers, which neurologically complement my empirical and observational research, regard the importance of singing and movement as readiness for learning to audiate. Succinctly, there are phonological and kinesthetic direct loops between ears and vocal folds and between ears and muscles throughout the body. That is, because these neurological loops bypass the cerebral cortex, they are instinctual and do not involve thinking processes."[32] Before music is formally processed, we must innately sing and feel the pulses in time with the music. We learn music first by doing, then we can analyze the process.

[32] Edwin E. Gordon. *Awakening Newborns, Children, and Adults to the World of Audiation: A Sequential Guide*. Chicago: GIA, 2007.

Solmization Systems

In a 1990 study, Riggins and Pembrook surveyed college and university level freshman and sophomore aural-skill instructors as to which sight-singing system they adopted.[33] Sixty percent use a movable system, twenty percent use a fixed system (mostly conservatory instructors), and twenty percent a neutral syllable. Out of the sixty percent of instructors that teach using a movable system, eighteen percent use *do*-based minor and sixteen percent used *la*-based minor.

A controversial debate about *la*-based minor and *do*-based minor can be found in the *Journal of Music Theory Pedagogy*: Timothy Smith, Micheal Houlahan, and Philip Tacka. Timothy Smith is an advocate for *do*-based minor solmization while Micheal Houlahan and Philip Tacka are advocates for *la*-based minor solmization.

In Smith's article, "A Comparison of Pedagogical Resources in Solmization Systems", he states that the *la*-based minor system is advantageous in easy application for beginners because it caters to what students hear rather than read. Secondly, Smith further supports that the *la*-based minor system would be beneficial to students who have progressed to the reading stage and can identify *do* in all encompassing seven pitches by observing the key signature. Musicians can freely move in and out between relative keys with ease without having to incorporate a new tonal center. Modulations may happen without the musician realizing that a new shift has entered. Teachers need to insist that students are cognizant of the shift between major and minor.

[33] H. Lee Riggins and Randall Pembrook, "'Send Help!' Aural Skills Instruction in U.S. Colleges and Universities," *Journal of Music Theory Pedagogy* 4, no. 2 (1990): 231-242.

According to Smith, half steps are always clearly defined as *mi-fa* and *ti-do* in any mode. The *la*-based minor is not unlike Guido's *ut, re, mi* because both systems identify half steps in simple form and "neglect the aural and notational differences between modes. By inference, they tend to portray all modes as infratypes of Ionian, diminishing the significance of modal variation to the degree that other scale degrees are implied to behave as tonic."[34]

Smith argues that it is necessary to understand the relationship between keys that share the same key signature to properly identify structures between sections of a piece, but when it comes to functional harmony, it is more practical to compare the relationship between the major scale and its parallel minor.[35] From a teaching perspective, one must bring shared features together by using similar labels. In the context of secondary chromatic relationship and modal music, *la*-minor solmization clearly becomes deficient because it gives seven different meanings to a solmization syllable. For example, in a major scale *ti* is the leading tone, in Aeolian mode, *ti* is the supertonic, and in dorian, *ti* is the supermediant. Unfortunately, according to *la*-based minor, the leading tone is *ti* in the major scale, *si* in aeolian, *di* in dorian, *ri* in phrygian, and *fi* in mixolydian.

Smith advocates that regardless of the mode, *do* should always remain the same and works well in parallel minor key relationships.[36] Unlike *la*-minor, *do*-minor accounts for the half steps differentiation by providing different phonemes such as *me-fa* and *sol-le* in harmonic minor.[37] Smith further advocates that solmization be sung with new labels

[34] Timothy Smith, "A Comparison of Pedagogical Resources in Solmization Systems," *Journal of Music Theory Pedagogy* 5, no 1, (Spring 1991): 14.
[35] Smith, 15.
[36] Ibid.
[37] Ibid.

and provides stronger unity comparison in each key rather than simply implied in *do*-minor solmization.

Micheal Houlahan and Philip Tacka wrote a response to Smith's article titled "The Americanization of Solmization: A Response to the Article by Timothy A. Smith, 'A Comparison of Pedagogical Resources in Solmization Systems'."[38] Houlahan and Tacka rebutted that a more complete argument needed to be made for *la*-minor solmization along with a more accurate examination of the methods, materials, and applications. Teaching of music literacy comes before music theory.[39] Singing *do*-minor supports music theory while singing la-minor solmization helps gain insight into the music repertoire.[40] Active music making participation should form the foundation of every theory class. Imposing music notation rules onto aural skills does carry over to students who can audiate. Solmization syllables should not be discussed in the matters of which solmization system has the least amount of syllables. Rather, the importance of developing audiation necessitates instructors to use solmization based on the patterns derived from the repertoire.[41]

According to Edwin Gordon, "the mechanical ability to name and define individual notes or other music symbols does not, of itself, provide the readiness for music literacy." Gordon further states that one does not read music names or definitions, but, on the contrary one hears groups of notes (patterns) as one reads. Only when one can audiate tonal and rhythm notation can the names and definitions of music symbols

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[38] Micheal Houlahan and Philip Tacka, "The Americanization of Solmization: A Response to the Article by Timothy A. Smith, 'A Comparison of Pedagogical Resources in Solmization Systems," *Journal of Music Theory Pedagogy* 6 (Jan 1992): 137.

[39] Houlahan and Tacka, 138.

[40] Houlahan and Tacka, 138.

[41] Houlahan and Tacka, 138.

become musically relevant."[42] Mere repetition does not guarantee that the student can audiate and read music fluently. Naming a pitch is the final stage of learning and the teaching sequence must be presented to adhere to all students' four perceptual learning modalities: visual, auditory, kinesthetic, or a combination of two before displaying a visual presentation. All of music theory derives first from an aural understanding.

In Kyle Daniel Brown's dissertation titled "Effects of Fixed and Movable Sight-singing Systems on Undergraduate Music Students", subjects, mainly music majors completing a second-year of ear-training course from selected four-year universities accredited by NASM, sight-sang twelve twenty-note passages without rhythm as a variable.[43] Each example was compartmentalized into the following categories: diatonic, modulatory, chromatic, and atonal and ranged between three levels of difficulty: easy, medium, and difficult.

The statistical procedure utilized a three-way mixed effects MANOVA with an A x (B x C x S) mixed design. The training of the students under the two sight-singing systems fixed-*do* and movable-*do* was the between-subjects variable. The two within-subjects variables were four music categories and three complexity levels. The dependent variables were students' pitch and label accuracy scores. Results indicate that students using the movable-*do* system scored significantly higher on pitch accuracy for chromatic and simple level of complexity while students who sang using the fixed-*do* system scored significantly higher on label scores for atonal music and difficult level of complexity.

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[42] Smith, 140.

[43] Kyle Daniel Brown, "Effects of Fixed and Movable Sightsinging Systems on Undergraduate Music Students' Ability to Perform Diatonic, Modulatory, Chromatic, and Atonal Melodic Passages" (Ph.D. diss., University of Oregon, 2001).

Bruce Taggart's *Journal of Music Theory Pedagogy* article titled "Sightsinging Schubert: A Study in Solfege"[44] compares fixed do, moveable do, and both the *la*-based and *do*-based minor. Undergraduate music majors applied four different solmization approaches to Lieder by Schubert (Der Schatzgräber, D. 256 and Schäfers Klagelied, D. 121) to demonstrate how modulation should can be handled. Taggart concluded that the study suggests that no system was found to be optimum.

