The Effects of Prior Aural Familiarity on Piano Students’ Sight Reading and Learning of Musical Excerpts

Thesis

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Abstract

The present study was designed to investigate how prior aural familiarity with a musical excerpt affected music learning and performance in school age students taking piano lessons. Specifically, the study examined how accurately piano students (n=22) played the rhythms and notes of an excerpt of a familiar piece of video game music compared to unfamiliar music of similar style and difficulty. Effects of age, piano training, and student practice time were also measured.

Students were given a sight-reading pre-test and an identical post-test following two weeks of practice. The sight-reading test consisted of two musical examples, one familiar and one unfamiliar, which were both 16 beats long and were effectively equivalent in terms of difficulty. Students were asked to perform each piece twice, and were then asked to practice the pieces at home and write down the number of minutes practiced. The process was repeated with the same piece for the post-test. Performances were scored based on rhythmic accuracy and performance (notes and rhythms) accuracy. Results were analyzed for familiarity level (familiar or unfamiliar), performance condition (pre-test or post-test), student age, piano training (measured in years), and student practice time (measured in minutes for each piece) for both rhythmic accuracy and performance accuracy.

For both rhythmic accuracy and performance accuracy, significant main effects were found for familiarity level and performance condition: students responded more
accurately on the familiar piece and on the post-test condition. No significant effects were found for subject age, piano training, or student practice time. For both rhythmic accuracy and performance accuracy, a significant interaction occurred between familiarity level and performance condition: student scores rose from pre-test to post-test for both conditions of familiarity level, but the growth in student scores was stronger for the familiar piece than for the unfamiliar piece. Results seem to suggest that prior aural familiarity may assist student rhythmic accuracy and performance accuracy, particularly when accompanied by student practice.
Dedication

To my mother, for buying both a piano and a Game Boy.

And to my wife, for being okay with me keeping them.
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First and foremost, I wish to thank my wonderful family for all of their love and support during the course of this degree program. My parents have always been ready to listen and offer advice, and they have always encouraged me to be the best person and student that I can be. I would not have the reward of teaching students today were it not for the example that they set for me. My wife has helped me to get through the thesis process with my sanity intact, despite having her own dissertation to deal with at the same time. Her love and cooperation has helped us to successfully navigate many busy months, and her work ethic and resolve always challenge me to work harder as well. I am so very blessed to have her by my side.

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Chapter 1: Introduction

In music education, transfer of knowledge is extremely important. Even a young student who knows just a few notes and a few rhythms has the potential to perform many different songs, thanks to an infinite number of ways to configure notes and rhythms. This means that music students have endless opportunities to transfer their knowledge from a previously-learned setting into a new setting.

Existing research has identified factors that relate to transfer of learning in music. For example, Duke and Pierce (1991) found that undergraduate music students showed adverse changes in tempo and pitch accuracy when a piece of music was transferred from the learned tempo to a new tempo. Pierce (1992) also showed that a particular learning procedure could help to transfer rhythmic knowledge more efficiently. In this study, instrumental students who used a procedure called “sizzling”—a rhythmic technique which closely approximates playing the instrument—attained a desired level of rhythmic performance faster than students who used other learning procedures such as clapping (Pierce, 1992). Grashel (1979) found that several different learning procedures (in-class instruction, programmed instruction, and a blend of the two) were effective at teaching concepts of form, and that the procedures allowed students to transfer knowledge to unfamiliar musical examples. Strand (2005) examined transfer of learning as it related to
music composition and found that direct instruction and guided teaching strategies helped to facilitate transfer from learning to composition in elementary school students.

Ultimately, in any performance setting, knowledge about pitch, rhythm, dynamics, and many other musical concepts are transferred into the performance. Many factors are involved in the transfer of learning that is necessary for each facet of performance, and each method of music instruction has its own way of introducing and transferring this knowledge.

