May 2019

The Effects of Collaboration on Harmonization in College Group Piano

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THE EFFECTS OF COLLABORATION ON HARMONIZATION IN COLLEGE GROUP PIANO

A Dissertation
Submitted to the Graduate Faculty of the Louisiana State University and Agricultural and Mechanical College in partial fulfillment of the requirements for the degree of Doctor of Philosophy

in
The School of Music

by
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August 2019
ACKNOWLEDGEMENTS

I would like to extend my gratitude to my advisor Dr. Pamela Pike for guiding me through this rewarding journey. Her classes certainly helped improve my teaching approach and inspired me to be a better music educator. I would like to thank her for being a great mentor and always making time for me whenever I needed her advice. Her patience, constant encouragement, guidance, and insight kept me on track to complete my dissertation.

Also, I would like to thank Dr. Daniel Isbell, Prof. Gregory Sioles, and Dr. Witoon Prinyawiwatkul for giving their time to serve my committee. Specifically, I would like to thank Dr. Isbell for introducing me valuable research techniques and encouraging me to consider different perspectives in research, and I would like to thank Prof. Sioles for enlightening my thinking about music and giving me thoughtful advice to improve my piano playing.

Last but not least, I want to thank my parents for their endless love and support for all the years. Thank you for believing and encouraging me.
# TABLE OF CONTENTS

ACKNOWLEDGEMENTS .................................................................................................................. ii

LIST OF TABLES .............................................................................................................................. v

LIST OF FIGURES ............................................................................................................................ vi

ABSTRACT ..................................................................................................................................... vii

CHAPTER 1. INTRODUCTION AND REVIEW OF LITERATURE ..................................................... 1
   Introduction .................................................................................................................................. 1
   College Group Piano Teaching ................................................................................................. 2
   Group Piano Classroom Setup ................................................................................................... 5
   Collaborative Learning ............................................................................................................... 6
   Literature Review on Collaborative Learning in Group Piano .................................................. 13
   Organization ............................................................................................................................... 16

CHAPTER 2. METHOD ....................................................................................................................... 18
   Statement of Purpose ................................................................................................................... 18
   Participants ................................................................................................................................. 19
   Group Piano Classroom Setting ............................................................................................... 20
   Experimental Setup .................................................................................................................... 20
   Data Collection ........................................................................................................................... 23

CHAPTER 3. RESULTS ..................................................................................................................... 28
   Accuracy of Harmonization via Quantitative Analysis ............................................................... 29
   Confidence Level Assessment via Survey .................................................................................... 42
   Confidence Level Assessment via Open-Ended Questions ......................................................... 60

CHAPTER 4. DISCUSSION ................................................................................................................ 69
   Accuracy of Harmonization ....................................................................................................... 70
   Confidence Level Assessment .................................................................................................... 76
   Implications of Collaborative Learning Application in Other Functional Skills ....................... 82

CHAPTER 5. CONCLUSIONS .......................................................................................................... 86

REFERENCES .................................................................................................................................. 89

APPENDIX A. IRB EXEMPTION AND CONSENT FORM ............................................................. 94

APPENDIX B. LESSON PLANS ...................................................................................................... 95

APPENDIX C. PRETEST, INTERIM ASSESSMENT, AND POSTTEST FOR GROUP PIANO I AND III ................................................................................................................................. 101
APPENDIX D. RUBRICS FOR PRETEST, INTERIM ASSESSMENT, AND POSTTEST FOR GROUP PIANO I AND III………………………………………………………………………………………….105

APPENDIX E. HARMONIZATION SELF-EVALUATION SURVEY………………………..107

APPENDIX F. QUESTIONNAIRE WITH OPEN-ENDED QUESTIONS………………….108

VITA……………………………………………………………………………………………..109
LIST OF TABLES

1. Independent-Samples t-test Results for Pretest, Interim, and Posttest for Group Piano I……31
2. Independent-Samples t-test Results for Pretest, Interim, and Posttest for Group Piano III……33
3. Group Piano I’s Survey Results for Pretest and Posttest……………………………………44
4. Group Piano III’s Survey Results for Pretest and Posttest……………………………………47
5. Wilcoxon Signed-Rank Tests for Group Piano I’s Survey Results ……………………………52
6. Wilcoxon Signed-Rank Test Statistics for Questions 1 and 3 from the Control Group in Group Piano I……………………………………………………………………………………53
7. Mann-Whitney U Tests for Group Piano I’s Survey Results ……………………………54
8. Mann-Whitney U Test Statistics for Question 1 from Group Piano I in the Pretest…………55
9. Mann-Whitney U Test Statistics for Question 4 from Group Piano I in the Posttest………55
10. Wilcoxon Signed-Rank Tests for Group Piano III’s Survey Results……………………57
11. Wilcoxon Signed-Rank Test Statistics for Questions 8 and 12 from the Experimental Group in Group Piano III……………………………………………………………………58
12. Mann-Whitney U Tests for Group Piano III’s Survey Results……………………………59
13. Mann-Whitney U Test Statistics for Questions 4 and 8 from Group Piano III in the Posttest…60
LIST OF FIGURES

1. Scaled mean test scores (over time) for Group Piano I and Group Piano III .......................... 35

2. Melody comparisons between control and experimental groups from pretest to posttest for Group Piano I ........................................................................................................................................... 36

3. Chord comparisons between control and experimental groups from pretest to posttest for Group Piano I ........................................................................................................................................... 37

4. Accompaniment comparisons between control and experimental groups from pretest to posttest for Group Piano I ........................................................................................................................................... 38

5. Continuity/coordination comparisons between control and experimental groups from pretest to posttest for Group Piano I ........................................................................................................................................... 39

6. Melody comparisons between control and experimental groups from pretest to posttest for Group Piano III ........................................................................................................................................... 40

7. Chord comparisons between control and experimental groups from pretest to posttest for Group Piano III ........................................................................................................................................... 41

8. Accompaniment comparisons between control and experimental groups from pretest to posttest for Group Piano III ........................................................................................................................................... 41

9. Continuity/coordination comparisons between control and experimental groups from pretest to posttest for Group Piano III ........................................................................................................................................... 42

10. Responses to open-ended Question 1 from control and experimental groups regarding the most confident functional skill (Group Piano I and Group Piano III) ........................................................................................................................................... 61

11. Responses to open-ended Question 2 for the control group’s questionnaire and Question 4 for the experimental group’s questionnaire regarding the most favorite in-class activity (Group Piano I and Group Piano III) ........................................................................................................................................... 63

12. Responses to open-ended Question 3 on how students felt when they played the harmonization examples for the control group’s questionnaire (Group Piano I and Group Piano III) ........................................................................................................................................... 64
ABSTRACT

Current university-level group piano classes may not provide adequate training on functional keyboard skills needed by non-keyboard professional musicians. Innovative teaching strategies involving collaborative learning have been successfully demonstrated in other areas of education (e.g., math, science, and English) and might efficiently improve students’ functional keyboard skills. This dissertation examined the effects of collaborative learning on harmonization in college group piano classes. This study explored the differences between performance outcomes among students who collaborated to learn harmonization, as opposed to those who worked alone. It also investigated how collaborative work influenced students’ attitudes and confidence toward learning and performing harmonization.

Non-keyboard music majors \( N = 111 \), including 71 students enrolled in Group Piano I and 40 students enrolled in Group Piano III at Louisiana State University, participated in the study. The participants were divided into control and experiment groups. Students in the experimental group engaged in collaborative learning activities, whereas students in the control group worked alone on the harmonization exercises.

Pretest, interim assessment, and posttest were given to all participants to evaluate their performance outcomes. The performance of most participants improved from pretest to posttest. Analyses of the data revealed that statistically significant differences between the groups after the treatment, indicating that collaborative learning positively affected students’ achievement in harmonization.

After the pretest and posttest, participants filled out a self-evaluation Likert scale survey. There were significant differences for questions related to confidence, preparation, persistence. The experimental group appeared to develop better attitudes and confidence toward learning and
performing harmonization. Experimental participants reported positive engagement with collaborative learning activities and many chose harmonization as their favorite in-class activity.
CHAPTER 1. INTRODUCTION AND REVIEW OF LITERATURE

Introduction

At the college level, undergraduate music majors have to enroll in group piano classes to learn keyboard skills and complete required piano competencies set by the National Association of Schools of Music (NASM). The NASM recommendations state that all undergraduate music major students must demonstrate basic levels of piano competency before graduating and are required to complete their keyboard proficiency exams by the end of the sophomore year in order to be ready to take more advanced music classes (NASM, 2017). The main functional keyboard skills that teachers use include (but are not limited to) sight reading, improvising, accompanying, harmonizing, transposing, and playing by ear (Christensen, 2000; Young, 2013). Mastering these skills allows future music educators to play the keyboard adequately and appropriately in a public-school setting, thereby enhancing the learning experience for students (Lyke, 1968).

Aside from the recommendations set by NASM, the keyboard has been identified as a tool that helps simplify the complexity of music theory because of the instrument’s layout (Pike, 2017; Suzy, 2014). Music theory can be used to explain harmony, melody, and rhythm, and it is of importance for composition, improvisation, and rehearsals. The piano keyboard is laid out in half steps, octave after repeating octave, which eliminates any guess work when learning music theory. Also, the range of the piano keyboard is wider than other instruments. One can hear chord progressions in a wide range of octaves with the piano, a feature that cannot be found in other instruments. In particular, chord progressions represent harmony, and using the piano allows one to understand the music theory behind harmony more completely (Suzy, 2014). Similarly, using the piano helps one understand enharmonic notes and key signatures (e.g., formulas to create scales) in a much easier manner, and such knowledge could then be
transferred to one’s own instrument (Pike, 2017; Suzy, 2014). In addition, most instruments only produce a single note and rhythm at a time, whereas on the piano students can create more complex rhythms, melody, and harmony (Pike, 2017), thereby allowing them to fully enjoy their own musical playing. Hence, having adequate piano knowledge could be quite useful to non-keyboard music majors’ future musicianship.

Also, there are several career paths for undergraduate music majors, which are public school music teachers, university faculty members, professional performers, private music teachers, theorists, historians, and therapists (Mathaug, 2004). Each career path listed above requires some degree of piano knowledge. For instance, Young (2013) conducted a study to show that sight-reading, playing chord progressions, playing scales, reading open scores, transposing melodies, and harmonizing melodies are the critical piano functional skills needed for any professional musician. These functional skills can be taught in college group piano classes, where students are expected to demonstrate each functional skill at a competency level determined by the music faculty at each institution (Pike, 2014). However, some music educators believe that current group piano practices do not provide adequate training on the functional piano skills that are needed for many professional musicians (Young, 2013).

**College Group Piano Teaching**

In the United States, since 1889, teaching piano in groups has been a typical format at the university level because it is efficient and students tend to develop musical skills more quickly in a group setting (Kokotsaki & Hallam, 2007; Pike, 2017; Shockley, 1982). Group teaching typically plays an essential role in many educational settings, particularly at the beginner and school levels (Daniel, 2004). Also, there are a number of conferences and seminars, such as the Music Teachers National Association Conference (MTNA), the National Conference on
Keyboard Pedagogy (NCKP) and Group Piano – Piano Pedagogy Forum (GP3), devoted to the group piano teaching format in recent years (Fisher, 2006). These types of conferences allow college and university group piano teachers to share their teaching strategies and research results, along with any ideas for shaping the direction of the profession in the future (Fisher, 2006).

There are a number of advantages for group piano teaching as opposed to the one-to-one piano lesson. A few benefits are provided here. One notable observation is that beginners appear to progress more quickly in a group setting than they do on their own (Pike, 2017). There is a general belief that piano students who learn in groups have more opportunities to perform in front of others; such experience is quite useful as students gain performance experience, poise, and composure in front of others (Burkett, 1982; Fisher, 2006; Pike, 2017; Shockley, 1999). Group piano students are also exposed to a wide variety of repertoire because they have more individual repertoire assignments (Fisher, 2006; Pike, 2017). In addition, students learn to rehearse and perform ensemble music in group piano classes (Pike, 2017). In particular, students tend to develop improved listening skills in groups (Burkett, 1982; Fisher, 2006; Johnson, 1981; Pike, 2017). When students listen to their peers’ play, they start to look for correct notes, rhythms, tempi, dynamics, phrasing, and pedaling involved in others’ playing. More importantly, the group piano lesson is a great platform for students to experience discovery learning as opposed to receptive learning that is typically found in one-to-one piano lesson (Fisher, 2006). Note that in the current context, receptive learning is defined as a learning style in which teacher transfers his/her knowledge to a group of passive recipients who simply accept the information and commit it to their memories, whereas discovery learning involves learning by discovery, meaning what is to be learnt has to be discovered by the learner himself/herself.
Two types of group piano classes are offered at most American universities: courses for music majors and for non-music majors (Young, 2013). Courses for non-music majors typically introduce students to reading notation and beginning piano pieces, while courses for music majors focus on developing functional piano skills that music majors will use in their future teaching careers (Chin, 2002; NASM, 2017; Young, 2013). In addition, there are quite a number of group piano textbooks available for the university music majors and non-majors (Pike, 2017; Fisher, 2006).

In general, a number of music students who enter college possess some degree of piano knowledge, but often not enough to pass each functional skill at the required competency level. College group piano classes often serve as great learning platforms for these students to master adequate proficiency in all required skills. Most often, students are expected to pass the competency requirements after two to four semesters of group piano lessons. However, there are quite a few music students who possess very little or no previous piano experience before college. These students have to first learn basic keyboard techniques before they can develop the requisite skills for proficiency. In particular, these students will need additional help and coaching, and often require a much longer time to learn the necessary skills to pass the competency test. They often find the 60 weeks of group piano instruction (in a four-year undergraduate curriculum) to be too short and insufficient for mastering the necessary functional skills (Meulink, 2011; Young, 2013).

To maximize teaching efficiency, it would be ideal for music faculty to place students of similar levels in the same group piano class. However, this is generally not the case owing to the size of the institution and the available resources, and students with different piano skills often find themselves in the same piano class (Baker, 2008; Meulink, 2011). With students of different
skill levels, group piano teachers also find it difficult to help all students become competent in all functional keyboard skills. Meanwhile, if the instructors don't use group teaching techniques, students (in group piano classes) tend to learn the materials individually, which might promote students’ competitiveness among each other or sometimes even despair (Slavin, 1990). Students who are more outgoing and more academically adept may be more active in class by asking and answering questions from teacher; these students tend to perform well. On the contrary, some students who struggle to keep up with the class can become discouraged and less motivated to participate in any class activities or even skip classes. Owing to students with different skill levels and/or different personalities, teachers cannot give individual students enough attention without slowing down the entire class or without spending extra time outside of his/her assigned teaching hours. A different teaching strategy is needed in order to hasten students’ piano learning process and also meet each student’s needs in group piano classes.

**Group Piano Classroom Setup**

Group piano classrooms typically consist of electronic keyboards equipped with a controller system that connects the teacher’s keyboard to the students’ instruments via headphones (Chin, 2002). Students can practice alone (without any distraction) or work in groups. The teacher can communicate with individual students, small groups or the entire group via headphones. Students can hear each other’s playing in this small group set up. The teacher’s keyboard can be heard in some settings.

Instead of practicing alone, students are often encouraged to work in groups. Students who require more attention can potentially receive help from their peers (who are more academically adept with certain musical concepts), thereby maximizing the time spent in class (Meulink, 2011). Learning can be more effective when students learn from each other.
will work together in small groups, share ideas, and reach a general consensus of answers. This type of learning style is considered as collaborative learning. Collaborative learning can be implemented in the college group piano setting.

**Collaborative Learning**

In the traditional pedagogical model, a master teacher transfers his/her knowledge (e.g., specialist technical, expressive, interpretive, and performance skills) to the student apprentice (Forbes, 2016); however, it is quite challenging to teach large numbers of students efficiently and effectively using this model. Bruffee (1999) stated that “the hierarchical authority structure of traditional classrooms can impede learning” (p. 89). Hence, innovative teaching strategies involving collaborative learning have recently been explored by instructors in many educational settings (e.g., music, science, and English). This type of instruction tends to be more informal, fluid, and dynamic as compared to the formally-structured classes (Reid & Duke, 2015). Collaborative learning reconceives the traditional roles of teacher and students (Forbes, 2015). In collaborative learning, teachers’ jobs are not to transmit their knowledge to their students. Instead, collaborative learning emphasizes the fact that knowledge must be constructed within a community of learners (Forbes, 2015). Students can “learn from each other as cooperative peer learners focused on a specific task and perhaps reflecting on and critiquing each other’s work within formal, teacher directed situations” (Reid & Duke, 2015). In other words, students are not simply working side by side to complete individual tasks, but they are actively involved in assisting each other to master the materials so that each of them improves his/her own understanding (Zbikowski & Long, 1994). For many disciplines, the collaborative learning environment can take place at various locations, such as the college coffee shop, the nearby park, the mutual study session, etc.
It is believed that there are several good outcomes resulting from the collaborative learning environment. First, collaborative learning leads to several positive effects, such as increased retention, student satisfaction, self-initiated and self-directed learning, lifelong learning, critical reflection and evaluation (Reid & Duke, 2015; Forbes, 2016; Hunter, 2006; Lebler, 2013). Additional positive effects for students, including “improved intellectual achievement, deeper understanding of subject matter, increased empathy, respect for others, and co-operation skills,” have been reported by Christophersen (2013). In particular, collaboration instills a sense of excitement and musical purposes both individually and collectively in students (Forbes, 2016). Second, collaborative-learning activities could reduce the high workload of the teaching staff, because students are responsible for their own learning (Reid & Duke, 2015). Third, collaborative-learning activities help students develop generic skills, creativity, joint problem solving, and a variety of other skills pertinent to their professional lives (Forbes, 2016; Reid & Duke, 2015). Fourth, within higher music education, instrumental teachers often expect their students to become independent, and collaborative learning allows students to achieve this goal. Students can “gain a greater sense of ownership and autonomy as learners and artists,” and their sense of self-efficacy can also be enhanced via observing and working with others (Hanken, 2016). Last, but not least, teachers could benefit from participating in collaborative learning activities with their fellow teachers (Hanken, 2016). This type of professional development can be done by attending workshops or conferences where they can exchange their knowledge, thereby evolving their pedagogical practice either individually or collaboratively with their fellow teachers (Hanken, 2016).