Solmization Applied to Other Music Instruments

In Michael Paul Dunlap's dissertation "The Effects of Singing and Solmization Training on the Musical Achievement of Beginning Fifth-Grade Instrumental Students,"[45] the main focus was to determine whether beginning elementary instrumental students using solmization to improve aural, performance, and reading skills would be more successful than those who did not. Dunlap focused on the relationships between vocal pitch accuracy and selected aspects of instrumental achievement as well as vocal pitch accuracy and music aptitude. Ninety-two beginning fifth-grade band students from four elementary students were randomly assigned to either the experimental or control groups. Students in the experimental group sang rhythm patterns on single concert pitch using rhythmic syllables, sang melodic patterns using movable-do solmization, and sang instrumental songs using lyrics. The control group chanted rhythmic patterns using rhythmic syllables and performed tonal patterns and instrumental songs strictly on their band instrument.

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[44] Bruce Taggart, "Sight singing Schubert: A Study in Solfège," *Journal of Music Theory Pedagogy* 11, 1997: 75-98.

[45] Michael Paul Dunlap, *The Effects of Singing and Solmization Training on the Musical Achievement of Beginning Fifth-Grade Instrumental Students.* (Ph.D. Dissertation, University of Michigan, 1989).

Five achievement tests were administered to measure the effects of instruction: pre- and post-test vocal accuracy, melodic ear-to-hand coordination, melodic aural-visual discrimination, instrumental performance, and instrumental music reading. No significant differences were found between the control and experimental group on any achievement tests; however, a positive correlation was found between vocal accuracy scores and measures of melodic ear-to-hand coordination, melodic aural-visual discrimination, instrumental performance, and musical aptitude.

Dunlap concluded that vocal accuracy is significantly related to melodic ear-to-hand coordination, melodic aural-visual discrimination, instrumental performance skills, and music aptitude. Dunlap further concluded that singing and solmization treatment did not help or hinder students' vocal accuracy, melodic ear-to-hand coordination, melodic aural-visual discrimination, instrumental performance, or instrumental music reading ability.

Solmization Applied at the Piano

Michelle Irene Wachter's Doctor of Musical Arts dissertation titled "Effects of Sight Singing Using Moveable- *Do* Solmization on the Transposition Performance of Undergraduate Group Piano Students".[46] Wachter surveyed thirty-nine undergraduate non-keyboard music majors during their first semester of keyboard group piano classes. During the six-week treatment duration, all students received reading and transposition music examples. The control group read and transposed without singing while the experimental group sang the musical examples using movable-do solmization before

[46] Michelle Irene Wachter, *Effects of Sight Singing Using Moveable-Do Solmization on the Transposition Performance of Undergraduate Group Piano Students*. (D.M.A. Dissertation, University of South Carolina, 2014).

playing and transposing. The results of the Kruskal-Wallis One-Way Analysis of Variance by Ranks revealed no significant difference between the control and experimental group on pitch and rhythm accuracy, continuity, and musical expression. Wachter used the Mann-Whitney U tests post-hoc and the students gain scores showed that the experimental group displayed a significant increase over the control group (p= .04). The experimental group also reached higher pretest to post-test scores upon the second post-test transposition example. Wachter concluded that the results from the study suggest singing before playing may positively influence students' ability to transpose at the keyboard.

CHAPTER TWO

METHODOLOGY

The research conducted was a quantitative quasi-experimental study designed to measure the accuracy and memorized outcome of subjects' performance who learned a piano piece by rote using *la*-based minor solmization compared to subjects who learned the identical piece using an intervallic reading approach with identified landmark notes. This chapter includes information on the setting, the subjects, materials, the treatment procedure, and research design.

2.1. Setting

The subjects were chosen from a sample of pupils enrolled in piano lessons at the Center for Piano Studies (CPS), a precollege and adult piano study program at the University of South Carolina (USC) located at the School of Music in Columbia, South Carolina. The School of Music is located in the downtown metro Columbia area.[47] Permission was obtained from Dr. Sara Ernst, director of the CPS (Appendix A).

At the CPS, subjects were enrolled during the Fall and Spring terms with the option of enrolling continuously throughout the Summer term. During the study, subjects were offered twenty-nine private lessons a year once a week for forty-fives or sixty-minute increments. Subjects might have enrolled and had access to theory and repertoire

[47] According to the Census Bureau in 2016, Columbia had an estimated population of 134,309 inhabitants, a median household income of $41,260, and 24.2% persons in poverty.[47] Additionally, from 2011-2015, 87.2% of the city population was a high school graduate or higher and 40.6% had a Bachelor's degree or higher.

classes, recitals, auditions, and examination opportunities. Instructors were graduate students enrolled as a piano pedagogy or piano performance degree major at USC.

2.2. Subjects

Ten, *n*= 10, pre-college subjects aged nine to seventeen years old, at the early intermediate level to the advanced level, and enrolled in the CPS at USC participated in this study. Participation in the study was voluntary. No discrimination was made based on gender, race, or religion. The subjects were not current or past pupils of the research investigator. The subjects may have benefited by learning a musical skill applicable to their musical study and enhancement of memory retention. There were no anticipated risks for the subjects participating in the study. Subjects' parents received an invitation letter including a description of the study, consent form, guarantee of anonymity, security of data collection and storage, benefits and risks, compensation for participation, and researcher contacts (Appendix B). Parents had the ability to withdraw their child from participation in this study at any time.

Statistical measures were used to adjust for the small number of subjects. All subjects who agreed to participate in the study stayed throughout the course of the study. Data was collected during a three-week time period from April 1 through April 24, 2017. The USC Institutional Review Board reviewed, approved, and determined that the study posed minimal risk to participants from the Human Research Subject Regulations (see Appendix C). Throughout the study, the principal researcher completed and updated her Collaborative Institutional Training Initiative: Human Research and Social & Behavioral Researchers refresher coursework (Appendix D).

2.3. Materials

Preparation

Subjects in the control and treatment groups reviewed preparatory examples before receiving the treatment. The control group reviewed materials in regards to landmark note identification (Figure 2.1) and rhythm (Figure 2.2).

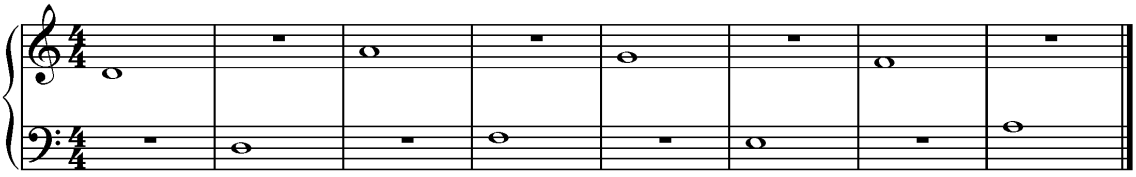

Figure 2.1 Control group preparatory landmark note identification

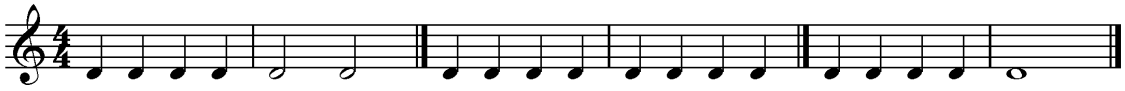

Figure 2.2 Control group preparatory rhythm

The experimental group performed tonal (Figure 2.3) and rhythm patterns associated with the repertoire (Figure 2.4). In addition, the experimental group was given a figure of a piano keyboard displaying the D-minor pentascale labeled with *la*-based minor solmization (Figure 2.5).