Byo (1988) analyzed a series of beginning band classroom method books and found a number of strategies that were used to promote transfer of learning. For instance, singing was used in an instrumental setting to help transfer knowledge about pitch to the instrumental playing. It was also noted that “In beginning band instruction, there is undoubtedly a need for vicarious learning promoted by unison playing” (p. 21). Most method books made use of familiar tunes to help assist melodic instruction. Rhythmic knowledge was transferred in multiple ways, including non-pitched rhythmic examples. Rhythmic chanting and syllables, a number system for counting rhythms, foot tapping, and rhythmic movement were also used to transfer rhythmic knowledge to student performance. Fingering charts, photographs, and instructional text were utilized to help convey musical knowledge and concepts, particularly those that were mechanical in nature.

Piano method books similarly use a variety of strategies to promote transfer of learning. Frewen (2010) studied the Alfred Premier Prep Course, Faber and Faber Piano Adventures, and the Hal Leonard Standard Piano Library. She noted that the Premier
Prep Course books ask students to tap rhythms and say finger numbers out loud prior to playing. Additionally, these books ask students to count while playing or sing while playing. It was also shown that the other two books make strong use of finger numbering systems, with the Piano Adventures books also using diagrams.

Perhaps the most famous music teaching method is the Suzuki Method, which is used worldwide and has been adapted for numerous instruments. Unlike some of the aforementioned methods, the Suzuki method focuses on learning how to develop technique on the instrument prior to learning how to read music ("Suzuki twinkler," 1998). Additionally, the program makes use of listening on a regular basis, and the Suzuki Association of the Americas notes that “Listening to music every day is important, especially listening to pieces in the Suzuki repertoire so the child knows them immediately.” ("Suzuki twinkler," 1998) Studies of the behaviors of Suzuki string teachers have also shown that modeling and teacher demonstrations are a key component of each lesson (Duke, 1999; Colprit, 2000).

Of interest to this particular study is the way in which prior aural familiarity has been emphasized as a component of many teaching methods. The Suzuki method features prior aural familiarity most prominently through its emphasis on teacher modeling and listening to pieces prior to performance. However, many of the band methods surveyed by Byo also included familiar music, sometimes in excess of 25% of the musical exercises (Byo, 1988). Additionally, many piano method books (even those focused on music reading skills) make use of familiar songs in some capacity. For instance, the first book of Faber and Faber’s Piano Adventures uses Old McDonald, Yankee Doodle, and
Ode to Joy (Faber & Faber, 2011). The *Piano Adventures* series also markets supplementary “Popular Repertoire” books at that contain popular tunes and feature graded repertoire matching their standard method books ("Piano adventures," n.d.). Alfred’s *Premier Prep Course* features similar supplementary books featuring Pop and Movie Hits (“Pop and movie hits book,” n.d.), while the Hal *Leonard Standard Piano Library* also has supplemental “Popular Piano Solos” books as well as books featuring Broadway and movie selections (“Popular piano solos,” n.d.). The underlying assumptions for using familiar works during instruction are likely to be that they serve multiple purposes, although the reasons are not usually explicitly stated in the literature. Perhaps the advantages are so obvious as to be intuitively accepted. At least two reasons seems to be plausible; first, familiarity may motivate students to learn a piece, perhaps as evidenced by spending more time practicing a work, and second having a piece “in their ears” may facilitate learning to play it more efficiently than an unfamiliar piece.

Given the common usage of familiar material in method books, it is appropriate to consider whether prior aural familiarity is a factor that could influence transfer of learning in music.

Grashel (1979) used popular music as an introductory agent to teach concepts of music form to middle school instrumentalists and found that instrumentalists could learn musical concepts from familiar popular music. This effect occurred regardless of the type of instruction the familiar music was paired with. Further, the learning was found to be transferable to unfamiliar band literature.
Frewen (2010) examined the effects of prior aural familiarity on children’s ability to correctly perform a melody on the piano. Students who had no keyboard training listened to a melody 128 times over two weeks to gain familiarity, and then learned how to perform the melody on the keyboard. A second group learned the melody on the keyboard prior to the familiarization process. Students who were familiar with the melody played significantly more correct notes than did students who had not been familiarized with the melody.