Fisher (2006) stated that successful results cannot be produced by simply organizing groups and instructing them to work together. Instead, cooperative learning must be structured
for success by teachers. Teachers often play major roles in executing an effective collaborative learning environment. One of the main roles for teachers is to design an effective task (Wiener, 1986). The quality of the initial tasks that students perform in class are crucial to the success of the implementation of subsequent effective collaborative learning activities. These initial tasks given by teachers should help students “reach consensus by their own authority,” with consensus being defined as “an intellectual negotiation which leads to an outcome through a process of taking responsibility and investing collective judgment with authority” (Wiener, 1986, p.55).

Second, teachers should act as classroom managers by ensuring that students in groups demonstrate an ability to work together and to complete their tasks in a timely manner (Wiener, 1986). Third, teachers need to understand their roles during group work. The main goal for teachers is to “help students gain authority over their knowledge and gain independence in using it” (Wiener, 1986, p.57). Teachers should avoid joining the group discussion too frequently because such interference might undermine the development of that authority (Wiener, 1986). Finally, teachers should serve as synthesizers after the activity in groups is complete (Wiener, 1986). In the collaborative learning environment, each group will share its consensus with the rest of the class, and teachers must help the whole class “to make sense and order out of the sometimes conflicting and contradictory reports” (Wiener, 1986, p.58). An example is provided as follows.

Imagine there is a group of three piano students taking a class together, and they take turns performing the assigned piece in their lessons. When one student performs the piece, the other two students listen, provide some feedback, ask questions, and discuss some technical solutions. By doing so, students can feel a sense of ownership of the lesson. Also, students can observe how their fellow classmates gradually work through their problems through determined
effort (without giving up). This allows students to realize that learning is a gradual process, which requires many steps (Falchikov, 2007). In particular, students can learn that hard work or perseverance is the key to success, and that a bad performance is the result of one’s insufficient effort rather than lack of talent. As for the teacher, he/she could be a facilitator in the classroom. The teacher should not interfere the students’ discussion unless some incorrect information is being explored, but he/she may occasionally ask a question to guide them to go deeper into the issue. The teacher should seldom correct students during collaborative learning activities, as this would undermine their sense of authority and ownership. If a mistake is found in the process, the teacher could approach individual student after group lessons to address the potential problem. Also, keep in mind that students are the ones responsible for their own learning, and they should eventually become independent of the teacher.

Furthermore, teachers should carefully select a proper group size to achieve a good learning outcome. Researchers suggested that a smaller group size might enhance the efficiency of collaborative learning. Johnson and Johnson (1999) recommended an ideal group size of two to four members, while Cohen (1994) proposed an optimal group size of four to five members for group discussion. Also, Johnson and Johnson (1999) provided some additional guidance on how to effectively form discussion groups. They discussed the need to increase the resources to help the group succeed every time when a new team member joins the existing group. They stated that a smaller group size is typically preferred if there is a limited amount of time available in class, because each member tends to interact with each other more in any group discussions, thereby promoting a good learning environment. In particular, it is also easier for teachers to identify any difficulties or problems students might encounter when working together in a smaller group setting. However, if a larger group is chosen, each group member must possess
some unique skills. Teachers might also need to be cautious about a larger group size as less interaction among members might occur, thereby inhibiting the collaborative learning environment. In addition, Johnson and Johnson (1999) stressed that the materials available or the specific nature of the task may dictate the group size in most settings. Moreover, previous research in non-musical domains (Basden, Basden, & Henry, 2000; Bouchard & Hare, 1970) demonstrated that group sizes of four or more could potentially create collaborative inhibition, whereas group sizes of two or three tend to promote more collaborative facilitation.

In addition to proper group size, Bruffee (1999) stated that a number of other factors, such as degree of heterogeneity, ethnic background, phases of work, students’ skill sets, and personalities, should be considered in order to foster successful learning within the group. Fisher (2006) suggested that heterogeneous groupings should be used in collaborative learning activities. He argued that this type of grouping allows for a rich diversity of personalities, abilities, experiences, interests, perspectives, and reasoning strategies, thereby enriching the experience of collaborative learning. He also recommended that random assignment might be the easiest method for assigning heterogeneous groups.

Moreover, Deutsch (1962) stated that working collaboratively promotes more positive attitudes toward the work than working individualistically does. There are “responsibility forces” existing in collaborative situations (Deutsch, 1962). Such forces resulted from a common understanding that one’s achievement affects the grades of groupmates; hence, students will work harder to achieve and will also expect their groupmates to do the same, thereby creating a positive interdependence outcome. Another study from Howng, Caswell, Johnson, and Johnson (1993) showed that music achievement was greater when positive interdependence outcomes were structured within learning groups than when students work individualistically on their own.
Their study also revealed that collaborative experiences resulted in more positive attitudes toward classical music and one’s own musical skills. In particular, students in the collaborative setting were found to: be more on-task academically (e.g., walking around the room less frequently), initiate fewer interaction with the instructor, perceive the instructor to be more supportive, perceive the grading system to be fairer, and perceive the feedback received as being more helpful (Howng, Caswell, Johnson, & Johnson, 1993).

Hanken (2016) stated that the collaborative learning environment is “an arena for inspiration and cooperation, but not for competition and envy.” From her study, students felt that the learning environment was safe, and it allowed them to trust one to another, freely experiment and share work in progress with each other. They gained more self-esteem and security in their role as musicians after engaging in collaborative learning. They also learned how important it was to be more open to other musicians’ understanding of music. They understood that they could benefit from being confronted with diverse ideas from others. Some students from her study even commented that “listening and giving feedback to each other has made them listen more actively both to their own playing and to the performances of other musicians” (Hanken, 2016). Throughout this experience, students appeared to develop skills including how to articulate their opinions and provide constructive feedback (Hanken, 2016); these skills are deemed to be essential for future professional musicians.

Although collaborative learning has many merits, some studies reported that collaboration could inhibit individual learning (Tindale & Sheffey, 2002; Stroebe & Diehl, 1994; Brandler & Peynircioglu, 2015). Brandler and Peynircioglu (2015) stated that collaboration could potentially block individual productivity or diminish individual motivation. This could happen when members “free-ride” off other members; these members might think their
individual contribution is less valuable than what others can offer (Davis, 1969; Latane, Williams, & Harkins, 1979; Tindale & Sheffey, 2002). As a result, members may not be as focused and thus spend less time learning the material during collaboration (Stroebe & Diehl, 1994; Brandler & Peynircioğlu, 2015).

Evaluation apprehension might occur in collaborative setting (Diehl & Stroebe, 1987). For instance, in a collaborative rehearsal setting, with other singers in the room, some singers might feel self-conscious, and their primary focus might have switched from learning to not appearing inferior to the other ensemble members, thereby inhibiting their proper learning progress (Brandler & Peynircioğlu, 2015). Such inhibitory effects are especially common when group members are not familiar with each other (Lim, 2013). If members get familiar with each other over time, they could gain cohesiveness and develop some strategies for efficiency in initial learning, thereby counteracting any negative impacts from potential “free-riding” (Lim, 2013). Further, it is quite crucial to make students understand that their contribution to the group is of importance (Forbes, 2015).

Despite a few potential negative issues, collaborative learning has begun to be implemented in the area of higher music education, primarily focusing on instrument-specific group classes, such as horn (Bjøntegaard, 2015; Luff & Lebler, 2013), drum kit (King, 2008), vocal (Latukefu, 2010; Latukefu & Verenikina, 2013), piano (Baker, 2008; Pike, 2014), and song-writing (Baker & Krout, 2012). Further, some studies have investigated the effects of combining individual and collaborative learning in higher music education (Bjøntegaard, 2015; Luff & Lebler, 2013). The outcome was found to be appropriate, effective, and enjoyable, and the combination of both pedagogical models was recommended as “the best way of educating students as responsible, reflective and professional musicians” (Bjøntegaard, 2015).
Literature Review on Collaborative Learning in Group Piano

To promote a faster learning process in piano at the university level, music educators have started to incorporate collaborative learning in college group piano teaching. Effective collaboration in piano settings involves positive interdependence among group members, individual accountability and personal responsibility within the group for completion of the task, face-to-face interaction among students, use of interpersonal and small group skills to solve the problem or resolve conflict within the group, and group processing. As a result, students tended to listen, concentrate, be responsible, exert self-control, handle disappointments, and generally care more about learning (Pike, 2014).

Baker (2008) investigated the effects of collaborative learning on students’ achievements in sight reading at the piano and determined whether collaborative learning would positively affect students’ attitude toward sight-reading at the piano. Using a mixed methods research approach, she selected a total of 85 students from Group Piano II and Group Piano IV classes. The students were divided into experimental and control groups. The experimental groups received weekly collaborative learning sessions, which consisted of sight-reading duet and solo repertoire. As for the control groups, the students completed the sessions individually without any collaboration. By comparing the pretest and posttest scores, all students demonstrated significant improvement in left-hand rhythmic and pitch accuracy between the pretest and posttest. In particular, the experimental groups had a significantly better achievement than the control groups (Baker, 2008). In addition, after the collaborative learning sessions, students from the experimental groups “felt more confident in their abilities to move forward or maintain continuity while sight-reading even if errors occurred during playing” (Baker, 2008, p.67). Consequently, students from the experimental groups appeared to have an overall positive
attitude toward the peer learning experience and their personal sight-reading abilities (Baker, 2008).

Pike (2014) had students implement cognitive strategies during collaborative learning in the group piano lab. She stressed that “an important component of cognition and learning is the limitations that humans experience with respect to cognitive load” (Pike, 2014, p.81). In particular, playing the piano is a complicated cognitive activity, which could cause some cognitive overload in students at any stage of learning. To alleviate such overload, teachers can implement effective cognitive strategies including chunking, elaboration, generation, and distributed practice in order to help students develop critical piano skills in the brief period of time (Pike, 2014). In this mixed methods research study, the participants were selected from two sections of a fourth semester piano class. One section was selected as the experimental group that engaged in collaborative activities with the implementation of cognitive strategies, while another section was selected as the control group, for comparison of in-class observations and performance tests. At the end of the semester, students from the experimental group tended to score higher on sight-reading and harmonization than those from the control group (Pike, 2014). The study also found that students from the experimental group appeared to have an enjoyable time, employ various practice strategies, and creatively use many tools available on the digital pianos while practicing (Pike, 2014). Additionally, there were significant improvements in continuity, musical flow, persistence, and self-efficacy from the experimental group after ten weeks of collaboration. On the contrary, students from the control group appeared to be filled with frustration and fear (Pike, 2014).

Meulink (2011) developed a comprehensive teaching guide that incorporates collaborative learning methods into the teaching and learning of functional keyboard skills in
college group piano classes. This guide could be used as a supplementary teaching material in conjunction with any current curriculum to teach functional keyboard skills. This guide covers a minimum of four detailed lesson plans for each functional skill (36 plans in total), and the plan includes functional skill objectives, collaborative skill objectives, specific collaborative learning methods, suggested time frame to complete the lesson, a definition of the collaborative methods, an application of the methods to the specific plan activity, grouping requirements, necessary teacher’s preparation, sequence of activities, and assessment procedures and tools (Meulink, 2011). In particular, each collaborative learning method, such as Think-Pair-Square, Numbered Heads Together, Inside-Outside Circle, etc., is intended to instill positive social skills in students. Interestingly enough, Meulink (2011) discovered that harmonization skill appears to be one skill that is emphasized the most in many group piano classes, and the application of collaborative methods seems to be quite easy to be implemented into harmonization lesson plans. Consequently, the teaching guide contains the greatest number of plans for the harmonization section (Meulink, 2011).

Fisher (2006) implemented five collaborative learning strategies or activities (adapted from general education) in group piano classes. First, a tournament activity based on Robert Slavin’s Student Teams-Achievement Divisions and Teams-Games-Tournaments was employed to encourage students to practice more on technique (Slavin, 1991). Second, Fisher (2006) utilized an activity called Sight Reading Drill Pairs with Eye Check, based on Spencer Kagan’s Pairs Check (Kagan, 1994), to improve students sight reading skills and to examine eye activity. Third, a group activity called Harmonization Think-Pair-Share, also from Spencer Kagan (1994), was used to improve students’ abilities in harmonizing melodies. Fourth, a group activity named Styles Improvisation Investigation, from Shlomo and Yael Sharan’s Group Investigation (Sharan
was designed to instruct different styles of piano playing and improvisation (Fisher, 2006). The last group activity, Practice Partnerships, was designed based on David and Roger Johnson’s concept known as Cooperative Base Groups (Johnson & Johnson, 1999), and this activity was implemented to motivate students’ practice and preparation (Fisher, 2006). After engaging in these group activities, Fisher found that students developed a cumulative sense of cooperation. In addition, students appeared to have a noticeable growth in piano playing levels and to develop an increased sense of dedication to the instrument (Fisher, 2006).

Organization

This dissertation is organized in the following manner. Chapter one presents a rationale behind the present study. I provide a list of reasons for why non-keyboard music majors could benefit from taking college group piano classes. I also discuss both the advantages and disadvantages of using group piano classes to teach non-keyboard music majors who have very little or no previous piano experience. After that, I propose the possibility of implementing collaborative learning experiences into college group piano classes, followed by a detailed discussion on its benefits. In addition, examples of the application of collaborative learning to piano functional skills are provided.

Chapter two provides the statement of purpose for the present study, along with the experimental procedure used in this work. Chapter three presents the results of the present study, including pretests, interim assessments, posttests, self-evaluation survey questions, and questionnaire with open-ended questions.

Chapter four offers the discussion of the present study, along with the implications of applying collaborative learning experience in other functional skills, and chapter five summarizes the finding from the study. Appendix A provides the IRB consent form. Appendix B
details the lesson plan (along with some sample harmonization exercises) used in this study. Appendix C provides the pretests and posttests used in this study, followed by detailed rubrics offered in Appendix D. Appendix E provides the self-evaluation survey that is comprised of 12 Likert-scale questions, and Appendix F lists all the open-ended questions that are used to supplement the survey.
CHAPTER 2. METHOD

Innovative teaching strategies involving collaborative learning have shown some promising results on improving students’ functional keyboard skills within a brief period of time. However, collaborative learning strategies are relatively diverse in the field of music education, and not well-tested or reported in group piano teaching literature. Hence, a comprehensive study which investigates the feasibility of applying collaborative learning strategies in college group piano classes is needed.

Statement of Purpose

A study on the effects of collaborative learning on harmonization in group piano classes was conducted for this dissertation. Sight-reading and harmonizing melodies for accompaniment purposes have long been considered important functional piano skills for future music educators to learn in class piano (Betts & Cassidy, 2000). In addition, previous researchers implemented collaborative learning strategies for sight reading, where positive outcomes were reported (Pike, 2014; Baker, 2008). However, very few efforts have been reported on the effects of collaborative learning on harmonization skills. The purpose of this study was to examine the effects of collaboration on 1st and 2nd year college music major students’ harmonizing skills in a group piano program. Two specific research questions were addressed, which were (1) whether students who worked in groups of two or three learned harmonization more accurately than those who worked alone and (2) how collaborative work influenced students’ attitudes and confidence toward learning and performing harmonization.

Harmonization can be defined as the ability to add and play chords in the left-hand based on the melodies that the right-hand plays (Lancaster & Renfrow, 1999). It requires students to choose the appropriate harmony, and appropriate accompanying patterns, in order to harmonize
the melodic line. A mixed-method design was used (including both quantitative and qualitative instruments) to examine the development of harmonization skills among students. The dependent variables measured in this study were (1) accuracy of harmonization and (2) attitudes and confidence toward learning and performing harmonization.

Participants

The study included one hundred and eleven non-keyboard music majors (N = 111), including 71 students enrolled in six sections of Group Piano I (first semester class of a four-semester group piano sequence) and 40 students enrolled in four sections of Group Piano III (third semester class) at Louisiana State University in the fall of 2018. IRB approval was obtained prior to the study (see Appendix A). Subjects were eligible to receive full points for three quizzes if they participated fully in the study. After being informed verbally, students from six sections of Group Piano I and four sections of Group Piano III were given the option to volunteer to participate in the study. Prior to the experimental period, subjects signed the IRB consent form and had an opportunity to ask questions or discuss the details regarding the research. Subjects were eliminated from the study if they failed to participate in any exercises during the experimental period or did not complete the posttest.

Both Group Piano I and III sections met for fifty minutes, twice a week (14 weeks in total). Students in Group Piano I used *Alfred’s Group Piano for Adults, Book 1* as their primary text, whereas students in Group Piano III used *Alfred's Group Piano for Adults, Book 2* (Lancaster & Renfrow, 2008). All classes were held in the keyboard lab at Louisiana State University. All sections were taught by three graduate teaching assistants (TAs): two Ph.D. students (including the researcher) and one Master of Music student. The years of teaching experience with group piano classes for these TAs were 6 years for one Ph.D. student (i.e., the
researcher), 3 years for another Ph.D. student, and 1 year for the Masters student. One of the threats that might interfere with the present study could be the effect of different teachers for different sections. To eliminate such effect as much as possible, I taught all of the experimental groups (5 groups) and two control groups (one for Group Piano I and one for Group Piano III). For the remaining control groups, I frequently observed how the other two teaching assistants interacted with the students during the study to ensure that the study would go as smoothly as possible.