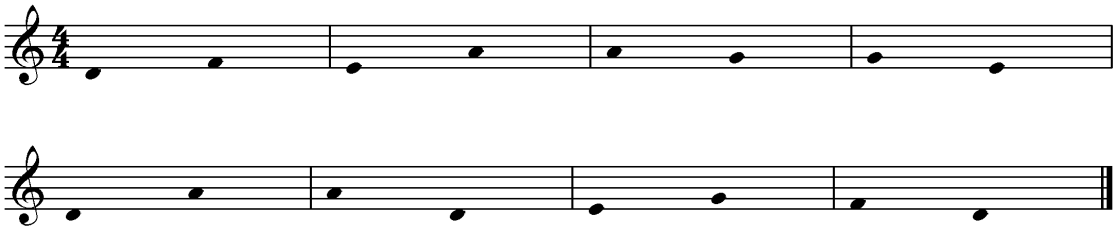

Figure 2.3 Experimental group tonal patterns

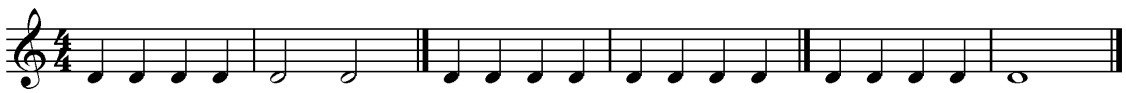

Figure 2.4 Experimental group rhythm patterns

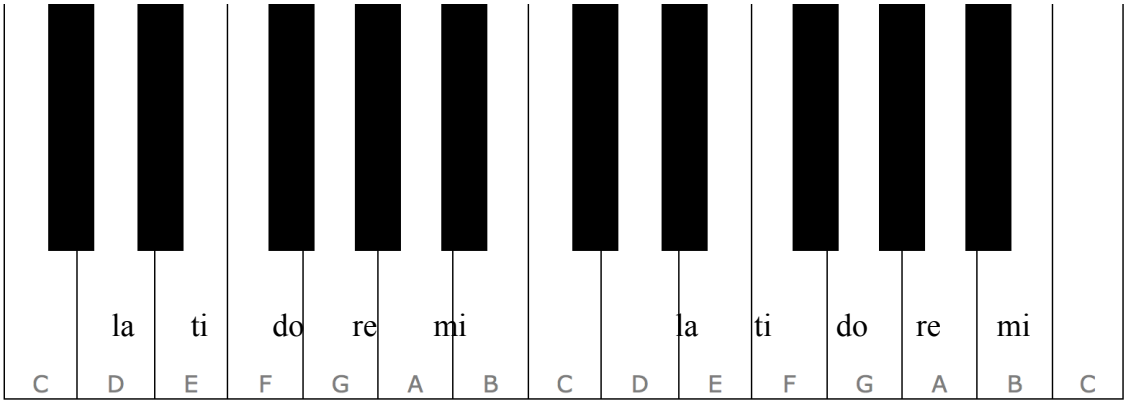

Figure 2.5 Experimental Group Piano with D-minor pentascale solmization

Repertoire

All subjects used identical repertoire selected by the principal researcher and chosen from a minor tonality. The repertoire selected was the student-teacher piano duet from Ferdinand Beyer's (1803-1863) *Vorschule im Klavierspiel* (Beginning Piano School or Elementary Instruction Book for Piano), Op. 101, No. 43 (1851) (Figure 2.6).[48]

[48] Ferdinand Beyer, *Vorschule im Klavierspiel* Op. 101 (Leipzig: Peters, 1894), 35-36.

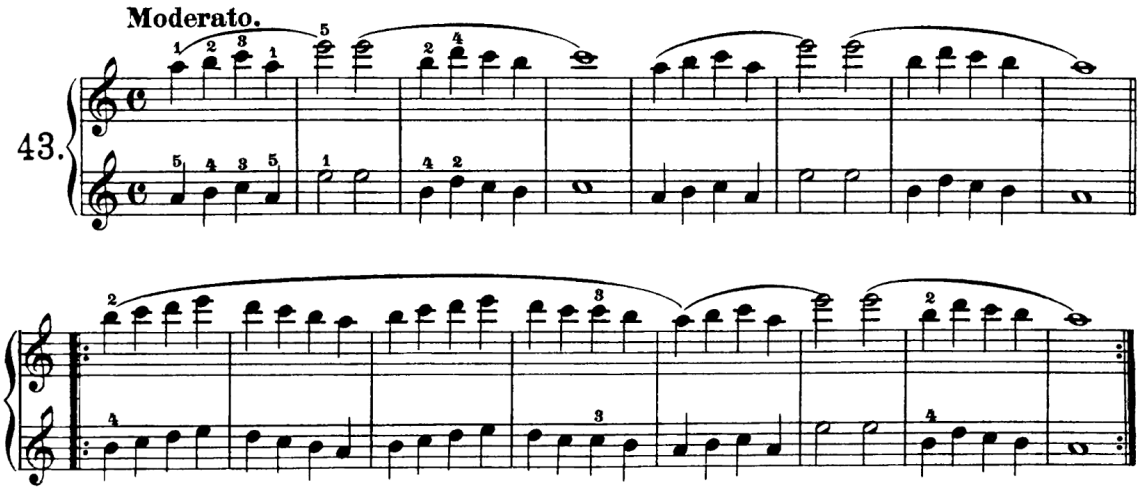

Figure 2.6 Ferdinand Beyer's *Vorschule im Klavierspiel* Op. 101 No. 43, prima part

The repertoire was transposed to D minor for ease of singing and range for the subjects (Figure 2.7):

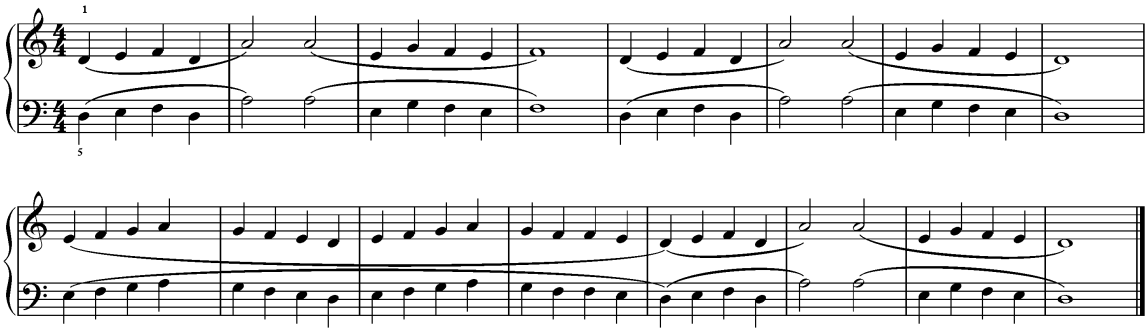

Figure 2.7 Transposed Version of Beyer's *Vorschule im Klavierspiel* Op. 101 No. 43

2.4. Treatment Procedure

Treatment and Randomization

Five subjects, *n*=5, received the independent treatment (rote with *la*-based minor solmization), and the other five subjects, *n*=5, received the dependent treatment (intervallic reading approach with identified landmark notes). Random assignment was used to assign subjects to either the treatment or control group.

Timespan

The teaching segments, tasks, and timeline treatment periods were conducted in a timespan of three weeks using the same repertoire piece (Table 2.1). During the first week, the principal researcher taught and recorded ms. 1-4. During the second and third week, the principal researcher reviewed content from the previous week, taught an additional four measures, and recorded content from the current and prior weeks. No music was sent home for practicing. All music instruction was completed in the allotted time of ten to fifteen minutes in addition to their original piano lesson.

TABLE 2.1. Tasks, teaching segments, and timeline for *Vorschule im Klavierspiel* Op. 101 No. 43 by Ferdinand Beyer

Weeks No.	Tasks and Teaching Segments
1	Taught ms. 1-4 Recorded ms. 1-4
2	Reviewed ms. 1-4 Taught ms. 5-8 Recorded ms. 1-8
3	Reviewed ms. 1-8 Taught ms. 9-12 Recorded ms. 1-12

Procedure

The principal researcher taught the subjects in the control group using the intervallic reading approach with identified landmark notes, and the experimental group using the rote approach with *la*-based minor solmization, with no reference to the score.