The present study builds upon the previous literature by studying the effects of prior aural familiarity on children’s ability to correctly perform rhythms and notes on the piano. Rhythms and notes in this study are examined within the context of a two-hand piano arrangement that contains melody and accompaniment. The study also examines whether familiarity influences practice time. Piano arrangements of familiar video game music are used as a key learning procedure. Video game music was chosen because video games are a popular form of American youth culture. 81% of students ages 5-8 have played a console video game (Rideout, 2011), and 97% of teens 12-17 play computer, web, portable, or console games (Lenhart, Kahne, Middaugh, Macgill, Evans, & Vitak, 2008). Additionally, 56% of all U.S. households own a modern console system such as the Playstation 3, Xbox360, or Nintendo Wii (Nielsen, 2012). Video game music thus has the potential to reach a very large audience. Furthermore, video game music tends to be “looped” in nature, so a student hearing a song in a video game will likely hear the melody numerous times. Songs are also often re-used within games and between games,
so certain video game music has the potential to be highly familiar among children and teens.

Need for the Study

While there have been studies that pertain to transfer of learning in music, there are still many factors that merit further investigation, including the effects of prior aural familiarity on student learning. Prior aural familiarity has been shown to increase students’ ability to play notes correctly on the piano (Frewen, 2010), and it has been shown to increase students’ understanding of concepts of form (Grashel, 1979). However, there has been no research to date linking prior familiarity and the ability of students to perform rhythms correctly. Research regarding prior familiarity and note accuracy has also not addressed two-hand piano performance examples, as is being done in the current study. The present study, however, does focus more on rhythmic accuracy. Considering the importance of rhythmic accuracy in performance, it seems appropriate to study any possible factors (such as prior aural familiarity) that might influence students’ ability to transfer rhythmic learning into performance. Secondary factors such as student age, experience level, or practice time may also impact rhythmic learning, and are also appropriate variables for study.

The present study focuses on prior aural familiarity’s impact on the ability of private piano students to correctly sight-read and perform rhythms and notes. This follows and extends the line of questioning regarding prior aural familiarity that was
developed by Frewen (2010). The study will also help to fill gaps in the literature on transfer of knowledge in music as well as popular music in music education.

Purpose of the Study

The purpose of the study was to determine the effects of prior aural familiarity on transfer of learning in music. Specifically, the study looks at how rhythm and note performance on both a sight-reading task and a music learning task is affected by the student’s level of prior familiarity with the excerpt. Popular video game music was used, because research has shown that most students play video games. Further research has shown that students can effectively learn from popular music. Age and experience level of the performers were also investigated as possible factors, as was student practice time. Specific research questions include:

1) Do piano students sight-read a piece of music better if they are previously familiar with the music?
2) Do students learn a piece of music more effectively if they are previously familiar with the music?
3) Do students spend more time practicing familiar music than unfamiliar music?
4) Do student age and experience level further influence the effects of prior aural familiarity?

Key Terms

For purposes of this study, key terms were defined as such:
**Video Games**- Any interactive experience in which a person plays a game on an electronic device. This can include console devices that plug into TVs or portable devices (including phones) that can be played anywhere.

**Video Game Music**- Any music that is contained within a video game and is played for purposes of accompaniment during the game.

**Limitations**

1) The students in this study were all private piano students of the researcher. As such, while they represent a range of ages, levels of experience, ethnic backgrounds, and socioeconomic statuses, they all are taught using generally the same teaching methods. As such, effects may not be generalizable and may be attributable in part to the teaching methods of the researcher.