**Group Piano Classroom Setting**

There were 16 standard-sized individual digital pianos (or workstations) in the keyboard lab. Each digital piano was equipped with a computer station, and each student was provided with an individual headphone. These pianos were also connected to the teacher’s instructional console. Hence, the teacher was able to control each individual workstation, listen to each individual student’s playing, communicate with the students, and demonstrate to the entire class or to an individual student. The setup allowed students to practice alone without any distraction from others, or engage in group activities as directed by the teacher. Students could be combined into dyads or small groupings for ensemble practice or for any other group work. Also, the teacher could set the appropriate controller setting so that group members could only hear each other during group activities. In addition, there was other equipment available in the piano lab, such as Visualizers, overhead projectors, etc.

**Experimental Setup**

This experiment took ten weeks. Each student was required to take a pretest, an interim test, and a posttest. The test scores were compared at the end of the experimental period. These tests were comprehensive, assessing the knowledge of harmonization covered during the
semester for each Group Piano class. These tests measured one of the dependent variables, the accuracy of harmonization. Accuracy included the choice of the chords and appropriate accompaniment of the harmonization.

After both the pretest and the posttest, students completed a self-evaluation survey. This survey assessed the second dependent variable: students’ attitudes and confidence toward learning and performing harmonization skill. The independent variable in this study was group placement. Groups were assigned control or experimental based on convenience. For Group Piano I classes, three sections were chosen as the control group ($n_1 = 35$), whereas the remaining three sections were selected as the experimental group ($n_2 = 36$). Similarly, for Group Piano III classes, two sections were chosen (based on convenience samples) as the control group ($n_1 = 12$), the remaining two sections served as the experimental group ($n_2 = 28$). Students in the experimental group worked in groups of two or three on the harmonization exercises during class. Students in the control group worked independently on the same exercises. The experiments were conducted at the beginning of each class period, and typically involved fifteen minutes of class time for both groups to work on harmonizing skills. Students in the control group were instructed to practice alone without any communication with others, except the instructor, during the experimental period. It should be noted that the researcher was directly involved in the experiments for all sections of group piano classes (i.e., the first 15 minutes of the class time when the experiments took place). The in-class exercise materials were selected mainly from the primary text for the course, and a sample lesson plan (along with sample harmonization exercises) is provided in Appendix B.

Fisher (2006) provided a list of activities and exercises that apply cooperative learning strategies to selected curricular competencies for group piano instruction. Note that the activities
were originally proposed by Kagan (1994) and were then adapted by Fisher (2006). This study utilized the Think-Pair-Share collaborative strategy developed by Kagan (1994) (also adapted by Fisher (2006)). The Think-Pair-Share strategy helps students learn how to think individually about a question, teaches students to share ideas with their classmates (thereby building their oral communication skills), and helps focus attention and engage students in comprehending the assigned (difficult) materials (Kagan, 1994). To implement this strategy properly, the instructor decides what materials (e.g., exercises or reading texts) are needed to cover the key concepts. Then the instructor elucidates the purpose of this strategy and provides guidelines for discussions. After that, the instructor needs to model the procedure to ensure that students understand how to use the strategy. Lastly, the instructor monitors and supports students while they are working through the following steps. Students first think individually on a topic/problem assigned by the instructor (the Think process). Then they pair up with a partner to discuss and compare their thoughts (the Pair process). If their ideas are different from each other, they need to explain their thought processes and try to reach a general consensus. After that, students in each pair are asked to share their thoughts with the entire class (the Share process). This structure intends to stimulate students’ participation and involvement (Fisher, 2006), and it was used to investigate its effectiveness on improving students’ harmonizing skills.

The Think-Pair-Share collaborative strategy (Kagan, 1994; Fisher, 2006) was implemented into the experimental group. In the current context, the instructor would assign an appropriate harmonization exercise. Students from the experimental group first thought about how to work on harmonization individually (e.g., decide what chord structures need to be used, or if any inversion of the chords is needed) after receiving the piece from the instructor. Then they paired up (sometimes in a group of 3) and discussed their solutions with each other verbally.
For instance, students in each pair would discuss what an appropriate harmony should be or what a good harmonic progression for the melodic line should be. If there were some discrepancies, students would explain their reasonings to their partners and attempt to reach a general consensus. When an agreement was reached, one student would play the melody line while the other student was playing the chords, or vice versa. Once they had a good handle on the previous tasks, students in each pair would then play with both hands together for the exercise, and prepared to play out loud in front of the entire class. The instructor could play the melody line while students from each pair would play the chords in front of the whole class. Or, they could be asked to play the exercise with both hands by themselves. In the control group, students simply worked independently without communicating with classmates.

For both experimental and control groups, the instructor walked around the classroom and guided students requiring assistance for the duration of the experiment. On some occasions, the instructor provided specific instruction and facilitated the learning activity, as necessary.

Data Collection

A pretest, an interim assessment, and a posttest were given to subjects in order to evaluate their individual harmonization skills. For both the pretest and posttest, the materials were not selected from the primary texts used by the Group Piano I and III students. Instead, the instructor chose the pieces from another text *Harmonization at the Piano, 6th edition* (Frackenpohl, 1990). The examples were modified to match the skills addressed in the primary text. The researcher arranged the rhythms and melodies for the pretest and posttests examples. Using arranged examples from another source decreased the risk of students seeing the examples prior to their pretest and posttest. It eliminated the potential for previewing the pieces. The pretest and posttest for harmonization are provided in Appendix C. Note that an identical test
was used for pretest and posttest for students in Group Piano I, and another, more difficult identical test (that was more tailored to their expected skill levels) was provided for pretest and posttest for students in Group Piano III. The level of difficulty for the tests was appropriately chosen based on their expected theory knowledge and physical coordination of both hands (i.e., their expected piano performance levels) for group piano students.

**Rubrics for Pretest, Interim Assessment, Posttest.** The pretest and posttest were evaluated for chords, accompaniment pattern style, and melody, continuity/coordination. Appropriate realization of each example required using primary chord progressions, secondary dominants and the correct accompaniment pattern. In the pretest and posttest, there were a total of 101 points for Group Piano I and a total of 105 points for Group Piano III.

For Group Piano I’s pretest and posttest, there were 20 chords with a broken-chord accompaniment in the left hand. Two points were assigned for each accurate chord, totaling 40 points. The melody was worth thirty-seven points in total. Correct pitches and rhythms earned students 1 point per note. For each accompaniment, there were 12 measures. Students who successfully played the broken-chord accompaniment style for all 12 measures received a total of 12 points for accompaniment (i.e., 1 point per measure in the broken-chord accompaniment style). If they used block-chords for all measures, they earned only 6 points (as partial credits). In addition, there were 12 measures for continuity/coordination that were worth 12 points. If there was a hesitation or lack of coordination between the hands, one point was deducted from the score for continuity/coordination. Students could not lose more than one point per measure in this category. A maximum score of 101 points could be obtained from the pretest and posttest for Group Piano I.

For Group Piano III, the same rubric was implemented for evaluating of harmonization
examples. The score distribution was 41 points for melody, 40 points for chords, 12 points for accompaniment, and 12 points for continuity/coordination. A maximum score of 105 was possible for the pretest and posttest.

In addition, an interim assessment was administrated five weeks after the pretest to check students’ grasp on harmonization skills and to guide on-going instruction. For this assessment, the researcher chose pieces at a similar level of difficulty to the pretests and posttests for both Group Piano I and Group Piano III classes. The interim assessment examples were chosen from each group’s primary textbook. For Group Piano I, the piece was from Book 1, page 131, example #4 (Lancaster & Renfrow, 2008); and for Group Piano III, the piece was from Book 2, page 154, example #2 (Lancaster & Renfrow, 2008). The grading criteria for interim assessment were the same as described above for both the pretest and posttest. The score distribution for interim test for Group Piano I was 21, 16, 8, and 8 for melody, chords, accompaniment, and continuity/coordination, respectively, with a total of 53 points. The score distribution for interim test for Group Piano III was 34, 28, 14, and 14 for melody, chords, accompaniment, and continuity/coordination, respectively, with a total of 90 points. The scoring rubrics are provided in Appendix D. It should be noted that 1 point was awarded for each correct measure for the melody, accompaniment, and continuity/coordination sections, whereas for chords, 2 points were given for each correct measure.

**Data Storage and Analysis.** The researcher purchased 16 USB drives for students to save their musical performances of their pretests, interim assessments, and posttests (for each section) in this study. The test was engraved by the researcher using a music score software, Version 2.0 of MuseScore (2015). Each subject first recorded the test data onto a USB drive and submitted the USB drive to the researcher. The researcher then saved these records to her
personal laptop for further analysis. After that, the researcher first listened and then evaluated the accuracy of harmonization in the pretest, followed by providing feedback to each individual student via writing.

To confirm the reliability of the grading from the researcher, another grader with a similar educational background (graduated with a DMA major in piano and with approximately four-year university-level group piano teaching experience) was sought for help. The additional grader evaluated two sections of Group Piano I and two sections of Group Piano III for both pretest and posttest. After that, the researcher compared the grades between the two graders by determining the intraclass correlation coefficients for average measures (using a two-way mixed effects model, along with an absolute agreement option) via Version 25 of the IBM SPSS Statistics software package (2017). If the intraclass correlation coefficient for average measures is higher than 0.7, then it indicates that reasonable agreement between graders can be found; hence, there is a good interrater reliability.

At the end of the pretest and posttest, the researcher also distributed a self-evaluation survey on harmonization. The same form was used for both tests. The survey consisted of 12 Likert scale questions, intended to measure students’ attitudes and confidence toward learning and performing harmonization. The questions for assessing students’ attitude towards learning harmonization are provided in Appendix E. Subjects were asked to circle the number that corresponded with their feelings (#1 if the answer is rarely; #5 if the answer is all or most of the time). This allowed students to evaluate themselves and also allowed the researcher to gain some understanding on students’ attitudes and confidence levels.

In addition, at the end of the experimental period, the researcher disseminated two different questionnaires to both the control and experimental groups: one questionnaire with 5
open-ended questions for the control group and one questionnaire with 14 open-ended questions for the experimental group. These questions were comprised of (but not limited to) how they felt about the collaborative learning process on harmonization, how they felt about working with their partners, what their thoughts were on the potential benefits, and if they would like to experience more collaborative work in the future. These open-ended questions would help the researcher gain a qualitative insight on the second research question, which was to examine whether collaborative work positively influences students’ attitudes and confidence toward learning and performing harmonization. These open-ended questions can be found in Appendix F. The answers provided by the students were coded and transcribed into the appropriate themes.
CHAPTER 3. RESULTS

The purpose of this dissertation was to examine the effects of collaboration on the first- and second-year college music students’ harmonizing skills in a group piano program. The independent variable in this study was group placement that consisted of control and experimental groups from Group Piano I and Group Piano III classes. Two specific research questions were addressed. The first was to investigate if students who worked in groups learned and performed harmonization more accurately than those who worked alone. The variable of interest (i.e., dependent variable) for this question was the accuracy of harmonization, including the components of melody, chords, accompaniment, and continuity/coordination. Students’ progress with harmonization skill development was monitored throughout the fall of 2018 by using the quantitative instruments, which were pretest, interim test, and posttest. By comparing the control and experimental test score differences, the effect of collaboration on students’ harmonization skills was discovered.

The second research question was to examine if collaborative work could positively influence students’ attitudes and confidence toward learning and performing harmonization. The variable of interest for this question was confidence level, which was measured using a self-evaluation harmonization survey and a questionnaire with open-ended questions. The survey included 12 Likert scale questions (with a 5-point scale), and students were expected to fill out the survey after pretest and posttest. The questionnaire with open-ended questions was also distributed to students at the end of the study, and the answers for the open-ended questions were transcribed and coded. Themes that emerged for each question were noted and general overarching themes were identified. This chapter discusses the results obtained from the pretest, interim test, posttest, self-evaluation survey, and questionnaire with open-ended questions.
Accuracy of Harmonization via Quantitative Analysis

The accuracy of harmonization was assessed using the pretest, interim test, and posttest for both control and experimental groups in Group Piano I and III. The scores were then analyzed for any statistically significant differences between control and experimental groups using Version 25 of the IBM SPSS Statistics software package (2017). Independent-samples t-tests were used to compare the scores between the control and experimental groups for all three tests.

Prior to any inferential statistical analyses, the sample of pretests was analyzed by an additional independent grader to check for interrater reliability (as discussed in the METHOD section). The independent grader evaluated two sections of Group Piano I (Sections 4 and 5; about 34% of Group Piano I) and two sections of Group Piano III (Sections 2 and 3; about 60% of Group Piano III). The same approach was used by Betts and Cassidy (2000). The intraclass correlation coefficients for average measures (using a two-way mixed effects model, along with an absolute agreement option) were found to be 0.865 and 0.818 for Group Piano I and III, respectively. Hence, there were good interrater agreement for the pretest scores in Group Piano I and III between two graders. Similarly, some posttests of Group Piano I (Sections 1 and 6) and Group Piano III (Sections 3 and 4) were analyzed by the independent grader to check for interrater reliability. The intraclass correlation coefficients for average measures were found to be 0.965 and 0.827 for Group Piano I and III, respectively, indicating that there were good interrater agreements for the posttest scores in Group Piano I and III between two graders.

Group Piano I’s Test Results. Table 1 shows the independent-samples t-test results for the pretest, interim test, and posttest for Group Piano I. The mean scores shown in Table 1 were the averages of the actual raw scores directly computed from the rubrics, meaning that the total
scores were not scaled to 100 points; the total scores for the pretest, interim test, and posttest were 101, 53, and 101, respectively. For the pretest, students from the control group \((n_1 = 35)\) received a mean score of \(X_1 = 60.6\) (out of 101) with a standard deviation of \(s_1 = 23.1\), whereas students from the experimental group \((n_2 = 36)\) received a mean score of \(X_2 = 63.5\) with a standard deviation of \(s_2 = 19.3\), resulting a mean difference of \(X_1 - X_2 = -2.9\). The independent-samples t-test was used to examine if such a mean difference was statistically significant. Prior to the t-test, Levene’s test was also performed to check if equal variances could be assumed. This step was particularly critical, because the SPSS output would typically provide two different t-test results, along with their corresponding \(p\)-values: one with equal variance assumption and the other with unequal variance assumption. As for the pretest, Levene’s test showed that equal variances can be assumed (as the corresponding \(p\)-value was 0.151); hence, the t-test result based on the equal variance assumption was used to interpret the observation. The t-value (for a two-tailed test) was \(-0.57\), with a \(p\)-value of 0.57, indicating that the mean difference of -2.9 was not statistically significant. In other words, such small difference could be attributed to random error. Hence, we could safely assume that there was no pre-existing skill level difference in harmonization between the control and experimental groups in Group Piano I prior to the experiment.
Table 1. Independent-Samples t-test Results for Pretest, Interim, and Posttest for Group Piano I

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>X</th>
<th>s</th>
<th>$X_1 - X_2$</th>
<th>Levene’s Test for Equality of Variances</th>
<th>Independent t-test</th>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>p-value</td>
<td>t</td>
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<tr>
<td><strong>Pretest</strong></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>35</td>
<td>60.6</td>
<td>23.1</td>
<td>-2.9</td>
<td>2.11</td>
<td>0.151</td>
</tr>
<tr>
<td>Experimental</td>
<td>36</td>
<td>63.5</td>
<td>19.3</td>
<td></td>
<td>0.071</td>
<td>0.026*</td>
</tr>
<tr>
<td><strong>Interim</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>28</td>
<td>34.5</td>
<td>9.9</td>
<td>-4.9</td>
<td>3.38</td>
<td>0.026*</td>
</tr>
<tr>
<td>Experimental</td>
<td>32</td>
<td>39.4</td>
<td>6.4</td>
<td></td>
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<tr>
<td><strong>Posttest</strong></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>35</td>
<td>63.0</td>
<td>19.1</td>
<td>-27.5</td>
<td>39.4</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>Experimental</td>
<td>36</td>
<td>90.5</td>
<td>6.8</td>
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</table>

Notes: * denotes significance. Maximum scores for pretest and posttest were 101 points, whereas maximum score for interim test was only 53 points.

A few students did not participate in the interim assessment: 7 students from the control group and 4 students from the experimental group. However, this should not affect the comparison on the interim assessment between the control and experimental groups, as these missing students represented only small percentages of the actual group sizes (20% of the control group and 8% of the experimental group). For the interim test, students from the control group ($n_1 = 28$) received a mean score of $\overline{X}_1 = 34.5$ (out of 53) with a standard deviation of $s_1 = 9.9$, whereas students from the experimental group ($n_2 = 32$) received a mean score of $\overline{X}_2 = 39.4$ with a standard deviation of $s_2 = 6.4$, resulting in a mean difference of $\overline{X}_1 - \overline{X}_2 = -4.9$. Similarly, an independent-samples t-test was performed to check for any significant difference between these two groups, and the t-value (for a two-tailed test) was found to be -2.28 with a p-value of $0.026 < 0.05$; hence, the mean difference of -4.9 (i.e., -9.2 in a 100-pt. scale) is statistically significant.

After a 5-week treatment, it began to show that the experimental group performed harmonization more accurately than the control group.