TABLE 2.2. Control and experimental group treatment procedure

Control Group: Intervallic Reading Approach with Identified Landmark Notes	Experimental Group: Rote with Solmization Approach
1a. Contextual: Subjects were given the key and pentascale hand position	
1b. Contextual: Students were given contextual phrases and form	
1c. Contextual: Subjects were given time signature and meter	
1d. Contextual: Subjects were given articulation	
2. Preparatory Notes and Rhythm Reading Exercises	2. Preparatory Tonal and Rhythm Listening Patterns
3. Identified landmark notes, leger line notes, and intervals in music example	3. Principal researcher played student part twice.
4. Played the music example twice	4. Echo-sing and played phrases with and without principal researcher
5. Two-minute time limit to memorize	
6. Performed memorized and video record	

Control Group Procedure

The principal researcher guided the control group subjects taught by an intervallic reading approach with identified landmark notes, given contextual expectations of key, pentascale hand position, phrases and form, time signature and meter, and articulation. and accomplished the following tasks:

1. Completed preparatory note and rhythm music reading exercises.
2. Identified landmark notes, leger line notes, and intervals found in the music example.
3. Played and read the music example in phrases.
4. Accomplished independent two-minute study time with the goal to perform from memory.
5. Performed from memory and completed a video recording

In the control group, the subjects were given the context to know what to expect. The principal researcher informed the subjects of the key, pentascale hand position, form,

phrases, time signature and meter, and articulation. In step two, the subject completed preparatory note (Figure 2.2) and rhythm music reading examples (Figure 2.3). In step three, the subjects identified landmark notes, leger line notes, and intervals found in Beyer's *Vorschule im Klavierspiel*, Op. 101, No. 43. In step four, the subjects read through the music example twice. In step five, the subject had a two-minute time limit to accomplish independent study, and was given the goal to memorize and play the music example. The subjects did not have to use the full two-minute timespan. Time variances occurred. For this reason, the amount of time required by subjects to memorize the music example was recorded. Finally, a video recording was made of the subject's memorized performance.

Experimental Group Procedure

The principal researcher guided the subjects in the experimental group taught by a rote process using solmization, given contextual expectations of key, pentascale hand position, phrases and form, time signature and meter, and articulation. and accomplished the following tasks:

1. Completed preparatory tonal and rhythm patterns through singing, chanting, and playing derived from the music example.
2. Heard the principal researcher perform the prima melody twice.
3. Echo-sang and played phrases using a *la*-based solmization with and without the principal researcher.
4. Accomplished independent study time with the goal to perform from memory.
5. Performed from memory and completed a video recording.

In the experimental group, the subject was given the context to know what to expect. The principal researcher informed the subject of the key, pentascale hand position, form, phrases, time signature and meter, and articulation. The subject then completed preparatory tonal (Figure 2.4) and rhythm patterns (Figure 2.5) derived from the music example. Rhythm patterns were identical to the preparatory rhythm music example performed in the control group. Then, the subject heard the principal researcher perform the music example in its entirety twice.

Next, the principal researcher sang a phrase on a neutral syllable and then the subject echo-sang along with the principal researcher on a neutral syllable with and without the principal researcher. In the next step, the principal researcher echo-sang and echo-played phrases using a *la*-based solmization with and without the subject. In step four, the subject echo-chanted preparatory rhythm patterns derived from the music. In step five, the subject had a two-minute time limit to accomplish independent study and was given the goal to memorize and play the music example. The subject did not have to use the full two-minute timespan. Time variances occurred. For this reason, the amount of time used by subjects to memorize the music example was recorded. Finally, a video recording was made of the subject's memorized performance.

2.5. Research Design

The Post-test Only Control Group Design was used for this study. A Post-test was given to both groups. The diagram for the post-test only design was used for this study (Table 2.3).

Table 2.3. Post-test only control group design

Experimental Group	R	X	O
Control Group	R		O

Source: Table from Phillips (2008).

Note: R= random assignment of participants, X= treatment or independent variable, and O= post-test.

CHAPTER THREE

RESULTS

The principal researcher performed the Mann-Whitney U, a rank-based nonparametric test, to test whether there was a statistically significant difference between the control and treatment groups on memorization. Due to the small sample size and non-normal distribution, a T-test was not appropriate and the nonparametric Mann-Whitney U test was used instead. The Mann-Whitney U was used through the IBM Statistical Package for the Social Sciences (SPSS).[49] The Legacy Procedure was used to perform the Mann-Whitney U Test on SPSS.

3.1. Analytic Rubric

An analytic rubric was used to measure the degrees of a performance quality.[50] A multidimensional rating scale of potential achievement was arranged on a spectrum from one to four, four being the highest rating a subject was able to achieve. Reliability and validity risks, especially the halo effect, were decreased by measuring specific musical performance dimensions. A five-dimensional, four-point rating scale was constructed to measure the quality of the same recorded performance across three different sessions one week apart. Note accuracy, rhythm accuracy, musicality, fingering, and fluency were

[49] IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.

[50] Ibid., 100.

dimensions the rater used to isolate each performance. Table 3.4 was the analytic rubric used to rate the subjects' performances.

TABLE 3.1. Analytic rubric of memory retention

	4	3	2	1
Note accuracy	Accurate throughout	Mostly accurate	Some flaws	Little accuracy
Rhythm	Accurate throughout	Mostly accurate	Some flaws	Little accuracy
Musicality	Desirable expressivity	Moderately expressivity	Somewhat expressivity	Little expressivity
Fingering	Accurate throughout	Mostly accurate	Some flaws	Little accuracy
Fluency	Very fluent	Mostly fluent	Somewhat fluent	Less fluent

3.2. Rate-rerate Reliability

The principal researcher listened to the recordings on two separate occasions with three days apart for rate-rerate reliability and avoid the halo effect (see Tables 3.1, 3.2, and 3.3 for all three consecutive weeks). The sum, mean, and standard deviation for the six dimensions (five dimensions and the composite) were calculated. The first and second ratings were in agreement, thereby indicating that the rate-rerate reliability of one rater was reliable.

3.3. Assumptions

In order to determine if the Mann-Whitney U test could be utilized for this study, four assumptions were satisfied: an ordinal dependent variable existed, one independent variable was categorical with both groups, the study had intact groups, and both distributions had the same distributional shape. The Legacy Procedure involved creating population pyramids to check the assumption that both distributions had similar distributional shape. Similar distributional shapes are displayed below in the population

pyramids in Tables 3.5, 3.6, and 3.7. Upon visual inspection, the distributional shapes are similar although one distribution may appear to have higher or lower scores than the other. Similar distributional shapes allowed differential median inferences between the two groups.

3.4. Median Comparison

The significance levels, either asymptotic *p*-value and the exact *p*-value, determined to retain the null hypothesis. The sample size of this study is twenty or less (*n*=10); thereby this calculation determined the exact *p*-value to be a better approximation than the asymptotic *p*-value. With this in mind, however, the exact *p*-value did not correct for ties in the data (when two or more subjects have the same scores on the dependent variable) and may have been inflated. Therefore, in this study, the approximate *p*-value will be reported to accept the null hypothesis or another hypothesis.

The approximate *p*-values found below in Tables 3.8, 3.9, and 3.10, are *p*= .881, *p*= .118, and *p*= .214, meaning the result has no statistical significance and the null hypothesis can be accepted. The approximate *p*-value is greater than .05. Anything greater than .05 means we can accept the null hypothesis. The lack of statistical significance in approximate *p*-value and the value of the Mann-Whitney U statistic, *U*= 12.000, *U*= 5.500, and *U*=7.000; *z* = -.149, *z* = -1.565, and *z*= -1.243; *p*= .881, *p*= .118, and *p*= .214, means that the results have no statistical significance in median scores between the control and experiment group. Tables 3.8, 3.9, and 3.10 show that the mean rank for the control group was 5.40, 6.90, and 6.60 while the mean rank for the experimental group was 5.60, 4.10, and 4.40. These mean ranks do not show statistical significant difference.