For the posttest, no students from both groups were missing; students from the control group ($n_1 = 35$) received a mean score of $\overline{X}_1 = 63.0$ (out of 101) with a standard deviation of $s_1 =$
19.1, whereas students from the experimental group \((n_2 = 36)\) received a mean score of \(\overline{X}_2 = 90.5\) with a standard deviation of \(s_2 = 6.8\), resulting in a mean difference of \(\overline{X}_1 - \overline{X}_2 = -27.5\). It should be noted that the dispersion of the scores (i.e., standard deviation) from the control group was much larger than that from the experimental group; in addition to higher scores, all the students from the experimental group appeared to perform more consistently, resulting in a smaller spread of the scores. Also, Levene’s test distinctly showed that equal variances cannot be assumed, and the t-value (for a two-tailed test using unequal variance assumption) was found to be -7.95, with a \(p\)-value less than 0.001. Similar to the interim assessment, the mean difference of -27.5 was statistically significant. By the end of the experimental period (ten weeks after the pretest), the experimental group was performing harmonization more accurately (and consistently) than the control group. In addition, the effect sizes for interim assessment and posttest were determined, and Cohen’s \(d\) values were found to be 0.59 (medium effect size) and 1.92 (very large effect size) for interim assessment and posttest, respectively; practical significance was found in the results.

**Group Piano III’s Test Results.** Table 2 shows the independent-samples t-test results for the pretest, interim test, and posttest for Group Piano III. Note that the total scores for the pretest, interim test, and posttest were 105, 90, and 105, respectively. For the pretest, students from the control group \((n_1 = 12)\) scored an average value of \(\overline{X}_1 = 84.4\) (out of 105) with a standard deviation of \(s_1 = 7.7\), whereas students from the experimental group \((n_2 = 28)\) scored an average value of \(\overline{X}_2 = 87.1\) with a standard deviation of \(s_2 = 8.6\), resulting in a mean difference of -2.7. An independent-samples t-test was used to confirm if such small difference could be statistically significant, and the t-value (for a two-tailed test) was found to be -0.94 with a \(p\)-value of 0.35, indicating that the mean difference was not statistically significant. One could
safely assume that there was no pre-existing skill level difference in harmonization between the control and experimental groups in Group Piano III.

Table 2. Independent-Samples t-test Results for Pretest, Interim, and Posttest for Group Piano III

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<td></td>
<td>n</td>
<td>$\bar{X}$</td>
<td>s</td>
<td>$\bar{X}_1 - \bar{X}_2$</td>
<td>$F$</td>
<td>p-value</td>
<td>Levene’s Test for Equality of Variances</td>
</tr>
<tr>
<td>Pretest</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
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<td>84.4</td>
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<td>-2.7</td>
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<td>0.765</td>
<td>Yes</td>
</tr>
<tr>
<td>Experimental</td>
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<td>87.1</td>
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</tr>
<tr>
<td>Interim</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>7</td>
<td>71.7</td>
<td>15.1</td>
<td>-9.9</td>
<td>6.73</td>
<td>0.014*</td>
<td>No</td>
</tr>
<tr>
<td>Experimental</td>
<td>26</td>
<td>81.6</td>
<td>6.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Posttest</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>12</td>
<td>87.8</td>
<td>7.9</td>
<td>-12.2</td>
<td>5.59</td>
<td>0.023*</td>
<td>No</td>
</tr>
<tr>
<td>Experimental</td>
<td>28</td>
<td>100</td>
<td>3.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: * denotes significance. Maximum scores for pretest and posttest were 105 points, whereas maximum score for interim test was 90 points.

There were quite a number of students from the control group (5 out of 12) who did not participate in the interim assessment, and two students (out of 28) from the experimental group were missing. Hence, the comparison on the mean scores for this case might not reflect the effect of collaborative learning on students’ harmonization skills. Nevertheless, students from the control group (who participated in the interim assessment) scored a mean value of 71.7 (out of 90) with a standard deviation of 15.1, whereas students from the experimental group scored a mean value of 81.6 with a standard deviation of 6.8, resulting in the mean difference of -9.9.

According to the difference of the mean scores, Group Piano III students from the experimental group appeared to play harmonization more accurately than those from the control group. The independent-samples t-test gave a t-value of -1.69 with a p-value of 0.14. Owing to the absence of a large number of students from the control group, the mean difference of -9.9 was not statistically significant enough to conclude that the effect of collaborative learning could positively improve students’ harmonization skills in Group Piano III after a 5-week treatment.
Toward the end of the semester (ten weeks after the pretest), all students in Group Piano III successfully completed the posttest. Students from the control group received a mean score of 87.8 (out of 105) with a standard deviation of 7.9, whereas students from the experimental group received a mean score of 100.0 with a standard deviation of 3.9, resulting in the mean difference of -12.2. Similar to Group Piano I, the standard deviation for the experimental group was much smaller than that from the control group. In addition, the independent-samples t-test gave a t-value of -5.08 with a p-value less than 0.001. As a result, there was a significant difference in the mean posttest scores between the control and experimental groups, revealing that students from the experimental group played harmonization more accurately and consistently than those from the control group after a 10-week treatment. Cohen’s $d$ was determined to be 1.96, indicating that the effect size was very large and there was a practical significance in the result.

**Comparisons between Experimental and Control Groups in Group Piano I and III.**

Figure 1 shows a scatterplot of the mean test scores for the control and experimental groups in Group Piano I and Group Piano III. For a better comparison, the mean scores were properly adjusted from their original point scale to a 100-pt scale, and the adjusted values were plotted against the weeks when students completed the tests (since the pretest). The black open and solid symbols represent the mean test scores for the control and experimental groups from Group Piano I, respectively. Similarly, the red open and solid symbols represent the mean test scores for the control and experimental groups from Group Piano III, respectively. A line of best-fit was plotted with the scaled mean scores for each group for better visualization. At first glance, all four groups appeared to have better mean scores over time, with more distinct changes shown in the performance from the experimental groups. It should be pointed out that Group Piano I students were comprised of 1st year incoming, non-major students, and some of them had very
little or no previous piano experience prior to the class. The pretest piece given to them might have been quite challenging at first, because very few of them knew how to use broken-chord accompaniment styles, resulting in rather low pretest scores from both groups. However, the collaborative learning activities during the semester seemed to help Group Piano I students improve their harmonization skills significantly as the mean score (from the experimental group) changed from 63.5 to 90.5 (the most change among all four groups).

![Figure 1. Scaled mean test scores (over time) for Group Piano I and Group Piano III.](image)

**Comparison of Individual Musical Elements in Group Piano I.** The tests covered four key musical elements, which were melody, chords, accompaniment, and continuity/coordination. These elements are essential harmonization skills for pianists. The grouped bar chart (Figure 2) illustrates the mean pretest and posttest scores on melody for the control and experimental groups in Group Piano I. In the pretest, the control and experimental groups scored average values of 29.6 and 32.1 points (out of 37 points), respectively, on melody. Based on the independent-samples t-test results ($t = -1.17$ and $p = 0.25$), these two mean scores were not
significantly different, meaning both groups had similar levels in playing melody prior to the class. After 10-weeks of collaborative learning activities, the experimental group seemed to excel in playing melody with a higher mean score of 35.8, whereas the control group improved only slightly with an increase of mean score of 1.7. Such difference between both groups (after 10-wk treatment) was found to be statistically significant (t = -3.05 and p = 0.004 < 0.05).

Figure 2. Melody comparisons between control and experimental groups from pretest to posttest for Group Piano I.

Figure 3 illustrates the mean pretest and posttest scores on chords for the control and experimental groups in Group Piano I. Initially, for the chord skill, both the control and experimental groups did not perform well (with a mean score of 19.4 for control and a mean score of 20.3 for experimental). By the end of the semester, the experimental group showed a significant improvement in the playing chords, with an increased mean score of 16.8; however, the control group did not demonstrate any improvement.
Figure 3. Chord comparisons between control and experimental groups from pretest to posttest for Group Piano I.

Figure 4 displays the mean pretest and posttest scores on accompaniment for the control and experimental groups in Group Piano I. The accompaniment section of the test was worth a total of 12 points, and both groups only scored poorly on this section of the pretest. This was not surprising, because most of these students had little previous experience in accompaniment prior to taking this class. After a 10-week treatment, the experimental group started to demonstrate the ability to play the broken-chord accompaniment styles as the mean scores in this section increased from 4.7 to 8.3. As for the control group, the improvement seemed to be slim, with a small increase of 0.5 point.
Figure 4. Accompaniment comparisons between control and experimental groups from pretest to posttest for Group Piano I.

Figure 5 illustrates the mean pretest and posttest scores on continuity/coordination for the control and experimental groups in Group Piano I. This section of the pretest was worth 12 points. Prior to the treatment, the control group (with a mean score of 7.1) appeared to perform slightly better than the experimental group (with a mean score of 6.5) in terms of continuity and coordination with both hands. However, after working on the collaborative learning activities for 10 weeks, the experimental group surpassed the control group, with a higher mean score of 9.4 on continuity/coordination.

In summary, the experimental group in Group Piano I performed harmonization more accurately than the control group, in terms of melody, chords, accompaniment, and continuity/coordination. In particular, there was a huge score improvement in chords and accompaniment skills after participating in collaborative learning experiences for 10 weeks.
Comparison of Individual Musical Element in Group Piano III. Similar analysis on each musical element was performed on the control and experimental groups in Group Piano III. Figures 6–9 illustrate the mean pretest and posttest scores on melody, chords, accompaniment, and continuity/coordination for both groups in Group Piano III, respectively. In general, for the pretest, the experimental group scored higher than the control group in the areas of melody, accompaniment, and continuity/coordination, but scored lower in the chord section. In particular, students from the experiment group seemed to perform rather well in the continuity/coordination section, with a mean difference of almost 2 points higher than the control group. Toward the end of the semester, both groups performed better in the posttest than the pretest in all 4 areas. The improvement in the skill levels from the experimental group was more noticeable than that of the control group, especially in the areas of chords and accompaniment. On average, the experimental group consistently scored about 1.1 and 2 points higher than the control group in the areas of melody and continuity/coordination, respectively, from the pretest to posttest, meaning that both groups were improving at the same rate in these two areas. In contrast, the
The experimental group improved at faster rates in the other two areas when working on collaborative learning exercises. The experimental group (on average) scored about 0.7 point lower than the control group in the chord skill initially, but scored about 5.2 points higher toward the end of the semester. Also, both groups seemed to possess similar skill levels in using broken-chord accompaniment styles in the beginning. After 10 weeks, the experimental group improved drastically with the mean score increasing from 7.2 to 11.6 points (out of 12 points); hence, most students from the experimental group received almost a full point in the accompaniment section in the posttest. As for the control group, there was only a slight increase (about a 0.7-point increase) in the mean score. According to these findings, Group Piano III students, who worked with peers on harmonization exercises in class, definitely learned and played harmonization more accurately and consistently than those who worked alone toward the end of the semester.

![Figure 6. Melody comparisons between control and experimental groups from pretest to posttest for Group Piano III.](image)
Figure 7. Chord comparisons between control and experimental groups from pretest to posttest for Group Piano III.

Figure 8. Accompaniment comparisons between control and experimental groups from pretest to posttest for Group Piano III.
Confidence Level Assessment via Survey

After the pretest and posttest, students from both control and experimental groups in Group Piano I and Group Piano III completed a self-evaluation Likert scale survey comprised of 12 questions. The survey was used to determine if collaborative learning could positively influence students’ attitudes and confidence toward learning and performing harmonization (see Appendix E). Students answered each question on the survey by circling the number that corresponded with their feelings on a five-point Likert scale (#1 if the answer was rarely and #5 if the answer was all or most of the time). The direction of difference on how each student responded to these questions before and after the experimental period helped evaluate how he/she felt about learning and performing harmonization during the course of the experiment.

Group Piano I’s Survey. Table 3 shows the mean Likert response with the corresponding standard deviation for each question on pretest and posttest for the control and experimental groups in Group Piano I. Positive changes in Questions 1, 2, 4, 7, 8, and 10 indicate that students developed better attitudes and confidence toward learning and performing.
harmonization during the experiment. For instance, Question 4 asked students if they would persist keep practicing when they cannot play the harmonization easily at first. If the response to that question had a positive change (more frequent), the student was likely to keep practicing harmonization despite the difficulties one might encounter. In contrast, negative changes in Questions 3, 5, 6, 9, 11, and 12 indicated that students felt better toward working on harmonization exercises by the end of the experiment. For example, Question 12 asked students whether they were incapable of dealing with most problems that came up when working on harmonization exercises. If the response change was negative (less frequent), then the student thought he/she was more capable of solving some difficult harmonization issues on his/her own.
Table 3. Group Piano I’s Survey Results for Pretest and Posttest

<table>
<thead>
<tr>
<th>Questions with #1 if the answer is rarely, #5 if the answer is all or most of the time</th>
<th>Pretest C&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Posttest C&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Pretest E&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Posttest E&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>1. I enjoy playing harmonization in the class.</td>
<td>3.11</td>
<td>1.16</td>
<td>3.43</td>
<td>1.12</td>
</tr>
<tr>
<td>2. I am confident that I can successfully learn the harmonization examples for class.</td>
<td>3.40</td>
<td>1.40</td>
<td>3.51</td>
<td>1.42</td>
</tr>
<tr>
<td>3. One of my problems is that I avoid practicing harmonization for class.</td>
<td>2.51</td>
<td>1.38</td>
<td>3.20</td>
<td>1.21</td>
</tr>
<tr>
<td>4. If I cannot play the harmonization easily at first, I keep practicing until I can.</td>
<td>3.91</td>
<td>1.07</td>
<td>3.54</td>
<td>1.27</td>
</tr>
<tr>
<td>5. Even when I decide to master harmonization examples, I rarely achieve success.</td>
<td>2.20</td>
<td>1.21</td>
<td>2.03</td>
<td>1.15</td>
</tr>
<tr>
<td>6. I am likely to give up preparing harmonization exercises before completing them successfully.</td>
<td>1.86</td>
<td>1.00</td>
<td>1.97</td>
<td>1.12</td>
</tr>
<tr>
<td>7. Even when I find practicing harmonization unpleasant, I can stick to it until I complete the task.</td>
<td>3.71</td>
<td>0.83</td>
<td>3.54</td>
<td>1.25</td>
</tr>
<tr>
<td>8. When I decide to practice harmonization, I go right to work on the assigned examples.</td>
<td>3.80</td>
<td>1.05</td>
<td>3.43</td>
<td>1.17</td>
</tr>
<tr>
<td>9. When playing a new harmonization exercise, I give up if I am not initially successful.</td>
<td>1.60</td>
<td>0.85</td>
<td>1.86</td>
<td>0.91</td>
</tr>
<tr>
<td>10. The prospect of failure at harmonizing melodies makes me work harder in preparation.</td>
<td>3.69</td>
<td>1.13</td>
<td>3.31</td>
<td>1.05</td>
</tr>
<tr>
<td>11. I am likely to give up on working on harmonization easily.</td>
<td>1.80</td>
<td>0.90</td>
<td>1.94</td>
<td>0.97</td>
</tr>
<tr>
<td>12. I am not capable of dealing with most problems that may come up when working on harmonization exercises.</td>
<td>1.69</td>
<td>1.08</td>
<td>1.97</td>
<td>1.12</td>
</tr>
</tbody>
</table>

Note: <sup>a</sup>C = Control (n = 35), <sup>b</sup>E = Experimental (n = 36).
By the end of the experiment, the mean response from the control group to Question 1 increased from 3.11 to 3.43, whereas the mean response from the experimental group remained the same at 3.92. This indicates that more students from the control group began to enjoy playing harmonization in the class. Even though there was no change in the mean response from the experimental group, the mean responses for both pretest and posttest were still higher than those from the control group, indicating more students from the experimental group still enjoyed playing harmonization in the class. On Question 2, the mean response from the control group increased from 3.40 to 3.51 (with a change of 0.11), whereas the mean response from the experimental group increased from 3.81 to 4.03 (with a slightly larger change of 0.22), meaning more students from the experimental group believed that they could successfully learn the harmonization examples for class.

Meanwhile, the positive changes in the mean responses to Question 3 from both control and experimental groups seemed to indicate that students more frequently avoided practicing harmonization outside of class by the end of the experiment. Also, the negative changes in the mean responses to Question 4 from both groups revealed that students tended not to keep practicing when difficulties arose when practicing harmonization. It should be noted that the mean responses for both pretest and posttest from the experimental group were consistently higher than those from the control group, meaning that the students from the experimental group self-reported a higher tendency to keep practicing regardless of the difficulties.

The remaining eight questions were similar in nature, asking students whether they persisted and believed in their own abilities to master harmonization. After comparing the mean responses for the pretest and posttest, the feedback was mostly negative for the control group (except for Questions 5 and 10). On Question 5, there was a negative change in the mean
response (from 2.20 to 2.03), indicating that more students believed they could achieve success once they decided to master harmonization examples toward the end of the semester. Similarly, on Question 10, there was a negative change in the mean response (from 3.69 to 3.31). Question 10 is a particularly interesting question that asks students if the prospect of failure at harmonizing melodies would make them work harder during preparation. One could speculate that students would not have any fears of failure at harmonizing melodies if they were confident with their harmonization skills. Hence, they would not need to spend more time in preparation. The negative change in the mean response seemed to suggest that students did not have any fears of failure at their harmonization skills. Despite the positive feedback received from Questions 5 and 10, negative feedback was found on the remaining six questions, revealing that students from the control group had a higher tendency to give up on working on harmonization exercises, fail to stick to the assigned tasks, and develop the idea that they were incapable of addressing the problems they may encounter when working on harmonization.

In contrast, students from the experimental group provided positive feedback on these eight questions. Students from the experimental group in Group Piano I appeared to have better attitudes and higher confidence toward learning and performing harmonization than those from the control group.