TABLE 3.2. Rating scale tally sheet week 1

Subjects	Notes		Rhythm		Musicality		Fingering		Fluency		Composite
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	
Control 1	4	4	4	4	4	4	4	4	4	3	4.00
Control 2	4	4	4	4	3	3	4	4	4	4	3.78
Control 3	4	4	4	4	4	4	4	4	4	4	4.00
Control 4	4	4	1	2	3	3	4	4	3	3	3.11
Control 5	4	4	4	4	4	4	4	4	4	4	4.00
Treatment 6	2	3	4	4	2	4	4	4	2	2	3.22
Treatment 7	3	4	4	4	3	4	4	4	4	4	3.78
Treatment 8	4	4	4	4	4	4	4	4	4	4	4.00
Treatment 9	4	4	3	3	3	4	4	4	4	4	3.67
Treatment10	4	4	4	4	4	4	4	4	4	4	4.00
Σ	37.00		36.00		34.00		40.00		37.00		*Σ Control* 18.9
Mean	3.70		3.60		3.40		4.00		3.70		*Σ Treatment* 18.7
SD	.67		.97		.70		0.00		.67		*Average Control* 3.78
											Average Treatment 3.73

TABLE 3.3. Rating scale tally sheet week 2

Subjects	Notes		Rhythm		Musicality		Fingering		Fluency		Composite
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	
Control 1	3	3	3	3	4	3	4	4	3	3	3.33
Control 2	3	4	2	3	4	4	4	4	4	4	3.56
Control 3	3	3	3	4	4	4	4	4	3	4	3.56
Control 4	3	4	3	4	3	3	4	4	4	4	3.56
Control 5	4	4	4	4	3	3	4	4	4	4	3.78
Treatment 6	4	4	4	4	4	4	4	4	4	4	4.00
Treatment 7	4	4	4	4	2	3	4	4	4	4	3.67
Treatment 8	4	4	2	3	4	4	4	4	4	4	3.67
Treatment 9	4	4	3	3	4	4	4	4	4	4	3.78
Treatment10	4	4	4	4	4	4	4	4	4	4	4.00
Σ	36.00		32.00		36.00		40.00		38.00	*Σ Control*	18.33
Mean	3.60		3.20		3.60		4.00		3.80	*Σ Treatment*	18.56
SD	.52		.79		.70		0.00		0.42	*Average Control*	3.67
										Average Treatment	3.71

TABLE 3.4. Rating scale tally sheet week 3

Subjects	Notes		Rhythm		Musicality		Fingering		Fluency		Composite
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	
Control 1	3	3	4	4	4	4	4	4	3	4	3.67
Control 2	2	3	2	2	4	4	4	4	3	3	3.11
Control 3	4	4	3	3	4	4	4	4	4	4	3.78
Control 4	4	4	3	3	3	3	3	4	3	3	3.33
Control 5	4	4	4	4	3	3	4	4	4	4	3.78
Treatment 6	4	4	3	4	4	4	4	4	3	4	3.78
Treatment 7	3	3	1	2	3	2	4	4	2	2	2.67
Treatment 8	3	3	3	3	4	4	4	4	3	3	3.44
Treatment 9	4	4	3	3	4	4	4	4	4	4	3.78
Treatment10	4	4	4	4	4	4	4	4	4	4	4.00
Σ	35.00		30.00		37.00		39.00		33.00	*Σ Control*	17.44
Mean	3.50		3.00		3.70		3.90		3.30	*Σ Treatment*	17.89
SD	.71		.94		.48		.32		0.67	*Average Control*	3.49
										Average Treatment	3.58

3.5. Distribution Comparisons

A Mann-Whitney U test was used to determine if there were differences in scores between the control and experimental group. Distributions of the scores were similar. Control median scores for weeks 1, 2, and 3 were 4, 4, and 4 and experimental median scores (those who received treatment) for weeks 1, 2, and 3 were 4, 3, and 3, therefore were not statistically significantly different (see Tables 3.11, 3.12, and 3.13).