**Group Piano III’s Survey.** Table 4 shows the mean Likert response with the corresponding standard deviation for each question on pretest and posttest for the control and experimental groups in Group Piano III. The differences in their attitudes toward learning and performing harmonization between the control and experimental groups in Group Piano III are similar to those in Group Piano I.
<table>
<thead>
<tr>
<th>Questions with #1 if the answer is rarely, #5 if the answer is all or most of the time</th>
<th>Pretest C&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Posttest C&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Pretest E&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Posttest E&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>1. I enjoy playing harmonization in the class.</td>
<td>3.00</td>
<td>1.27</td>
<td>3.09</td>
<td>1.14</td>
</tr>
<tr>
<td>2. I am confident that I can successfully learn the harmonization examples for class.</td>
<td>3.45</td>
<td>1.21</td>
<td>3.27</td>
<td>0.91</td>
</tr>
<tr>
<td>3. One of my problems is that I avoid practicing harmonization for class.</td>
<td>3.18</td>
<td>1.25</td>
<td>3.36</td>
<td>1.50</td>
</tr>
<tr>
<td>4. If I cannot play the harmonization easily at first, I keep practicing until I can.</td>
<td>3.82</td>
<td>0.98</td>
<td>3.55</td>
<td>0.82</td>
</tr>
<tr>
<td>5. Even when I decide to master harmonization examples, I rarely achieve success.</td>
<td>2.64</td>
<td>1.43</td>
<td>2.00</td>
<td>0.89</td>
</tr>
<tr>
<td>6. I am likely to give up preparing harmonization exercises before completing them successfully.</td>
<td>2.36</td>
<td>1.29</td>
<td>2.18</td>
<td>1.47</td>
</tr>
<tr>
<td>7. Even when I find practicing harmonization unpleasant, I can stick to it until I complete the task.</td>
<td>3.55</td>
<td>1.29</td>
<td>3.09</td>
<td>1.22</td>
</tr>
<tr>
<td>8. When I decide to practice harmonization, I go right to work on the assigned examples.</td>
<td>3.91</td>
<td>1.22</td>
<td>3.64</td>
<td>0.81</td>
</tr>
<tr>
<td>9. When playing a new harmonization exercise, I give up if I am not initially successful.</td>
<td>1.73</td>
<td>1.01</td>
<td>2.00</td>
<td>1.00</td>
</tr>
<tr>
<td>10. The prospect of failure at harmonizing melodies makes me work harder in preparation.</td>
<td>2.73</td>
<td>1.01</td>
<td>2.45</td>
<td>1.37</td>
</tr>
<tr>
<td>11. I am likely to give up on working on harmonization easily.</td>
<td>1.91</td>
<td>0.94</td>
<td>2.36</td>
<td>1.29</td>
</tr>
<tr>
<td>12. I am not capable of dealing with most problems that may come up when working on harmonization exercises.</td>
<td>2.09</td>
<td>1.14</td>
<td>2.09</td>
<td>1.14</td>
</tr>
</tbody>
</table>

Note: <sup>a</sup>C = Control (n = 12), <sup>b</sup>E = Experimental (n = 28).
For the control group in Group Piano III, it appeared that they were more positive with regard to their attitudes toward learning and performing harmonization based on the changes in the mean responses to Questions 1, 5, 6, and 10, as compared to the control group in Group Piano I. However, there were decreased levels of confidence, preparation, and persistence based on the changes in the mean responses to Questions 2-4, 7-9, and 11, when compared to the experimental group. The mean response to Question 12 did not change between the pretest and posttest (2.09) which indicated their attitudes did not change.

For the experimental group in Group Piano III, positive feedback was provided on Questions 1, 2, 5-10, and 12. On the other hand, the mean response to Question 3 increased from 3.18 to 3.39, whereas the mean response to Question 4 decreased from 4.43 to 4.29. These two questions are very similar and ask (in an opposite way) if students practiced harmonization more, even if they could not play harmonization well initially. The direction of the changes in the mean responses to these two questions seem to suggest that students would not practice more by the end of the semester (if they encountered some difficulties), meaning less persistence in their learning. In addition, the mean response to Question 11 stayed at 1.89, revealing that students from the experimental group were not likely to give up on working on harmonization easily. In general, the responses from the experimental group in Group Piano III were more positive than those from the control group. One could also speculate that students from the experimental group had better attitudes and confidence toward learning and performing harmonization than those from the control group by the end of the semester.

Two statistical analyses, namely Wilcoxon signed-rank test and Mann-Whitney U test, were performed on each of the twelve survey questions. First, the Wilcoxon signed-rank test is a non-parametric statistical hypothesis test used to compare repeated measurements on a single
sample (e.g., experimental group in Group Piano I) to assess whether its population mean ranks differ (Russell, 2018). Here, it was used to evaluate if there was a significant difference in the mean response to each of the twelve survey questions from pretest to posttest for 4 separate groups (i.e., control and experimental groups in Group Piano I and III).

Second, the Mann-Whitney U test is a non-parametric statistical hypothesis test used to compare measurements on two independent samples (e.g., control and experimental groups in Group Piano I) to determine whether their population mean ranks are not equal (Russell, 2018). Here, it was used to compare the mean responses to each of the twelve survey questions provided by the control and experimental groups. For both Group Piano I and III, this test was performed on the survey questions after the pretest, followed by another test on the questions after the posttest. The level of significance for these two-tailed tests was set at $\alpha = 0.05$.

**Statistical Analyses on Survey Questions for Group Piano I.** Table 5 shows the results of the Wilcoxon signed-rank tests calculated for the survey questions for each of the two groups in Group Piano I. For the control group, no statistically significant differences occurred in the mean responses to most of the questions occurred from pretest to posttest, except for Questions 1 and 3. Table 6 lists the detailed test statistics for Questions 1 and 3. Question 1 asked students if they enjoyed playing piano in the class. The test statistics were $Z = -2.05$ and $p = 0.040$, indicating that there was clearly a difference in terms of how students from the control group responded. Their mean response after the pretest was 3.11, whereas it changed to 3.43 after the posttest. Hence, the control group enjoyed playing harmonization more in the class by the end of the semester. Question 3 asked students if they would avoid practicing harmonization for the class. Here, the mean response changed from 2.51 to 3.20, with $Z = -2.70$ and $p = 0.007$. This indicates that the mean response change was statistically significant, and more students seemed
to avoid practicing harmonization for the class. The responses to Questions 1 and 3 appeared to contradict each other. On one hand, more students seemed to enjoy playing harmonization in the class. On the other hand, more students seemed to avoid practicing it outside of class by the end of the semester. As for the experimental group, no significant differences in how they responded to the twelve survey questions from the pretest to posttest were found.

Next, I compared the mean responses to each survey question between the control and experimental groups. Table 7 shows the results of the Mann-Whitney U tests on the survey questions provided after the pretest and posttest. In the pretest, there was a significant difference in only one question (i.e., Question 1). Table 8 lists the detailed test statistics for Question 1, with $U = 376$, $Z = -3.07$, and $p = 0.002$. The mean responses provided by the control and experimental groups were 3.11 and 3.92, respectively; hence, more students from the experimental group enjoyed playing harmonization in the class in the beginning.

In the posttest, the Mann-Whitney U tests revealed that the mean responses to Question 4 provided by the two groups were significantly different. Table 9 lists the detailed test statistics for Question 4, with $U = 461.5$, $Z = -2.03$, and $p = 0.042$. The mean responses were 3.54 and 4.17 for the control and experimental groups, respectively. This question asked students whether they would keep practicing until they can play an example, even if they cannot play it easily at first. The experimental group seemed to be more persistent in learning harmonization. On the contrary, no significant differences were found in the mean responses to the remaining questions. The $p$-values for Questions 1 and 11 were 0.061 and 0.062, respectively, which were approaching significance. It should be noted that significant difference was found in the mean response to Question 1 in the pretest, but not in the posttest. This could be explained by the fact that the mean response to Question 1 provided by the experimental group remained the same.
from the pretest to posttest, whereas the mean value provided by the control group increased. However, the mean value was still higher for the experimental group in the posttest, but not high enough to show any significant difference. In addition, Question 11 asked students if they would give up on working on harmonization easily. In the posttest, the experimental group responded with a mean value of 1.61, whereas the control group gave a mean value of 1.94. Again, the experimental group seemed to be more persistent in learning, because its mean value was lower, but not low enough to cause any significant difference.
Table 5. Wilcoxon Signed-Rank Tests for Group Piano I’s Survey Results

<table>
<thead>
<tr>
<th>Questions with #1 if the answer is rarely, #5 if the answer is all or most of the time</th>
<th>Control</th>
<th>Experimental</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( Z )</td>
<td>( p )-value</td>
</tr>
<tr>
<td>1. I enjoy playing harmonization in the class.</td>
<td>-2.05</td>
<td>0.040*</td>
</tr>
<tr>
<td>2. I am confident that I can successfully learn the harmonization examples for class.</td>
<td>-0.68</td>
<td>0.50</td>
</tr>
<tr>
<td>3. One of my problems is that I avoid practicing harmonization for class.</td>
<td>-2.70</td>
<td>0.007*</td>
</tr>
<tr>
<td>4. If I cannot play the harmonization easily at first, I keep practicing until I can.</td>
<td>-1.56</td>
<td>0.12</td>
</tr>
<tr>
<td>5. Even when I decide to master harmonization examples, I rarely achieve success.</td>
<td>-1.04</td>
<td>0.30</td>
</tr>
<tr>
<td>6. I am likely to give up preparing harmonization exercises before completing them successfully.</td>
<td>-0.66</td>
<td>0.51</td>
</tr>
<tr>
<td>7. Even when I find practicing harmonization unpleasant, I can stick to it until I complete the task.</td>
<td>-0.48</td>
<td>0.63</td>
</tr>
<tr>
<td>8. When I decide to practice harmonization, I go right to work on the assigned examples.</td>
<td>-1.45</td>
<td>0.15</td>
</tr>
<tr>
<td>9. When playing a new harmonization exercise, I give up if I am not initially successful.</td>
<td>-1.61</td>
<td>0.11</td>
</tr>
<tr>
<td>10. The prospect of failure at harmonizing melodies makes me work harder in preparation.</td>
<td>-1.39</td>
<td>0.17</td>
</tr>
<tr>
<td>11. I am likely to give up on working on harmonization easily.</td>
<td>-1.03</td>
<td>0.30</td>
</tr>
<tr>
<td>12. I am not capable of dealing with most problems that may come up when working on harmonization exercises.</td>
<td>-1.66</td>
<td>0.096</td>
</tr>
</tbody>
</table>

Note: * denotes significant difference.
Table 6. Wilcoxon Signed-Rank Test Statistics for Questions 1 and 3 from the Control Group in Group Piano I

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>Mean Rank</th>
<th>Sum of Ranks</th>
<th>Z</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1 Post – Q1 Pre</td>
<td>4</td>
<td>6.50</td>
<td>26.00</td>
<td>-2.05</td>
<td>0.040*</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>8.55</td>
<td>94.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>35</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q3 Post – Q3 Pre</td>
<td>9</td>
<td>8.00</td>
<td>72.00</td>
<td>-2.70</td>
<td>0.007*</td>
</tr>
<tr>
<td></td>
<td>17</td>
<td>16.41</td>
<td>279.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>9</td>
<td></td>
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<td></td>
<td>35</td>
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<td></td>
</tr>
</tbody>
</table>
Table 7. Mann-Whitney U Tests for Group Piano I’s Survey Results

<table>
<thead>
<tr>
<th>Questions with #1 if the answer is rarely, #5 if the answer is all or most of the time</th>
<th>Pretest</th>
<th>Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Z</td>
<td>p-value</td>
</tr>
<tr>
<td>1. I enjoy playing harmonization in the class.</td>
<td>-3.07</td>
<td>0.002*</td>
</tr>
<tr>
<td>2. I am confident that I can successfully learn the harmonization examples for class.</td>
<td>-1.25</td>
<td>0.21</td>
</tr>
<tr>
<td>3. One of my problems is that I avoid practicing harmonization for class.</td>
<td>-0.89</td>
<td>0.37</td>
</tr>
<tr>
<td>4. If I cannot play the harmonization easily at first, I keep practicing until I can.</td>
<td>-1.31</td>
<td>0.19</td>
</tr>
<tr>
<td>5. Even when I decide to master harmonization examples, I rarely achieve success.</td>
<td>-0.35</td>
<td>0.73</td>
</tr>
<tr>
<td>6. I am likely to give up preparing harmonization exercises before completing them successfully.</td>
<td>-0.012</td>
<td>0.99</td>
</tr>
<tr>
<td>7. Even when I find practicing harmonization unpleasant, I can stick to it until I complete the task.</td>
<td>-1.07</td>
<td>0.29</td>
</tr>
<tr>
<td>8. When I decide to practice harmonization, I go right to work on the assigned examples.</td>
<td>-0.036</td>
<td>0.97</td>
</tr>
<tr>
<td>9. When playing a new harmonization exercise, I give up if I am not initially successful.</td>
<td>-0.16</td>
<td>0.88</td>
</tr>
<tr>
<td>10. The prospect of failure at harmonizing melodies makes me work harder in preparation.</td>
<td>-0.036</td>
<td>0.97</td>
</tr>
<tr>
<td>11. I am likely to give up on working on harmonization easily.</td>
<td>-0.76</td>
<td>0.45</td>
</tr>
<tr>
<td>12. I am not capable of dealing with most problems that may come up when working on harmonization exercises.</td>
<td>-1.26</td>
<td>0.21</td>
</tr>
</tbody>
</table>

Note: * denotes significant difference.
Table 8. Mann-Whitney U Test Statistics for Question 1 from Group Piano I in the Pretest

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Mean Rank</th>
<th>Sum of Ranks</th>
<th>U</th>
<th>Z</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>35</td>
<td>28.74</td>
<td>1006</td>
<td>376</td>
<td>-3.07</td>
<td>0.002*</td>
</tr>
<tr>
<td>Experimental</td>
<td>36</td>
<td>43.06</td>
<td>1550</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>71</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 9. Mann-Whitney U Test Statistics for Question 4 from Group Piano I in the Posttest

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Mean Rank</th>
<th>Sum of Ranks</th>
<th>U</th>
<th>Z</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>35</td>
<td>31.19</td>
<td>1091.5</td>
<td>461.5</td>
<td>-2.03</td>
<td>0.042*</td>
</tr>
<tr>
<td>Experimental</td>
<td>36</td>
<td>40.68</td>
<td>1464.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>71</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Statistical Analyses on Survey Questions for Group Piano III. Table 10 shows the results of the Wilcoxon signed-rank tests calculated for the survey questions for each of the two groups in Group Piano III. Again, it was used to compare repeated measurements on the response to each of the twelve survey questions provided by each of the two groups. For the control group, no significant differences were found in the responses to the survey questions from the pretest to posttest. As for the experimental group, the tests revealed that significant differences were found in the mean responses to Questions 8 and 12. Table 11 lists the detailed test statistics for Questions 8 and 12. Question 8 asked students if they would go right to work on the assigned examples when they decide to practice harmonization. The mean response increased from 3.75 in the pretest to 4.21 in the posttest, indicating more students would go right to work on the assigned examples (with $Z = -2.29$ and $p = 0.022$). Similarly, Question 12 asked students if they are not capable of dealing with most problems that may come up when working on harmonization exercises. The mean response decreased from 2.14 in the pretest to 1.75 in the posttest, indicating that they believed they were more capable of dealing with harmonization problems (with $Z = -1.98$ and $p = 0.050$). Hence, experimental participants seemed to develop
higher levels of confidence, preparation, and persistence in learning harmonization at the end of the semester.