TABLE 3.5. Week 1 population pyramid of control and treatment group scores

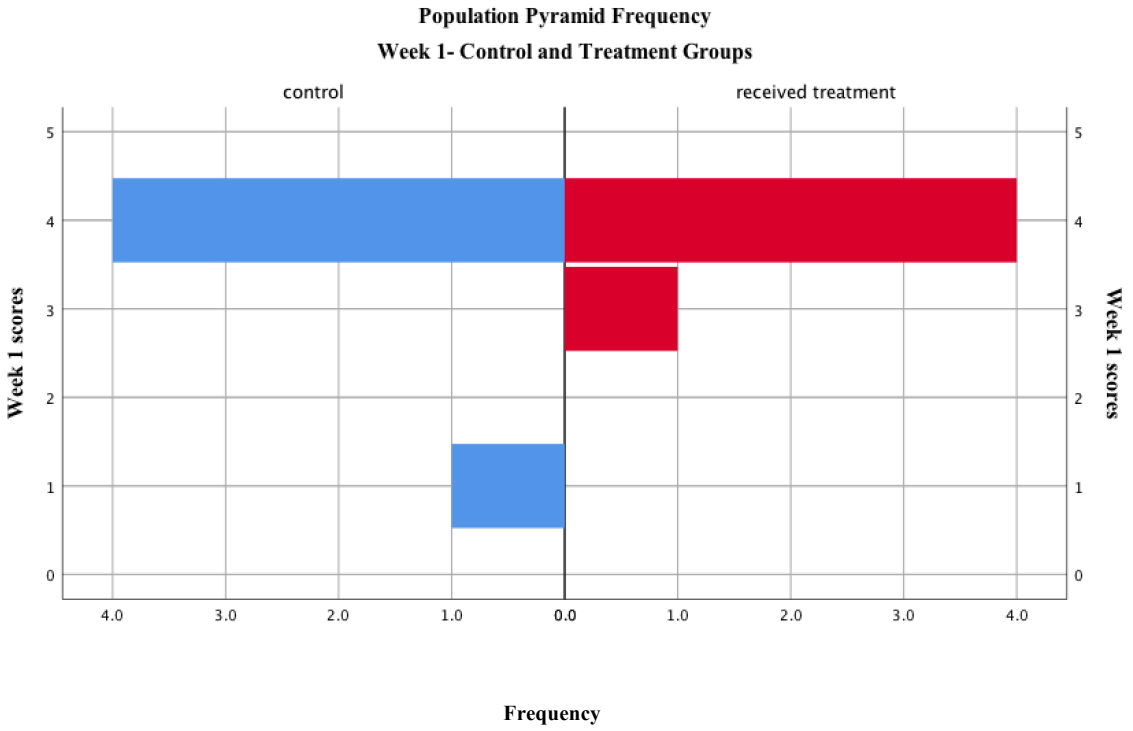

TABLE 3.6. Week 2 population pyramid of control and treatment group scores

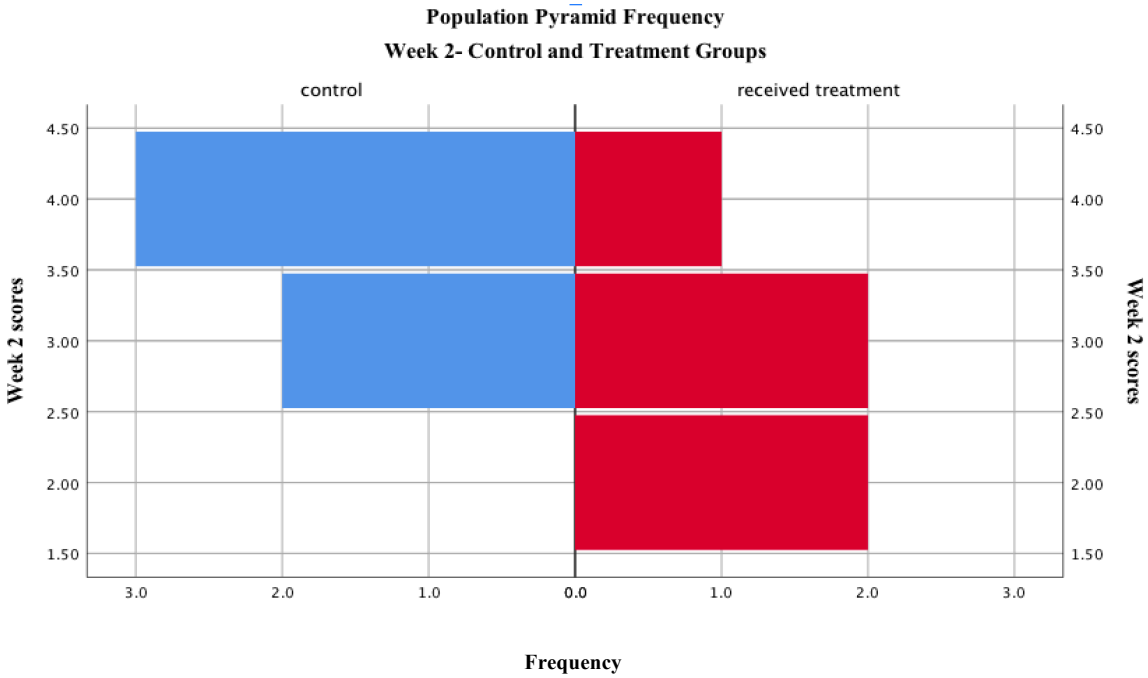

TABLE 3.7. Week 3 population pyramid of control and treatment group scores

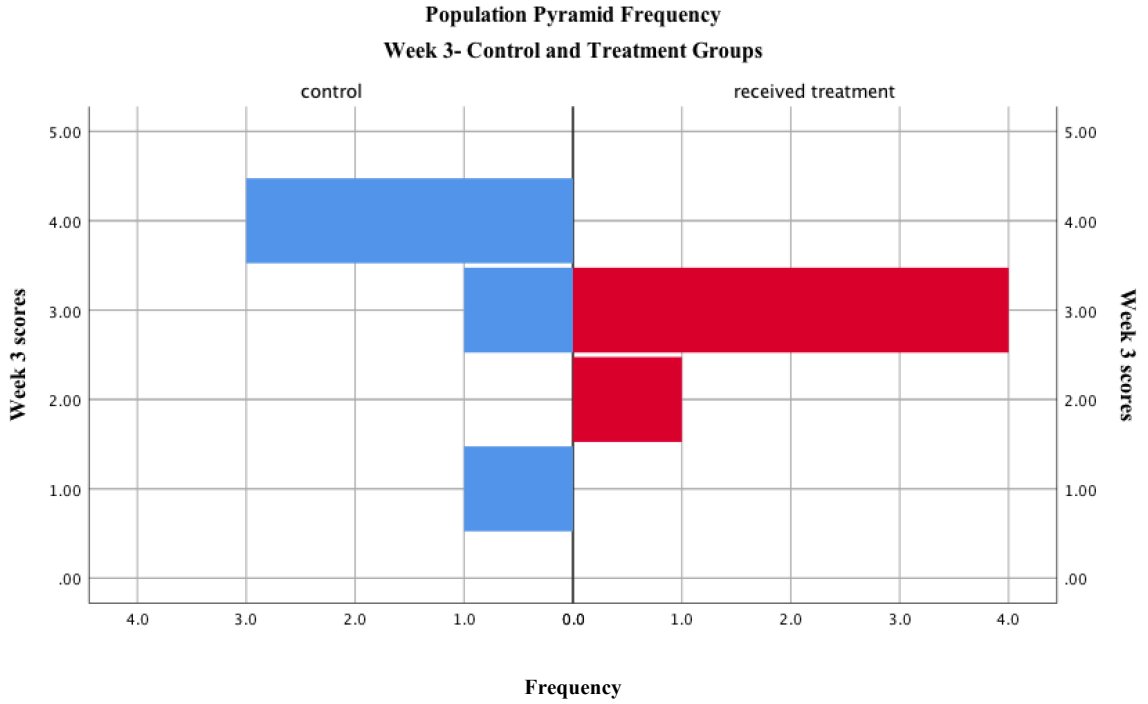

TABLE 3.8. Week 1 Mann-Whitney U test scores

Mann-Whitney Test

Ranks

	Week 1 La minor solfege treatment	N	Mean Rank	Sum of Ranks
Week 1 scores	control	5	5.40	27.00
	received treatment	5	5.60	28.00
	Total	10		

Test Statistics[a]

	Week 1 scores
Mann-Whitney U	12.000
Wilcoxon W	27.000
Z	-.149
Asymp. Sig. (2-tailed)	.881
Exact Sig. [2*(1-tailed Sig.)]	1.000[b]

a. Grouping Variable: Week 1 La minor solfege treatment

b. Not corrected for ties.

TABLE 3.9. Week 2 Mann-Whitney U test scores

Mann-Whitney Test

Ranks

	Week 2 La minor solfege treatment	N	Mean Rank	Sum of Ranks
Week 2 scores	control	5	6.90	34.50
	received treatment	5	4.10	20.50
	Total	10		

Test Statistics[a]

	Week 2 scores
Mann-Whitney U	5.500
Wilcoxon W	20.500
Z	-1.565
Asymp. Sig. (2-tailed)	.118
Exact Sig. [2*(1-tailed Sig.)]	.151[b]

a. Grouping Variable: Week 2 La minor solfege treatment

b. Not corrected for ties.

TABLE 3.10. Week 3 Mann-Whitney U test scores

Mann-Whitney Test

Ranks

	Week 3 La minor solfege treatment	N	Mean Rank	Sum of Ranks
Week 3 scores	control	5	6.60	33.00
	received treatment	5	4.40	22.00
	Total	10		

Test Statistics[a]

	Week 3 scores
Mann-Whitney U	7.000
Wilcoxon W	22.000
Z	-1.243
Asymp. Sig. (2-tailed)	.214
Exact Sig. [2*(1-tailed Sig.)]	.310[b]

a. Grouping Variable: Week 3 La minor solfege treatment

b. Not corrected for ties.

TABLE 3.11. Median comparison week 1

Means

Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
Week 1 scores * Week 1 La minor solfege treatment	10	100.0%	0	0.0%	10	100.0%

Report

Median

Week 1 La minor solfege treatment	Week 1 scores
control	4.00
received treatment	4.00
Total	4.00

TABLE 3.12. Median comparison week 2

Means

Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
Week 2 scores * Week 2 La minor solfege treatment	10	100.0%	0	0.0%	10	100.0%

Report

Median

Week 2 La minor solfege treatment	Week 2 scores
control	4.0000
received treatment	3.0000
Total	3.0000

TABLE 3.13. Median comparison week 3

Means

Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
Week 3 scores * Week 3 La minor solfege treatment	10	100.0%	0	0.0%	10	100.0%

Report

Median

Week 3 La minor solfege treatment	Week 3 scores
control	4.0000
received treatment	3.0000
Total	3.0000

CHAPTER FOUR

DISCUSSION AND CONCLUSIONS

4.1. Current Practice Implications

Globally, music has been a tradition passed down from generation to generation aurally and orally.[51] Along with the invention of the printing press and more readily available sheet music, some focused towards notation-based musicianship.[52] Generally speaking, teachers have given the ability to read music notation more priority than the ability to play by ear out of fear that students will lose the motivation to read.[53] Additionally, piano teachers feel insecure with developing acute musical ears themselves and training their own students; [54] however, research suggests otherwise.

According to Gary McPherson's three-year longitudinal study, ear-based musicianship is a skill that contributes to other musicianship skills such as improvising and sight-reading.[55] McPherson completed research that found a positive relationship

[51] Robert H. Woody, "Playing by Ear: Foundation or Frill?" *Music Educators Journal* 99, no. 2 (Dec 2012): 83.