Table 12 shows the results of the Mann-Whitney U tests on the survey questions provided after the pretest and posttest. Again, the tests were used to compare the mean responses provided by the two groups in the pretest (and also posttest). In the pretest, no significance differences were found in the responses to the survey questions between the two groups. In the posttest, significant differences were found in the responses to Questions 4 and 8. Table 13 lists the detailed test statistics for Questions 4 and 8. For Question 4, the control group responded with a mean value of 3.55, whereas the experimental group gave a mean value of 4.21, indicating more experimental participants would keep practicing harmonization until they could play it, even if they were not successful at first (with \( U = 79, Z = -2.49 \), and \( p = 0.013 \)). For Question 8, the control group responded with a mean value of 3.75, whereas the experimental group gave a mean response of 4.21, indicating more experimental participants would go right to work on the assigned examples once they decided to practice harmonization (with \( U = 93, Z = -2.02 \), and \( p = 0.043 \)). Similar to the results obtained from the Wilcoxon signed-rank tests, the Mann-Whitney U tests provided the evidence that experimental participants appeared to be more confident and persistent in their learning.
Table 10. Wilcoxon Signed-Rank Tests for Group Piano III’s Survey Results

<table>
<thead>
<tr>
<th>Questions with #1 if the answer is rarely, #5 if the answer is all or most of the time</th>
<th>Control</th>
<th></th>
<th>Experimental</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Z</td>
<td>p-value</td>
<td>Z</td>
<td>p-value</td>
</tr>
<tr>
<td>1. I enjoy playing harmonization in the class.</td>
<td>-0.27</td>
<td>0.79</td>
<td>-0.82</td>
<td>0.41</td>
</tr>
<tr>
<td>2. I am confident that I can successfully learn the harmonization examples for class.</td>
<td>-0.71</td>
<td>0.48</td>
<td>-1.62</td>
<td>0.11</td>
</tr>
<tr>
<td>3. One of my problems is that I avoid practicing harmonization for class.</td>
<td>-0.54</td>
<td>0.59</td>
<td>-1.14</td>
<td>0.25</td>
</tr>
<tr>
<td>4. If I cannot play the harmonization easily at first, I keep practicing until I can.</td>
<td>-1.00</td>
<td>0.32</td>
<td>-0.74</td>
<td>0.46</td>
</tr>
<tr>
<td>5. Even when I decide to master harmonization examples, I rarely achieve success.</td>
<td>-1.51</td>
<td>0.13</td>
<td>-0.64</td>
<td>0.53</td>
</tr>
<tr>
<td>6. I am likely to give up preparing harmonization exercises before completing them successfully.</td>
<td>-0.69</td>
<td>0.49</td>
<td>-0.65</td>
<td>0.52</td>
</tr>
<tr>
<td>7. Even when I find practicing harmonization unpleasant, I can stick to it until I complete the task.</td>
<td>-0.86</td>
<td>0.39</td>
<td>-1.12</td>
<td>0.27</td>
</tr>
<tr>
<td>8. When I decide to practice harmonization, I go right to work on the assigned examples.</td>
<td>-0.97</td>
<td>0.34</td>
<td>-2.29</td>
<td>0.022*</td>
</tr>
<tr>
<td>9. When playing a new harmonization exercise, I give up if I am not initially successful.</td>
<td>-0.74</td>
<td>0.46</td>
<td>-1.07</td>
<td>0.29</td>
</tr>
<tr>
<td>10. The prospect of failure at harmonizing melodies makes me work harder in preparation.</td>
<td>-0.63</td>
<td>0.53</td>
<td>-0.24</td>
<td>0.81</td>
</tr>
<tr>
<td>11. I am likely to give up on working on harmonization easily.</td>
<td>-0.88</td>
<td>0.38</td>
<td>-0.12</td>
<td>0.90</td>
</tr>
<tr>
<td>12. I am not capable of dealing with most problems that may come up when working on harmonization exercises.</td>
<td>0.00</td>
<td>1.00</td>
<td>-1.98</td>
<td>0.050*</td>
</tr>
</tbody>
</table>

Note: * denotes significant difference.
Table 11. Wilcoxon Signed-Rank Test Statistics for Questions 8 and 12 from the Experimental Group in Group Piano III

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>Mean Rank</th>
<th>Sum of Ranks</th>
<th>Z</th>
<th>p-value</th>
</tr>
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<tbody>
<tr>
<td>Q8Post – Q8Pre</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative Ranks</td>
<td>3</td>
<td>6.00</td>
<td>18.00</td>
<td>-2.29</td>
<td>0.022*</td>
</tr>
<tr>
<td>Positive Ranks</td>
<td>11</td>
<td>7.91</td>
<td>87.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ties</td>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>28</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q12Post – Q12Pre</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative Ranks</td>
<td>11</td>
<td>7.45</td>
<td>82.00</td>
<td>-1.98</td>
<td>0.050*</td>
</tr>
<tr>
<td>Positive Ranks</td>
<td>3</td>
<td>7.67</td>
<td>23.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ties</td>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>28</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 12. Mann-Whitney U Tests for Group Piano III’s Survey Results

<table>
<thead>
<tr>
<th>Questions with #1 if the answer is rarely, #5 if the answer is all or most of the time</th>
<th>Pretest</th>
<th></th>
<th>Posttest</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Z</td>
<td>p-value</td>
<td>Z</td>
<td>p-value</td>
</tr>
<tr>
<td>1. I enjoy playing harmonization in the class.</td>
<td>-1.38</td>
<td>0.17</td>
<td>-1.57</td>
<td>0.12</td>
</tr>
<tr>
<td>2. I am confident that I can successfully learn the harmonization examples for class.</td>
<td>-0.048</td>
<td>0.96</td>
<td>-1.80</td>
<td>0.071</td>
</tr>
<tr>
<td>3. One of my problems is that I avoid practicing harmonization for class.</td>
<td>-0.048</td>
<td>0.96</td>
<td>-0.28</td>
<td>0.78</td>
</tr>
<tr>
<td>4. If I cannot play the harmonization easily at first, I keep practicing until I can.</td>
<td>-1.90</td>
<td>0.06</td>
<td>-2.49</td>
<td>0.013*</td>
</tr>
<tr>
<td>5. Even when I decide to master harmonization examples, I rarely achieve success.</td>
<td>-0.36</td>
<td>0.72</td>
<td>-0.54</td>
<td>0.59</td>
</tr>
<tr>
<td>6. I am likely to give up preparing harmonization exercises before completing them successfully.</td>
<td>-1.12</td>
<td>0.26</td>
<td>-0.90</td>
<td>0.37</td>
</tr>
<tr>
<td>7. Even when I find practicing harmonization unpleasant, I can stick to it until I complete the task.</td>
<td>-0.20</td>
<td>0.84</td>
<td>-1.61</td>
<td>0.11</td>
</tr>
<tr>
<td>8. When I decide to practice harmonization, I go right to work on the assigned examples.</td>
<td>-0.36</td>
<td>0.72</td>
<td>-2.02</td>
<td>0.043*</td>
</tr>
<tr>
<td>9. When playing a new harmonization exercise, I give up if I am not initially successful.</td>
<td>-0.22</td>
<td>0.83</td>
<td>-1.45</td>
<td>0.15</td>
</tr>
<tr>
<td>10. The prospect of failure at harmonizing melodies makes me work harder in preparation.</td>
<td>-1.59</td>
<td>0.11</td>
<td>-1.53</td>
<td>0.13</td>
</tr>
<tr>
<td>11. I am likely to give up on working on harmonization easily.</td>
<td>-0.20</td>
<td>0.84</td>
<td>-1.11</td>
<td>0.27</td>
</tr>
<tr>
<td>12. I am not capable of dealing with most problems that may come up when working on harmonization exercises.</td>
<td>-0.07</td>
<td>0.95</td>
<td>-0.91</td>
<td>0.36</td>
</tr>
</tbody>
</table>

Note: * denotes significant difference.
Table 13. Mann-Whitney U Test Statistics for Questions 4 and 8 from Group Piano III in the Posttest

<table>
<thead>
<tr>
<th></th>
<th>Group</th>
<th>n</th>
<th>Mean Rank</th>
<th>Sum of Ranks</th>
<th>U</th>
<th>Z</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q4</td>
<td>Control</td>
<td>12</td>
<td>13.18</td>
<td>145</td>
<td>79</td>
<td>-2.49</td>
<td>0.013*</td>
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<tr>
<td></td>
<td>Experimental</td>
<td>28</td>
<td>22.68</td>
<td>635</td>
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<tr>
<td></td>
<td>Total</td>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q8</td>
<td>Control</td>
<td>12</td>
<td>14.45</td>
<td>159</td>
<td>93</td>
<td>-2.02</td>
<td>0.043*</td>
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<tr>
<td></td>
<td>Experimental</td>
<td>28</td>
<td>22.18</td>
<td>621</td>
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<td></td>
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<tr>
<td></td>
<td>Total</td>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Confidence Level Assessment via Open-Ended Questions

The control and experimental groups from Group Piano I and Group Piano III each filled out a questionnaire that contained open-ended questions upon completion of the posttest. There were 5 questions for the control group participants and 14 questions for the experimental group.

**Control Group’s Questionnaire.** Although the questionnaires were different for the control and experimental groups, the first question on these two questionnaires was identical; it asked which functional skills students felt the most confident playing on the piano. The pie charts (as illustrated in Figure 10) show the self-reported skills with which the students were the most confident. For the control group, 7% of Group Piano I students picked harmonization, 48% of students picked sight reading, 10% of students picked repertoire, and the remaining 35% picked technique. Similarly, 25% of Group Piano III students picked harmonization, 33% of students picked sight reading, 17% of students picked repertoire, and the remaining 25% who picked technique. For the experimental group, 79% of students from Group Piano I identified harmonization, 9% chose sight reading, 8% chose repertoire, and the remaining 4% picked accompaniment. From the piano III experimental group, 72% picked harmonization, 21% picked sight reading, and 7% selected repertories. Note that there were much higher percentages of
students from the experimental group (79% from Group Piano I and 72% from Group Piano III) who chose harmonization as their most confident skills, as opposed to far fewer students from the control group (7% from Group Piano I and 17% from Group Piano III).

Figure 10. Responses to open-ended Question 1 from control and experimental groups regarding the most confident functional skill (Group Piano I and Group Piano III).

The second question from the questionnaire for the control group is similar to the fourth question from the experimental group questionnaire. Both questions asked students which
activities they enjoyed the most during the piano class. Figure 11 shows the responses provided by students from Group Piano I and Group Piano III to Question 2 for the control group’s questionnaire and Question 4 for the experimental group’s questionnaire. For the control group, only 3% of Group Piano I students ranked harmonization as the most enjoyable activity, 29% enjoyed the ensemble activities, 46% enjoyed playing repertoire, 11% enjoyed sight reading, and the remaining 11% enjoyed activities that involved scales, technique, or improvisation. The Group Piano III students ranked enjoyable activities as follows: 34% for chord progressions (which is a necessary skill set for harmonization), 11% for sight reading activities, 11% for transposition activities, 33% for ensemble activities, and the remaining 11% for playing repertoire. Less than 3% of students from the control group listed harmonization among the enjoyable the in-class activities.

Responses to the fourth question from the experimental group, were as follows. For Group Piano I, 47% students enjoyed the harmonization activities the most. In particular, 32% students said that they enjoyed playing and collaborating with their peers. The remaining percentages were 12% for sight reading activities and 9% for playing repertoire as their favorite activities during the class. For Group Piano III, 64% students enjoyed the harmonization examples in class, 16% enjoyed playing and collaborating with their peers, 8% enjoyed sight reading activities, 4% enjoyed playing repertoire, and the remaining 8% enjoyed improvisational/compositional activities. It became clear that there was a high percentage of students from the experimental group who really enjoyed harmonization the most in class. In addition, a good number of students from the experiment group really enjoyed playing or collaborating with their peers.
Figure 11. Responses to open-ended Question 2 for the control group’s questionnaire and Question 4 for the experimental group’s questionnaire regarding the most favorite in-class activity (Group Piano I and Group Piano III).

Question 3 from the control group’s questionnaire asked how students felt when they played the harmonization examples. Figure 12 shows the responses to this open-ended question from Group Piano I and Group Piano III students. For Group Piano I, only 11% of students felt confident when they played the harmonization examples, 11% felt okay, 31% believed that they would do better if there were more time or if they worked harder, 39% felt not confident, and the
remaining 8% hated playing the harmonization examples. For Group Piano III, 22% of students felt confident, 22% felt okay, 34% believed they would do better with more time or hard work, and 22% felt not confident.

Figure 12. Responses to open-ended Question 3 on how students felt when they played the harmonization examples for the control group’s questionnaire (Group Piano I and Group Piano III).

Question 4 from the control group’s questionnaire asked students if they could describe collaborative learning, even though they had not engaged in this activity in piano class during the experimental period. The Group Piano I, students described it as a way to: learn as a group (62%), learn from each other (19%), and play for each other (19%). Group Piano III students described it as a way to: learn from each other / solve problems together with peers (55%) and learn as a group (27%). Surprisingly, a few students (18%) from Group Piano III had never heard of collaborative learning.

Question 5 from the control group’s questionnaire asked students if collaborative learning might be an effective teaching strategy in piano classes. Most students from Group Piano I believed this would be or might be a good idea (88%), but the remaining 12% thought it might
not be a good idea. Similarly, most students from Group Piano III believed this would be a great idea (70%), but there were a few students who thought this might not be a good idea (30%).

**Experimental Group’s Questionnaire.** Question 2 from the experimental group’s questionnaire asked students to comment on their collaborative learning experience. All of the Group Piano I students reported having a great experience in collaborative learning during this study. They said that they learned a lot from their peers, such as getting useful ideas and getting help in checking their work from their classmates. Other positive comments included, “This experience is very interesting and effective,” “It encourages performance among peers and allows students to learn not only from the teacher but also from each other,” and “It is valuable in both having fun while creating a learning environment.” Also, a few students commented, “It helps to know that there are others who are also struggling like you.” By knowing this fact, students appear to have a higher tendency to be persistent in learning piano even as difficulties arise. Similarly, 98% of Group Piano III students felt good about the collaborative learning experience and said that it was beneficial, enjoyable, and fun. Typical comments were, “It is a good way to learn and build confidence by playing in front of others,” and “Working with partners motivates better performance and is a good outlet for creativity.” In general, students thought the experience was very helpful; such experience helped students solidify new information and also helped improve students’ harmonization skills.

Question 3 asked students what they learned from their partners throughout this collaborative learning experience. Group Piano I students identified four areas where they learned from classmates. These fell into four broad categories: learning strategies (54%), music theory (38%), learning to communication (4%), and improved motivation (4%). Learning strategies identified by students included (but were not limited to) different ideas for fingering.
discovering diverse ways of approaching chords and music, and learning music faster. Improved learning speed could be a result of observing how others approached music. Music theory included key signature, tempo, chord progressions, and chord inversions. Comments from the communication theme suggested that the collaborative experience appeared to help students better develop their communication skills, thereby allowing them to communicate musical ideas better with each other. Similarly, Group Piano III students identified the following elements: learning strategies (53%), music theory (37%), and better communication (7%). Only one student from Group Piano III commented that he preferred to work by himself.

Question 5 asked if students would like to continue with collaborative learning activities in piano class next semester. The majority of the students (91% from Group Piano I and 92% from Group Piano III) indicated that collaborative learning activities in piano class were very fun and were particularly helpful to their piano learning thus, they wished to continue with these activities next semester. The remaining students claimed that they preferred to work alone as they “learn better alone,” or “sometimes working with a partner could be distracting and slows down the process of learning music.”

Question 6 asked whether in-class collaborative learning activities helped in figuring out harmonization examples. Similar to Question 5, the majority of the experimental participants responded positively. Students from Group Piano I (92%) and Group Piano III (96%) thought the collaborative learning during class was particularly helpful in figuring out harmonization examples. Some students also commented, “Discussing harmonization examples with my classmates is my favorite part of collaboration.” The general finding was that collaborative learning experience in harmonization was useful because it helped many students to get different
opinions from peers, test their personal assumptions, and correct their mistakes in a more
effective and efficient manner.

Question 7 asked students to describe how they worked with their partners during in-class
collaborative learning harmonization activities. All students said that they would first agree on
what chord structures / options should be used. Then one student would play chords while the
other played the melody. After that, when they felt comfortable, they would try to put both hands
together, followed by playing out loud as a group together.

Questions 8 and 9 attempted to gauge if students’ opinions about collaborative learning
changed as a result of the in-class experiences by asking how students felt about collaborative
learning before and after the experiment. Before the experiment, one third of the students from
Group Piano I and Group Piano III thought collaborative learning might not be helpful for
improving their piano skills, particularly harmonization skills. One third of the students thought
it would be helpful or even enjoyable, and the remaining students had no opinions or no ideas
about what collaborative learning entailed. Following the experiment, the overall opinion about
collaborative learning remained consistent or improved for the group of students who thought it
would be helpful or even enjoyable. They confirmed that it was a fun, enjoyable experience. In
fact, a student from this group said that he could catch mistakes faster when he repeated things
with a group. For the remaining two-thirds of the students, their thinking changed in a positive
manner. Some general comments were, “the collaboration helps me grow with my
harmonization,” “it is not as scary as I thought,” “I am enjoying the collaboration now,” and “it
can be helpful in engaging students.”

It is worth noting that the majority of the students (100% from Group Piano I and 96%
from Group Piano III) believed that collaborative learning could be applied to other functional
piano skills (based on the responses to Question 10). Also, based on the responses to Question 13, most students (91% from Group Piano I and 84% from Group Piano III) believed that collaborative learning could be implemented in their other studies or on their own instrument.

Question 11 asked students to comment on the amount of class time devoted to collaborative learning activities. Based on the responses, almost all students thought that 15 minutes during each class was a sufficient amount of time to do collaborative learning activities. Only a very few students (8%) wished for more time, such as 30-45 minutes. It appeared that collaborative learning had a positive influence on students’ perception of learning and performing harmonization at the piano. The researcher wished to discover if students believed collaborative learning activities could be applied to other functional piano skills. Responses were mixed. In the Group Piano I experimental group, 52% answered “yes”, 18% said “maybe”, and 30% answered “no”. As for Group Piano III, 46% answered “yes”, 18% said “the current structure is good enough”, and 36% said “maybe not for the entire piano class”.

For the last question, all students would recommend collaborative learning to their friends. Most students thought that collaborative learning experience allowed students to gain different perspectives from everyone involved, thereby greatly increasing the learning productivity. A few of them commented that this study was a dynamic, challenging, and rewarding experience. In particular, collaborative learning could be a big part in the growth of being a musician (and also a person).
CHAPTER 4. DISCUSSION

Owing to the fact that a number of music students possess very little or no previous piano experience before entering university, current university-level group piano classes may not provide adequate training on important functional keyboard skills that are needed for preparing them to be professional musicians. Innovative teaching strategies involving collaborative learning have been successfully demonstrated in other areas of education; hence, they could be implemented in current group piano classes and might potentially improve students’ functional keyboard skills within a brief period of time. This study involved implementing a specific collaborative learning activity into group piano classes. Harmonization was chosen to be studied due to the fact that it was identified as one of the most important functional keyboard skills for accompaniment purposes and was particularly useful for future music educators to learn in class piano (Betts & Cassidy, 2000).

This study explored the potential differences between the performance outcomes among students who worked in groups to learn harmonization, as opposed to those who worked alone. The application of collaborative learning in the current study involved an activity proposed by Fisher (2006) and Kagan (1994), which was the Think-Pair-Share collaborative strategy; this activity was intended to be used to improve students’ harmonizing skills in a more efficient manner. For instance, during in-class collaborative learning activities on harmonization, students from the experimental group (in a group of two or three) would first discuss about the chord structures. Then they would reach some form of consensus and attempt to play the piece for each other. One would play the harmony while the other played the melody, or vice versa. Eventually, individual students attempted to play with both hands together: the right hand on melodies and the left hand on harmony. Throughout the process, students learned to work well with each other
and provide support for each other. The activities encouraged students to give each other critiques, comments, advice, or compliments in a constructive manner. Finally, students would play out loud in front of the whole class. Note that in any conventional setting, students are typically fearful of playing out loud in front of the whole class as they are afraid of judgements from their peers. However, in-class collaborative learning allows them to feel safer to play out loud in front of others as they realize they are not the only ones who are struggling with learning how to play the piano. As a result, students tended to perform better and learn things more efficiently.

In addition to performance outcomes, this study intended to investigate whether or not collaborative work influenced students’ attitudes and confidence toward learning and performing harmonization. Previous research has found that a positive attitude can help people learn more efficiently (Stenger, 2018). This could be attributed to the fact that a positive attitude towards learning has the potential to improve “the functions of the brain’s memory center and predict performance independent of confounding factors such as a student’s IQ” (Stenger, 2018). Also, students who are positive about music tend to be more interested in it and are also more likely to practice it, thereby allowing them to have a better achievement in musical learning.

**Accuracy of Harmonization**

**Group Piano I’s Performance Outcome.** Group Piano I is the first semester class of a four-semester group piano sequence, and the majority of the students who attended this class did not have any experience on playing the piano, especially on harmonization. Typically, at the beginning of the semester, they just started to learn grand staff reading and chords and also learn how to harmonize the melody, which could be a big challenge for their present skill levels. In general, prior to Group Piano I class, students barely knew how to read the single melody line or
how to harmonize the melody with left chords. Group Piano I was structured in a way that they would start to learn the primary chords (and their progression). Another challenging task for them was that they needed to have a good coordination with two hands, and most of them had difficulties with using both hands together. Developing motor skills for adult students can be much more difficult than for children; hence, it can take quite a bit of time for these students to learn harmonization properly.

Prior to taking any Group Piano I lessons, some notable observations of students were as follows. Students from both control and experimental groups barely knew how to choose and play the chords. Some students simply played the single note with the left hand, and they could not play the full chord. Also, reading right-hand melody with correct rhythm was hard for some students. The pretest and posttest required students to play broken-chord accompaniment style that required even a higher level of coordination, and such style presented quite a challenge for almost all students in the beginning. The deficiency in these important motor skills explained the poor scores for the pretest from Group Piano I’s students with mean scores of 60.6 and 63.5 for the control and experimental groups, respectively. Students particularly scored low in the areas of chord, accompaniment, and continuity/coordination. The pretest appeared to be difficult for the first-year students who have no prior piano experience.

After ten weeks of treatment, both control and experimental groups seemed to have better accuracy with playing melodies with their right hands, with a notable improvement from the experimental group. Note that the difference between the control and experimental groups started to show even after five weeks of treatment, indicating collaborative learning could improve students’ learning quickly. Students from the experimental group would check each other on the key signatures, octaves, notes, rhythms, etc., during in-class collaborative learning activities.
Also, they would work with each other by discussing the choice of harmony. They were able to identify the best inversions to use, thereby allowing them to limit the number of hand shifts. Throughout these in-class collaborative learning activities, I heard students comment that checking with peers on what harmony they should use was quite helpful and effective. The mean posttest score in the area of chords was much higher than the mean pretest score for the experimental group, whereas the mean score for the control in the area of chords stayed almost the same. This indicates that the experimental group had a better grasp on playing chords with their left hands, whereas the control group continued to struggle in this area.

The experimental group performed much better in the area of accompaniment, which required knowledge of playing both melodies and chords. In particular, the experimental group was more comfortable and confident to play the broken-chord accompaniment style, instead of simply playing the simple block chord accompaniment. As for the control group, students still struggled in the area of accompaniment, and they tended to play the simple block chord accompaniment in the posttest.

Similarly, in the area of continuity/coordination, students from the experimental group improved significantly, as compared to the control group. Note that students in the control group were instructed to work alone, and they did not play out loud in front of others. On the other hand, students from the experimental group were asked to perform out loud in front of others. Although they were nervous with some hesitation at first, they became more comfortable to play with each other and perform in front of the entire class at the end. Fluency also improved towards the end of the experiment. In particular, they tended to have better coordination. Perhaps, playing out loud in front of others forced them to practice harder during the fifteen minutes of in-class experimentation. This allowed students to have more performance
opportunities than they normally would, thereby indirectly improving their performance skills. As they performed more, they knew they could successfully play through the entire piece, thereby boosting their confidence level. With a higher confidence level, they could play the piece with less stress, resulting in a more fluent performance (i.e., higher continuity).

It should be noted that the mean score for the experimental group increased significantly after ten weeks, with a notable improvement in the areas of chords, accompaniment, and coordination/continuity. It appeared that students with no prior or very little piano experience would certainly benefit from engaging in collaborative learning activities.

**Group Piano III’s Performance Outcome.** Group Piano III’s students had already received two semesters of piano instruction prior to the class. Unlike Group Piano I’s students, the topic of harmonization was not foreign to them, but it remained a challenging topic for them. The harmonization became harder requiring students to figure out secondary dominant chords with inversions and changes in hand position more frequently. Some students had not taken the appropriate level theory class prior to entering this class. Without appropriate knowledge pertaining to theory, students were confused initially and continued to struggle in this area. In the pretest, although students from both the control and experimental groups scored reasonably well in the areas of melody and chords, they did poorly or struggled in the areas of accompaniment and continuity/coordination.

During the experiments, students from the experimental group figured out the chords together with their assigned partners. They discussed with their partners on what might be the best solutions on the inversions. Some students patiently helped their partners figure out the secondary dominant chord. Also, some students were not confident in playing out loud in front of the class at first; however, their partners encouraged them to give the performance a try. After
that, they were motivated and performed well in front of the class. Moreover, throughout the ten weeks of collaborative learning activities, students often confirmed their thinking/options or sought a second opinion from their partners. By doing so, less time was needed to achieve the goal each time, resulting in a more efficient learning process and a significant improvement in the accuracy of harmonization. In the posttest, students from the experimental group earned almost full points in melody and chords. As for the control group, their mean scores in melody and chord changed very slightly.

Prior to this study, students primarily focused on block-chord accompaniment style, which is much easier than broken-chord accompaniment style. Although they had learned both styles in Group Piano I and II classes, the coordination of broken-chord accompaniment style remained challenging for them to perform. The pretest required students to use broken-chord accompaniment style, but instead, a large number of students still used block-chord accompaniment style; hence, the mean scores in accompaniment area were quite low for both the control and experimental groups. After in-class collaborative learning activities, students from the experimental group performed noticeably better in the area of accompaniment, whereas students from the control group only had a slight improvement in this area. This could be explained by the fact that students who worked in groups provided practice strategies for each other, as described as follows.

In general, it required a series of steps to help improve students’ broken-chord accompaniment style. I often taught my students to play block chords with their left hands first. Once they were familiar with this step, I would ask them if they could try playing melodies with their right hands while playing block chord with left (hands together). Once all previous steps were successful, then the last step was to try playing broken chords (instead of block chords).
with right hand melodies in a very slow tempo. This strategy allowed them to start with a simple
task, followed by a series of increasingly more difficult tasks, and the end goal was to build up
their confidence with coordinating their hands. However, the abovementioned instructions were
not easily adapted by students, as could be seen in the students from the control group. I often
found that students who worked alone were struggling even in the first two steps. They barely
had a chance to get to the third step. Once they were stuck in any of the steps, many simply gave
up, stopped practicing, and just sat there waiting for the end of the lesson. On the other hand, for
the experimental group, a different kind of atmosphere was present in the classroom, and
students were very encouraging. When one student was struggling with both hands, another one
tried to help by tapping the rhythms in both hands in broken chord patterns. Note that they
encouraged each other and understood that these were difficult topics. They provided each other
with some practice strategies. When one student wanted to give up, the other refused to let their
partner stop/quit; each of them pushed each other to their limits, thereby persisting in their
learning. Once they got used to the rhythms, they could easily transfer the rhythms to the
keyboard playing. I noticed that students from the experimental group, with their partners’ help,
could get to the third step within a brief period of time. After they successfully completed the
third step of the instruction, they kept practicing until they felt comfortable with the task. Once
they finished the exercises, I observed that they had a sense of accomplishment with smiles on
their faces.

Moreover, the experimental group performed much better than the control group in the
area of continuity/coordination after ten weeks of in-class collaborative activities. Note that
similar to Group Piano I, the differences between the control and experimental groups in Group
Piano III became more obvious even after 5 weeks of treatment, and were also reflected on the
interim assessment. Since playing broken-chord accompaniment style emphasized a great degree of coordination with both hands, one would expect that the experimental group would also do better in continuity/coordination, as was the case in the posttest. As mentioned above, more students from the experimental group (with their partners’ help) were able to play broken chords with their left hands while playing melodies with their right hands, which required a high level of coordination skills. As for the control group, very few students could play broken-chord accompaniment style, implying that most of them did not have as good coordination skills as the experimental group.

Confidence Level Assessment

A self-evaluation harmonization survey with twelve Likert scale questions and questionnaire with open-ended questions were used to evaluate the effect of collaborative learning upon students’ attitudes and confidence toward learning and performing harmonization.

Self-Evaluation Survey for Group Piano I’s Students. In Group Piano I, there was one Likert scale question in the self-evaluation survey that had significantly different mean responses from both control and experimental groups in the posttest (based on the analyses of the Mann-Whitney U tests). The question was “(4) If I cannot play the harmonization easily at first, I keep practicing until I can.” The responses from both groups revealed that more students from the experimental group would keep practicing until they could play the harmonization example, even if they were not successful at first. After engaging in ten weeks of in-class collaborative learning activities, experimental participants appeared to be more persistent in their learning. This could be attributed to the fact that when students struggled in playing, their partners encouraged them, shared practice tips, and told them not to give up. With their partners’ help, they were able to complete the difficult task within a short period of time. After completing the difficult task,
students tended to develop a sense of accomplishment, knowing that they were capable of learning piano (in this case, harmonization); consequently, they were more confident in trying new things at the piano.

Also, based on the analyses of the Wilcoxon signed-rank tests, it appeared that more students from the control group tended to avoid practicing harmonization for class by the end of the semester. It is worth noting that students from the control group might have had a negative experience in playing harmonization during Group Piano I classes. This could be due to the fact that they received no help from their classmates on performing harmonization even when they were struggling. As a result, they reported being more likely to give up and avoid practicing as much because they might have developed a misconception that they would not perform harmonization well regardless of their efforts.

**Self-Evaluation Survey for Group Piano III’s Students.** In Group Piano III, significantly different responses from the control and experimental groups after the treatment were provided to the questions about persistence (based on the analyses of the Mann-Whitney U tests). Students were asked if they would keep practicing even if they could not play the harmonization easily at first. More students from the control group became less eager to practice challenging harmonization by the end of the semester. Also, students were asked if they would go right to work on the assigned examples when they decided to practice harmonization. More control group students self-reported that they would be less eager to work on the assigned examples voluntarily. As mentioned previously, students from the control group continued to struggle with harmonization exercises. Control group students didn’t benefit from suggestions by their classmates. A large number of them would simply give up when they encountered problems. Unlike the control group, a positive in-class atmosphere was found with the
experimental group; their partners would not allow them to give up easily. Hence, collaborative learning may indirectly help students develop better attitudes toward learning. If students have a better attitude, they are more likely to continue practicing until they master musical skills.

Similarly, based on the analyses of the Wilcoxon signed-rank tests, students from the experimental group believed that they were more capable of dealing with most harmonization problems. During their ten-week collaborative learning activities, experimental group participants had their partners on their side to constantly encourage them, provide practice strategies, and refuse to let them quit/stop. Students understood that mastering harmonization skills required hard work (i.e., persistence and good preparation). They understood that they were not the only ones who were struggling with the harmonization exercises. With their partners’ assistance, they could complete the difficult tasks, thereby developing a sense of accomplishment and building up their confidence level. Collaborative learning activities appeared to foster a more positive learning environment for these students.

**Questionnaire with Open-Ended Questions.** At the end of the study, students were asked to fill out a questionnaire with open-ended questions. These questions allowed students to freely express their feelings and/or thoughts about the experimental activities. For the control group, very few students selected harmonization as their most confident functional keyboard skill, and very few students enjoyed in-class harmonization exercises. In particular, a lot of students reported that they were not confident when playing the harmonization examples. Some of them commented that they could do better if they had more time or if they had put enough effort into their practice. Their responses were not surprising as most of them found in-class harmonization exercises to be quite difficult; many of them could not complete the exercises alone. When that happened, they simply lost interest, gave up, sat there, and waited for the class
to end. It appeared that students from the control group lacked persistence in overcoming difficult tasks, primarily because they did not have positive attitudes toward learning harmonization.

Unlike the control group, a large number of students from the experimental group selected harmonization as their most confident functional keyboard skill. Such differences could be attributed to the fact that students from the experimental group took advantage of the collaborative learning experience to learn more about harmonization. Positive comments on the collaborative learning experience were made by many students, and a few of them are provided below:

(1) “I enjoyed different perspectives offered by other students, especially in harmonization exercises. I would gladly participate in another collaborative learning course.”

(2) “I think collaborative is very helpful and create new ideas.”

(3) “It helps me check my answers and get tips from my partner.”

(4) “I think it sometimes helps solidify the new information if we are able to talk it out and collaborate with another person.”

(5) “I think it is a good way to learn and build confidence by being forced to play in front of others.”

(6) “It is interesting and effective.”

(7) “I enjoy it. It shows me that I am not the only one struggling.”

(8) “I feel that it encourages performance among peers and allows for students to learn not only from the teach but from each other.”
Several good outcomes resulted after engaging in collaborative learning experiences. Students recognized that they were not the only ones who were struggling. When students got stuck in some areas, their peers would provide tips and encouragement. Also, collaborative learning experiences allowed students to develop better communication skills, which is quite important to students’ future career development. Based on my in-class observation, I could see that students were having fun while engaging in collaborative learning activities.

However, grouping students for collaboration surfaced as an important matter. A few students commented, “It’s ok mostly. If I know the person I am collaborating with, it’s fine. If I don’t know the person, it’s very awkward because they don’t talk to me and I don’t talk to them, so nothing gets done.” This could be explained by the fact that personality or familiarity of the surroundings might play a role in collaborative learning. If two people have similar introverted personalities, they might not work well together because they could be too shy to communicate with each other, or they are afraid of making mistakes in front of others. As suggested by Fisher (2006), heterogeneous groupings should be used in collaborative learning activities. This type of grouping allows for a rich diversity of personalities, abilities, experiences, interests, perspectives, and reasoning strategies, thereby enriching the experience of collaborative learning. Hence, for a successful collaborative learning experience, instructors should consider pairing two students with different personalities or skill levels together. Although having a rich diversity (difference) is good, one should be careful that having a huge difference might also hinder students’ academic achievement. For instance, if an excellent student was paired with a poor student, the poor student might improve significantly, whereas the excellent student might think the experience was a wasted effort. Hence, it is teacher’s job to ensure that students are paired up appropriately with some degree of differences in skills and personalities (Pike, 2006).
collaboration might not take place immediately, because students were not familiar with their partners. When this happens, it is also teacher’s job to facilitate student interaction by monitoring students’ activity, approaching them, encouraging them to get to know each other, and posing some questions to guide them to toward meaningful activity and discussion within the small group.

A large number of students from the experimental group selected working harmonization examples with their peers as their favorite in-class activity. Some notable comments were: “the process is relaxed and helps me learn faster,” “I enjoy working with a partner the most during this whole semester,” and “I got to collaborate with someone else rather than doing everything myself.” Also, a majority of the students from the experimental group found in-class collaborative learning to be quite helpful in figuring out harmonization examples, and would like to continue this experience in their future group piano classes. Note that students from the control group were also asked if they would like to participate in collaborative learning in their future studies, and most of them provided positive responses.

Although a large number of students were uncertain about collaborative learning in the piano class at the beginning of this semester, their opinions changed greatly by the end of the semester. A majority of the students thought this experience was enjoyable and beneficial, and some of them commented that the experience was not as scary as they had anticipated and that collaboration helped improve their approach to harmonization. In particular, it could easily turn a difficult task (such as broken-chord accompaniment style) into a reasonable one within a short period of time. After learning the potential benefits of collaborative learning, students started to think about how they would implement this type of learning into their primary instrument studies with their peers. They thought it would be a great idea for their friends to participate in these
types of activities. Their comments were: “it allows us to learn from each other,” “it teaches you how to work with others and provides another viewpoint,” “it’s a good way to keep your learning on track,” and “I have grown as a pianist because of it.” Based on these comments, students who engaged in collaborative learning could become a better communicators and team players. They also were more likely to persist in their learning. These are some good qualities to have for future employment.

**Implications of Collaborative Learning Application in Other Functional Skills**

In addition to harmonization conducted in this study, Baker (2008) implemented collaborative learning activities in sight reading in her group piano class teaching, and she also discovered that there were significant improvements in students’ sight-reading skills and attitudes toward learning sight-reading at the piano when students were paired up to do in-class activities. Because of its success in helping students to learn harmonization and sight reading, collaborative learning could also be implemented to develop other functional keyboard skills, such as improvisation, transposition, and technique. There are many lesson plans developed by educational researchers (Fisher, 2006; Meulink, 2011) that use collaborative learning to help students learn appropriate functional keyboard skills. Teachers can simply adapt some of these plans into their future group piano classes. The following section will discuss three lesson plans (adapted from Meulink (2011)): one for improvisation, one for transposition, and one for technique.