[52] Ibid.

[53] Anne Marie Musco, "Playing by Ear: Is Expert Opinion Supported by Research?" *Bulletin of the Council for Research in Music Education*, no. 184 (Spring 2010): 51.

[54] Ibid.

[55] Gary E. McPherson, Michael Bailey, and Kenneth E. Sinclair, "Path Analysis of a Theoretical Model to Describe the Relationship among Five Types of Musical Performance," *Journal of Research in Music Education* 45, no. 1 (1997): 123.

between sight-reading skills and playing by ear.[56] Even if music teachers do not offer by-ear learning in a formal setting, students can develop the skill of learning by ear in an informal music setting.[57] Ear-playing skills develop over time, including that of which completed outside of formal education.[58] Music can be learned by ear in informal settings such as on the playground, in garages and basements, during religious worship services, and during cadences and chants on military bases. Playing by ear may be picked up across a wide variety of genres including, but not limited to, jazz, Indian raga, Irish Celtic music, and popular vernacular music.[59]

In future research, the following considerations may be important:

1. First, differentiate the two types of learning by-ear modes: rote learning and by-ear. Rote learning is differentiated for having a visual stimulus. For this study, the researcher chose to focus on rote-learning mode.
2. Delzell, Rowher, and Ballard tested musicians' skills to echo-play short melodic patterns and found out that students are more successful when presented with a step-wise pattern to copy followed by a leap pattern.[60]
3. McPherson discovered that the ability to play rehearsed music successfully is heavily influenced by the length of study and the ability to sight read.[61]
4. Luce discovered that students who have studied music privately or accumulated more hours playing in an ensemble tend to score higher on playing by-ear tests.[62]

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[56] Musco, 54.
[57] Ibid., 52.
[58] Musco, 54.
[59] Woody, 83.
[60] Judith K. Delzell, Debbie A. Rohwer, and Diane E. Ballard. "Effects of Melodic Pattern Difficulty and Performance Experience on Ability to Play by Ear." *Journal of Research in Music Education* 47, no. 1 (1999): 58.
[61] McPherson, 123.

5. In Dezell's study, success of playing by ear has a moderate, positive correlation between tonal aptitude and playing by ear.[63]
6. According to McPherson's research, the next larger direct correlation of successful playing by ear after sight-reading was improvisation.[64]
7. According to Puopolo's research, students prefer and have a more successful time playing by ear if they have an opportunity to cross reference their individual practice at home using recordings.[65]
8. Parent involvement and supervision at home aided students' music success.[66] Sperti included Suzuki aural-based instruction while having parental supervision, enabling the experimental group to be successful in all categories.

4.2. Future Research Recommendations

Based on the acceptance of the null hypothesis of this case study, the principal researcher suggests the following for future research implications:

1. **No prior reading experiences.** The control group may have had an advantage over the treatment group because they received years of training in the intervallic with landmark note identification method. The treatment group received a new form of treatment, along with a set of new teaching instructions, which may have

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[62] Luce, 108.

[63] Delzell, 60.

[64] Gary E. McPherson, *Factors and Abilities Influencing the Development of Visual, Aural and Creative Performance Skills in Music and Their Educational Implications* (Doctoral dissertation, University of Sydney, 1993), 536.

[65] Vito Puopolo, "The Development and Experimental Application of Self-Instructional Practice Materials for Beginning Instrumentalists." *Journal of Research in Music Education* 19, no. 3: 348.

[66] Sperti, J, *Adaptation of Certain Aspects of the Suzuki Method to the Teaching of Clarinet* (Doctoral dissertation, New York University, 1970).

caused stress or required time to adapt to the new method and instructions, regardless of how well the treatment was received.

2. **Larger sample size.** A small sample size of n=10 subjects derived from the Center of Piano Studies was obtained. It is recommended in quantitative research that the n>30. Conflicted scheduling of the principal researcher and the subjects showed to be a hindrance to the available selection of subjects.

3. **Longer treatment.** The treatment period was limited to three 15-minute sessions although in most cases, the treatment only lasted 5-10 minutes. A treatment period of more than 12 sessions is recommended to observe possible statistical difference between the control and treatment groups.

4. **Different age groups.** Age groups ranged from nine years old to under eighteen years of age. The decision to choose students at or above the age of nine was to ensure all subjects' music aptitude had stabilized. It is recommended to narrow the age group for greater specificity.

5. **Fingering and additional memorization study time.** Natalie Douglass remarked in "Aural Approaches to Horn Instruction" the aural sequential steps of audiate, sing, buzz, and play.[67] If one were to replicate this study for a pianist, an additional step of having the subjects shadow play (mimic playing on the surface of the keys) or fingering the melody would support the treatment. Additionally, Douglass encouraged students that performed incorrectly the first time during memorization to allow an additional thirty seconds of study time and glanced at the notation.

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[67] Natalie Douglass, "Aural Approaches to Horn Instruction." *Horn Call: Journal of the International Horn Society* 44, no. 2 (Feb 2014): 57.

6. **Preconceived sound to physical action.** Gary McPherson examined the three cognitive abilities underlying a musical performance: goal imaging-creating the expectation of what sound should be, motor production-generating the physical movements to create prior conceived sounds, and self-monitoring-accurately assessing one's music performance.[68] According to McPherson, it is imperative that music students develop a link to preconceived sound to physical action.[69] Fingering may have aided the subjects' memorized performance.

4.3. Conclusion

Although the results of this study were a null hypothesis, the results between the experimental and control group did not improve, neither worsen. In fact, subjects in both groups performed at similar performance levels despite having differing methods. This leaves unanswered questions and room for more research to be gleaned on how best one can acquire and attain music. The pursuit for the best suitable answers are worthwhile and paramount to enhance and improve future music performance, memorization, and comprehension.

[68] Gary E. McPherson, Michael Bailey, and Kenneth E. Sinclair, "Path Analysis of a Theoretical Model to Describe the Relationship among Five Types of Musical Performance," *Journal of Research of Music Education* 45, no. 1 (1997): 103-29.

[69] Ibid., 103.

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APPENDIX A

CENTER OF PIANO STUDIES PERMISSION AND GUIDELINES LETTER

UNIVERSITY OF
SOUTH CAROLINA
School of Music

October 28, 2016

Ms. Xu Khuc,

Thank you for your letter. I have received and reviewed your materials requesting permission to utilize ten Center for Piano Studies students for your dissertation research, titled "The Effects of Learning by Rote with La-based Minor Solmization on Memory Retention for Pre-College Students."

Please follow the guidelines below:

1. The Center database contains student's ages, although student ages may not be exact. You may schedule an appointment with Katie Chandler, Admissions Assistant, to gather potential student participant names and teacher names. Contact information of students and parents will not be provided.
2. Discuss your study briefly with each student's teacher, per your invitation letter. If a teacher is concerned about a student's suitability for the study (for reasons such as behavior or progress in studies), defer to the teacher's judgment and find an alternate student.
3. Keep the teacher informed as to when you will be adding time to lessons.
4. Time added to a lesson for research must never cause another student's lesson to be moved to another room or have a delayed start.
5. Inform me when you will formally begin research procedures in lessons.
6. Inform me when you have concluded all research procedures in lessons.

Let me know if there is further information needed from me at any point during your research. I am happy to be of assistance.

Sincerely,

Sara Ernst
Assistant Professor of Piano and Piano Pedagogy
Director of the Group Piano Program
Director of the Center for Piano Studies
sernst@mozart.sc.edu
803-777-1688

cc: Dr. Scott Price

University of South Carolina • Columbia, South Carolina 29208 • 803-777-4280 • Fax 803-777-6508
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APPENDIX B

INVITATION LETTER AND CONSENT FORM

Invitation Letter and Consent Form

University of South Carolina
School of Music

Study Title: *Effects of Learning by Rote and La-Based Minor Solmization on Memory Retention for Pre-College Piano Students*
Xu Khuc, principal researcher

Dear Parent or Guardian,

Your child is invited to participate in a research study completed by Xu Khuc. Ms. Khuc is a doctoral candidate in piano pedagogy at the University of South Carolina School of Music. The results of the study will be in partial fulfillment of the requirements for the Doctor in Musical Arts in Piano Pedagogy degree. The purpose of this study is to measure the effects of *la*-based minor solmization on memory retention on pre-college piano students.