Based on Meulink (2011), for improvisation, the instructor should present one particular piano style, such as jazz, folk, or country. The students are then asked to prepare a 15-minute group presentation on one piano performance style that covers broader stylistic category (e.g., historical information, performance characteristics, etc.). This presentation requires each student
in the group to improvise and demonstrate that particular style. Students would form groups of three and are expected to prepare their presentation as groups outside of class. All members in a group must agree on a rhythmic or melodic motive that represents their style and come up with a plan to utilize that motive when improvising. To successfully accomplish this assignment, the groups need to divide all the tasks between all members appropriately. After that, each group would present its project in class. In the end, the whole class would summarize what they have learned, and students would evaluate the strengths of each group and provide some suggestions for improving their presentations. As discussed by Meulink (2011), this exercise intends to help students “construct and relay knowledge that leads to whole-class cooperation in attaining a goal” (p. 84), thereby improving students’ improvisation skills on a particular style.

For transposition, Meulink (2011) suggested a plan that could help students learn how to transpose melodies up or down a whole or half step, using collaborative learning. The teacher creates cards with a melody on one side and the same melody transposed up or down a whole or half step on the other side, and then disseminates the cards with different melodies to students. The plan requires students to work in pairs. One student (Student A) could sit at the keyboard while the other student (Student B) would stand in front of and face Student A. Students A and B in each pair use a headphone plugged into the same keyboard, and they could switch the headphone if needed. During collaborative learning activities, Student B would first show the melody side of the card to Student A, and Student A would name the key and play the melody one time. Student B would then name the new key from the back of the card, and Student A names the sharps or flats in the key signature and plays the melody in the new key with Student B’s coaching if needed. After that, students would reverse their roles. Once this is accomplished,
each pair would exchange the card with their neighboring pair. This exercise allows students to work together (via affirmation and coaching) to get to the correct answer on their own.

For technique, a lesson plan provided by Meulink (2011) can also be considered. The objective of the plan is to help students learn how to perform scales with correct fingerings using a collaborative skill strategy called *Jigsaw I*, developed by Aronson, Blaney, Stephan, Sikes, and Snapp (1978). In this lesson, the teacher groups students (typically groups of 3 to 4) and assigns a different scale to each student in the group. Students (from each original group) who have been assigned the same scales form (different) jigsaw groups and learn the fingerings for the same scales with their jigsaw members. The teacher sets the appropriate controller setting, thereby allowing jigsaw members to only hear each other. After learning the correct fingerings for their assigned scale, students would then return to their original groups and take turns teaching their fellow group members the scale they learned in their jigsaw groups. Again, the teacher would set a different controller setting, so that only original group members can hear each other. At last, each group plays all the scales (learned from the members) together for the teacher. This exercise intends to force students to learn information from one group (i.e., jigsaw group) and then relay that information to the second group (i.e., original group), thereby helping students demonstrate their understanding.

The intended ideas offered by the abovementioned lesson plans have many merits that could potentially help students learn improvisation, transposition, and technique more effectively. More research studies (similar to harmonization and sight reading) are needed to ensure that collaborative learning could improve students’ achievements and attitudes toward learning and performing other functional skills. Regardless, I would encourage music educators not to stick with the conventional teaching method (i.e., rote learning or receptive learning
method), but to consider using some of these plans in their group piano classes, and students might find the in-class activities fun and meaningful, thereby fostering a positive learning environment.
CHAPTER 5. CONCLUSIONS

The purpose of this study was to examine the effects of collaboration on the first- and second-year college music major students’ harmonizing skills in a group piano program at Louisiana State University in Fall 2018. Two specific research questions were addressed, which were (1) whether students who worked in groups of two or three learned harmonization more accurately than those who worked alone and (2) how collaborative work influenced students’ attitudes and confidence toward learning and performing harmonization.

There were one hundred and eleven non-keyboard music majors participated in this study, including 71 students enrolled in six sections of Group Piano I and 40 students enrolled in four sections of Group Piano III. The researcher divided these sections into two groups based on convenience: control and experimental groups. For Group Piano I classes, three sections were chosen as the control group ($n_1 = 35$), whereas the remaining three sections were selected as the experimental group ($n_2 = 36$). For Group Piano III classes, two sections were chosen as the control group ($n_1 = 12$), the remaining two sections served as the experimental group ($n_2 = 28$). Students in the experimental group engaged in collaborative learning activities when learning harmonization, whereas students in the control group worked alone on the harmonization exercises.

To address the first research question, pretests, interim assessment, and posttests were used to track the students’ achievement in harmonization during the course of the experiment. The pretest was given at the beginning of the study, and no significant differences were found between the control and experimental groups in Group Piano I and III, indicating the piano performance skill levels between these two groups were similar prior to the study. Note that the spreads or standard deviations of the pretest scores between these two groups were also similar.
After five weeks of the experiment, students were asked to take the interim assessment (a different test from the pretest) that was used to evaluate their progress. The mean scores between the control and experimental groups in Group Piano I started to show a significant difference, along with some difference in the standard deviations of the scores. The experimental group performed better than the control group in interim assessment, along with a smaller standard deviation of the scores. For Group Piano III, although there was no significant difference between the control and experimental groups, the mean score from the experimental group was higher (with a smaller standard deviation of the scores). Finally, students took the posttest, which was identical to the pretest, at the end of the semester. The experimental group in Group Piano I and III performed significantly better than the control group. It should also be noted that the standard deviation of the posttest scores of the experimental group was noticeably smaller than that of the control group, indicating that collaborative learning activities could help students improve their harmonization skills in a more effective, consistent manner. It appeared that all the students from the experimental group tended to grow together as a team because most of their scores did not deviate from the mean value as much.

To address the second research question, a self-evaluation survey with 12 Likert scale questions and a questionnaire with open-ended questions were used to evaluate students’ attitudes and confidence level toward learning and performing harmonization. Both survey and questionnaire indicated that students from the experimental group were more persistent and confident in learning harmonization even though difficulties might have encountered. They developed a sense of confidence that they could accomplish any new harmonization exercises given in the class (with their peers’ affirmation and coaching). Also, a majority of students from the experimental group commented that harmonization was their most favorite and confident
functional keyboard skill. They found the in-class collaborative learning activities to be fun and beneficial to their learning, and they commented that they learned many great practice tips from their partners. Throughout this experience, they learned that they were not the only ones who were struggling in learning harmonization; hence, they became more patient in learning and understood that learning required persistence. In addition, they would like to continue the collaborative activities in their future piano and primary instrument classes, and they encouraged everyone to participate in collaborative learning.

Given the success found in this study, music educators should consider implementing collaborative learning in their future group piano classes. More research studies are still needed for other functional skills, such as improvisation, transposition, and technique. Regardless, collaborative learning can certainly help students improve their achievement and confidence in learning and performing harmonization.
REFERENCES


Westerlund (Eds.), *Collaborative learning in higher music education* (pp. 173-177). Farnham, England: Ashgate.


**APPENDIX A. IRB EXEMPTION AND CONSENT FORM**

---

**ACTION ON EXEMPTION APPROVAL REQUEST**

**TO:** Yining Li  
Music

**FROM:** Dennis Landin  
Chair, Institutional Review Board

**DATE:** September 13, 2018

**RE:** IRB# E11183

**TITLE:** The Effects of Collaboration on Hamonization in College Group Piano Class

**New Protocol/Modification/Continuation:** New Protocol

**Review Date:** 9/11/2018

**Approved** [X] **Disapproved**

**Approval Date:** 9/13/2018  **Approval Expiration Date:** 9/12/2021

**Signed Consent Waived?**  **No**

**Re-review frequency:** (three years unless otherwise stated)

**LSU Proposal Number (if applicable):**

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**By:** Dennis Landin, Chairman  
[Signature]

---

**PRINCIPAL INVESTIGATOR: PLEASE READ THE FOLLOWING –**

**Continuing approval is CONDITIONAL on:**

1. Adherence to the approved protocol, familiarity with, and adherence to the ethical standards of the Belmont Report, and LSU's Assurance of Compliance with DHHS regulations for the protection of human subjects.
2. Prior approval of a change in protocol, including revision of the consent documents or an increase in the number of subjects over that approved.
3. Obtaining renewed approval (or submittal of a termination report) prior to the approval expiration date, upon request by the IRB office (irrespective of when the project actually begins); notification of project termination.
4. Retention of documentation of informed consent and study records for at least 3 years after the study ends.
5. Continuing attention to the physical and psychological well-being and informed consent of the individual participants, including notification of new information that might affect consent.
6. A prompt report to the IRB of any adverse event affecting a participant potentially arising from the study.
8. **SPECIAL NOTE:** When emailing more than one recipient, make sure you use bcc. Approvals will automatically be closed by the IRB on the expiration date unless the PI requests a continuation.

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*All investigators and support staff have access to copies of the Belmont Report, LSU's Assurance with DHHS, DHHS (45 CFR 46) and FDA regulations governing use of human subjects, and other relevant documents in print in this office or on our World Wide Web site at http://irb.lsu.edu/irb*
APPENDIX B. LESSON PLANS

Consent email obtained from publisher (to reuse some examples in this dissertation)

Michael Worden
Re: Print_190306_17
To: Yining Li

March 11, 2019 at 14:11

Hello Yining,

Thank you for your clarification.

I am happy to inform you that this type of usage would be called EDUCATIONAL in nature and therefore would fall under FAIR USE. There would be no need for a license.

You are clear to proceed forward.

Best,

Michael Worden
Manager, Business Affairs
Alfred Music
P.O. Box 10003 • Van Nuys, CA 91410-0003
(818) 891-5999 x269 | (818) 646-7003 fax

The information contained in this transmission may contain legally privileged and confidential information. It is intended only for the use of the person(s) named above. If you are not the intended recipient, you are hereby notified that any review, dissemination, distribution or duplication of this communication is strictly prohibited. If you are not the intended recipient, please contact the sender by reply e-mail and destroy all copies of the original message.
Sample Lesson Plan for the Experimental Group in Group Piano III

Collaborative strategy: *Think-Pair-Share* (Kagan, 1994)

**Example:** p.154 #1 Prelude in A minor by Frederic Chopin

**Step 1 (2 min)**
- Students work individually to harmonize the melody from the assigned example
- Teacher asks them to identify if any inversions could be used for some chords

**Step 2 (4 min)**
- Teacher sets the controller and pairs students up (sometimes a group of 3) so that group members can hear each other only (Note that the pairing can be different in each class.)
- Students talk and work through the chords with their partners, especially when they need to figure out if any inversion of the chords is required to be used (thereby limiting the leap in the left hand)
- Students discuss and reach a consensus for the answer within each pair
- Teacher monitors the discussion of the activities

Scenario that might happen in a pair during Step 2:
- In the first measure, some partners discussed the solutions. For this particular example, there could be two solutions from students. For instance, one student might argue that the E7 chord could be played in the root position, so the 5th finger of the left hand stayed the same when going to the A major chord in measure 3.
- While the other student (partner) would argue whether they could play with the first inversion of the E7 chord. Hence, the 5th finger would be on G sharp, and A major chord would just keep in the root position. In this case, the 5th finger just needed to be simply moved half step up.
- After that, students explained their reasonings to support their arguments and tried to reach a general consensus for each individual pair.

**Step 3 (6 mins)**
- Students play with their partner and prepare to play out loud in the class
- Students take turns to play the melodies and harmony (within the pair). One student plays the melodies while the other student plays the harmony, or vice versa.
- Students play with both hands together by themselves eventually

**Step 4 (3 mins)**
- Students in each pair play out loud in front of the entire class sequentially (sometimes by themselves or with the instructor)

Note: In Step 4, students could play the waltz style while the instructor is playing the melody. Or, they could try both hands themselves (in front of the entire class).
Sample Exercises for Group Piano I

**6-12**

*DU, DU LIEGST MIR IM HERZEN*

*Vivace (lively)*

Germany

Transpose to E major.

2. Block Chord Accompaniment

**6-13**

*LA CUCARACHA*

*Moderato*

Mexico

Transpose to A major.
SALLY GO ROUND

Allegretto

United States

Transpose to F major.

2. Alberti Bass Accompaniment

Moderato

Germany

Transpose to A major.

Unit 12 ■ The Subdominant Chord
Sample Exercises for Group Piano III

SHALOM, CHAVERIN

Prelude in A Major

Frédéric Chopin (1810–1849)  
Op. 28, No. 7
Pretest/Posttest for Group Piano I

Piano 1 Harmonization Pretest

Take 1 minute to study this example silently. You may write in Roman numerals below.
Flay the R.H as written and add a broken-chord accompaniment in the L.H.

Note: Identical music score was used for pretest and posttest.
Interim Assessment for Group Piano I
Note: Identical music score was used for pretest and posttest.
Interim Assessment for Group Piano III
APPENDIX D. RUBRICS FOR PRETEST, INTERIM ASSESSMENT, AND POSTTEST FOR GROUP PIANO I AND III

Rubric for Pretest/Posttest for Group Piano I          Fall 2018

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<th>Melody (37)</th>
<th>Chords (40)</th>
<th>Accomp (12)</th>
<th>Continuity/coord (12)</th>
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Rubric for Pretest/Posttest for Group Piano III          Fall 2018

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## Rubric for Interim Assessment for Group Piano I

**Fall 2018**

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## Rubric for Interim Assessment for Group Piano III

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<th>Chords (28)</th>
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APPENDIX E. HARMONIZATION SELF-EVALUATION SURVEY

Name: ___________________________  Date: __________________________

Circle number that corresponds with your feeling (#1 if your answer is rarely; #5 if your answer is all or most of the time).

| 1. I enjoy playing harmonization in the class. | 1 | 2 | 3 | 4 | 5 |
| 2. I am confident that I can successfully learn the harmonization examples for class. | 1 | 2 | 3 | 4 | 5 |
| 3. One of my problems is that I avoid practicing harmonization for class. | 1 | 2 | 3 | 4 | 5 |
| 4. If I cannot play the harmonization easily at first, I keep practicing until I can. | 1 | 2 | 3 | 4 | 5 |
| 5. Even when I decide to master harmonization examples, I rarely achieve success. | 1 | 2 | 3 | 4 | 5 |
| 6. I am likely to give up preparing harmonization exercises before completing them successfully. | 1 | 2 | 3 | 4 | 5 |
| 7. Even when I find practicing harmonization unpleasant, I can stick to it until I complete the task. | 1 | 2 | 3 | 4 | 5 |
| 8. When I decide to practice harmonization, I go right to work on the assigned examples. | 1 | 2 | 3 | 4 | 5 |
| 9. When playing a new harmonization exercise, I give up if I am not initially successful. | 1 | 2 | 3 | 4 | 5 |
| 10. The prospect of failure at harmonizing melodies makes me work harder in preparation. | 1 | 2 | 3 | 4 | 5 |
| 11. I am likely to give up on working on harmonization easily. | 1 | 2 | 3 | 4 | 5 |
| 12. I am not capable of dealing with most problems that may come up when working on harmonization exercises. | 1 | 2 | 3 | 4 | 5 |
APPENDIX F. QUESTIONNAIRE WITH OPEN-ENDED QUESTIONS

Questions for the Control Groups
1. Now that we are at the end of the semester, which functional skills do you feel the most confident playing on the piano?
2. During piano class, what activities did you enjoy the most?
3. How did you feel when you played the harmonization examples?
4. Describe collaborative learning, if you can?
5. Do you think teachers can include collaborative learning in piano classes?

Questions for the Experimental Groups
1. Now that we are at the end of the semester, which functional skills do you feel the most confident playing on the piano?
2. How do you feel about the collaborative learning experience?
3. What did you learn from your partner(s) throughout the semester?
4. What in-class activities did you like the most? What did you enjoy the most during this experience?
5. Would you like to continue with collaborative learning activities in piano class next semester? Do you think it is helpful (or not)? Why?
6. Was the collaborative learning in class helpful in figuring out harmonization examples?
7. Describe how you worked with your partners during in-class collaborative learning. For example, did you discuss chord options first? Did you play for each other? List anything that you did.
8. How did you think about collaborative learning before this semester started?
9. After this experience, has your thinking about collaborative learning changed or stayed the same? Please elaborate the changes, if any.
10. Do you think collaborative learning could be applied to other functional skills?
11. Do you think 15 mins during each class is a sufficient amount of time to do collaborative learning activities?
12. Do you think it would be a good idea for teachers to re-structure the entire piano class to include more collaborative learning in another areas?
13. Would you like to implement collaborative learning in your other studies or on your own instrument, if possible?
14. Would you recommend collaborative learning to your friends? Why?
VITA

Yining Li was originally from Qingdao, China. She completed her bachelor’s degree in Music Education with an emphasis on piano performance from Jiangnan University in China. She received a graduate certificate on piano pedagogy from Oakland University and Master of Music degree in piano performance from the University of Toledo. During her time in Toledo, she taught group piano classes as a teaching assistant. In her spare time, she also worked as a pianist at Good Shepherd Lutheran Church. After that, she served as an adjunct piano instructor at Owens Community College for a year. Her primary duties were teaching group piano classes, giving private piano lessons, and playing accompaniment for vocalists.

She is currently working toward her Ph.D. degree in Music Education with a minor in Piano Pedagogy. During her time at LSU, she has worked as a graduate teaching assistant, teaching group piano classes to music major students, non-music major students, and secondary students. Her primary research interests include piano pedagogy, group piano teaching, and music education.