Please read this form carefully and feel free to ask any questions before making a decision about participating. Should you decide to allow your child to participate, this form explains what your child will do for participating in this research study. Completed signature on this form constitutes consent to participate in this research project.

Description of the Study

Over the course of three weeks, your child will receive instruction in some or all of the following skills: singing, reading, keyboard playing, and memorizing during your regular lesson time. As the researcher, I will instruct approximately an additional fifteen minutes to your lesson time taught by your primary instructor.

The session will be video recorded and will only be used for educational purposes by the research team who will analyze the results. After the study is completed, the results will be stored securely in the Piano Pedagogy Library in the School of Music building and destroyed three years after the study is completed. The researcher will not use the recoding(s) for any other reason other than what has been stated above in this consent form without your written permission

Participation is completely voluntary and confidential. Your child will never be identified by name or on any records made. You have the option to withdraw your child from participation of the study at any time. Results of the study may be published or presented at professional meetings, but you or your child's identity will not be revealed.

Benefits and Risks

Your child may benefit from learning a musical skill applicable to his or her music studies and improve memory retention. There are no anticipated risks to your child's participation.

Compensation for Participation

You and your child will not be reimbursed for your time and participation in this research study.

Contacts

Feel free to contact the principal researcher, Xu Khuc at xukhuc@gmail.com or (714) 721-1789 or the research study chairman, Dr. Scott Price at sprice@mozart.sc.edu or (803) 777-1870 with any questions about the research study.

Please provide your email and phone number below. Your contact information will be used for this research study only and will not be shared with any outside persons.

Consent

I have read this consent form and provide my consent to participate in the voluntary study. I have received a copy of this form for my records and future reference.

_____	_____
Printed Name of Participant	Date
_____	_____
Printed Name of Participant's Parent/Guardian	Email
_____	_____
Signature of Participant's Parent/Guardian	Phone
_____	
Principal Researcher's Signature	

APPENDIX C

IRB HUMAN RESEARCH SUBJECT APPROVAL LETTER FOR EXEMPT REVIEW

UNIVERSITY OF
SOUTH CAROLINA

OFFICE OF RESEARCH COMPLIANCE

INSTITUTIONAL REVIEW BOARD FOR HUMAN RESEARCH
APPROVAL LETTER for EXEMPT REVIEW

This is to certify that the research proposal: **Pro00063290**

Title: *The Effects of Learning by Rote with La-based Minor Solmization on Memory Retention for Pre-College Piano Students*

Submitted by:
Principal Investigator: Duong Khuc
School of Music
813 Assembly St.
Columbia, SC 29208

was reviewed in accordance with 45 CFR 46.101(b)(**1**), the referenced study received an exemption from Human Research Subject Regulations on **2/14/2017.** No further action or Institutional Review Board (IRB) oversight is required, as long as the project remains the same. However, the Principal Investigator must inform the Office of Research Compliance of any changes in procedures involving human subjects. Changes to the current research protocol could result in a reclassification of the study and further review by the IRB.

Because this project was determined to be exempt from further IRB oversight, consent document(s), if applicable, are not stamped with an expiration date.

Research related records should be retained for a minimum of three (3) years after termination of the study.

The Office of Research Compliance is an administrative office that supports the University of South Carolina Institutional Review Board (USC IRB). If you have questions, contact Arlene McWhorter at arlenem@sc.edu or (803) 777-7095.

Sincerely,

Lisa M. Johnson
IRB Assistant Director

APPENDIX D

COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE CERTIFICATE

CITI PROGRAM

Completion Date 27-Sep-2017
Expiration Date 26-Sep-2020
Record ID 24465025

This is to certify that:

Xu- Duong Khuc

Has completed the following CITI Program course:

Human Research (Curriculum Group)
Social & Behavioral Researchers (Course Learner Group)
2 - Refresher Course (Stage)

Under requirements set by:

University of South Carolina

CITI
Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?wd5e84775-1d4a-4fb5-89b6-ccb2f73afee8-24465025

APPENDIX E

YAMAHA CORPORATION OF AMERICA TRANSCRIPT CONSENT

From: Duong Xu Khuc [mailto:xukhuc@yahoo.com]
Sent: Thursday, February 25, 2016 11:14 AM
To: Kathy Anzis
Subject: University of South Carolina Dissertation

Dear Kathy,

I'm writing a dissertation as part of the requirements for the DMA in Piano Pedagogy from the University of South Carolina under the direction of my advisor, Scott Price. My topic is Effects of La-based Minor Solmization and Memory Retention on Piano Students. I'd like to have a brief discussion in the introduction about Yamaha Music Education System in a general sense but not divulging into any particular system about the curriculum.

I recall signing a Yamaha nondisclosure agreement and I wanted to cover my bases so to speak. May I have your permission to write briefly about YMES in a general sense in my dissertation introduction?

Warm regards,

Xu Khuc

On Monday, February 29, 2016 5:50 PM, Kathy Anzis <kanzis@yamaha.com> wrote:

Dear Xu,

Thank you for your patience in awaiting a reply. I needed to consult with various resources. YCA will give you permission to write briefly about YMES in a general sense in your introduction, provided that:

1. Yamaha can review and approve the content referencing YMES in the document prior to its submission and/or publication. Yamaha reserves the right to withhold permission if it determines during its review that the content is inconsistent with the terms of the Trade Name Agreement.
2. You provide us with the date that the final draft will be presented to Yamaha for review.

Please let me know if you have questions and if you intend to move forward with your proposal with the stipulations listed above.

Best Regards,

Kathy Anzis
Director of Teacher Training
YMES Department
Yamaha Corporation of America
714-522-9006
kanzis@yamaha.com

From: Duong Xu Khuc [mailto:xukhuc@yahoo.com]
Sent: Wednesday, March 02, 2016 4:43 AM
To: Kathy Anzis
Subject: Re: University of South Carolina Dissertation

Dear Kathy,

Thank you for taking the time to help me with my document. I understand the need for the stipulations and would be happy to submit the relevant portion of the document for review. My final draft will be no later than November 22, 2016.

Best,
Xu

From: Xu Khuc <xukhuc@yahoo.com>
Sent: Monday, September 10, 2018 11:10 AM
To: Wai Leong <wleong@yamaha.com>; Mike Morrell <mmorrell@yamaha.com>
Cc: kanzis.musiced@gmail.com
Subject: Re: University of South Carolina Dissertation

Dear Wai Leong and YMES,

My dissertation, "The Effects of Learning By Rote with La-based Minor Solemnization on Memory Retention for Pre-College Piano Students" from the University of South Carolina, is near completion and I'd like to send you the portion that contains the relevant information of the document about YMES before going to publication. Please review the attachments (in docx and PDF files) and make any changes you deem fit.

Thank you for your time and consideration.

Regards,

Xu Khuc, University of South Carolina
DMA Piano Pedagogy Candidate
NCA Fine Arts Director
xukhuc@gmail.com
(714) 721-1789 Cell

Wai Leong

To: xukhuc@yahoo.com Cc: kanzis.musiced@gmail.com

RE: University of South Carolina Dissertation

September 14, 2018 at 5:28 PM

Inbox - Yahoo!

WL

Hello, Xu,

I hope you are staying dry and safe!

Attached please find your paper with small edits to clarify a few things about our courses.

Please feel free to contact us again should you have further questions.

Best Regards,

Wai Leong
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