2) The design of the study used real-world music examples, which made it impossible to control precisely how familiar students were with the pieces. As such, familiarity was assessed by having students rate their own level of familiarity with each piece, which means that any effects of student incorrectness (i.e., not actually knowing a piece despite claiming that they do) are uncontrolled.
Chapter 2: Survey of Literature

Musical knowledge does not exist in isolation. Pitch, rhythm, and many other elements of music must be constantly combined, reworked and transferred to new situations to create new musical experiences. Transfer of knowledge in music thus has broad implications for the field. Some research regarding transfer in music has been completed on how motor tasks transfer into new musical situations, but there is less research into the factors that influence the cognitive transfer of knowledge in music. When teachers and researchers fully understand the factors that influence how musical learning is transferred from familiar situations into novel situations, teaching for transfer can be become more specific and allow students to progress at faster rates. The primary objective of the present study is to add to the current literature on transfer of learning in music by investigating the influence of prior aural familiarity on the ability of students to transfer rhythmic knowledge from sight-reading to performance.

The following survey of literature looks dually at the topics of transfer of learning in music and prior aural familiarity. Both areas are key components of the present study. The topic of transfer of learning in music includes general discussion of transfer of learning, as well as studies involving specific factors that relate to transfer of learning in music. Related areas such as pitch discrimination, sight-reading, and motor skills are also surveyed. Within the topic of prior aural familiarity, studies directly pertaining to prior
aural familiarity in music are included. Additional studies related to reading and language acquisition provide further context for prior aural familiarity in music. Popular music studies are also included due to their relevance to the study.

Transfer of Learning

Transfer of learning has been defined as “whenever prior-learned knowledges and skills affect the way in which new knowledges and skills are learned and performed” (Cormier & Hagman, 1987, p.1). Such a definition brings about an important question for any research study involving transfer: What is considered to be a new knowledge or skill? Gick & Holyoak (1987) leave room for each study to create a different interpretation of that question.

They take the view that no major theoretical separation can be made between “transfer” and “learning”. (Learning has a definition that is similar to transfer, with the only major difference being that the second task performed is the “same” as the first, rather than “different”). Rather, they note that a continuum exists whenever one piece of learning is performed in a novel setting. Tasks that are simple repetitions are classified as “self-transfer”, while tasks that are very different are classified as “far-transfer”. In between are tasks that are highly similar, which are considered to be “near-transfer” (Gick & Holyoak, 1987). It can be implied that many studies that cite “transfer” may often be referring to “far-transfer”, but there is room for interpretation in studies that involve transfer.
Further, the field of transfer is quite broad. Cormier and Hagan note that transfer can be very general or very specific, and that motor transfer, cognitive transfer, and metacognitive transfer are all possible facets of transfer of learning (Cormier & Hagan, 1987).

Transfer of Learning in Music

Robert Duke and Michael Pierce (1991) addressed the topic of motor skill transfer in music through a study involving collegiate music majors. The study assessed the effects of performance tempo and melodic context on the ability of musicians to transfer knowledge from a learned melody into an unfamiliar one. Students learned to correctly play a target measure at 80 beats per minute and then performed a novel example that contained the target measure preceded by either a high-difficulty or low-difficulty measure. Some students were asked to play the novel example at the same tempo (80 bpm), while others were instructed to go either slower or faster. The tempo and note accuracy of the novel example were measured for each subject. Results showed that the accuracy of the subjects’ tempo and pitch both declined when the performance tempo differed from the learning tempo, meaning that tempo and pitch transfer best when the example is learned at the same tempo as the performance. Melodic context (whether the target measure was preceded by easy or difficult material) also showed an effect, as performance of the target measure declined when it was preceded by a difficult measure, as compared to an easy measure. The effect, however, was not statistically significant.
Pierce created a related study in 1992 that used the variables of performance condition, learning procedure, and tempo to study the transfer of rhythmic skills in middle school instrumentalists (Pierce 1992). The study looked specifically at rhythm because multiple instructional methods for rhythm exist, but there is no consensus as to which best facilitates student instruction. Four methods were chosen: clapping, counting, clapping and counting, and “sizzling”, an instrumental procedure in which students pulse air through the instrument in rhythm, similar to actual playing. Students were then grouped by performance level (intermediate and advanced), and were given a melody to play. Students learned the melody’s rhythm using one of the four rhythmic procedures. Once the rhythm had been learned, they played the melody twice on their instrument at one of four different tempi. This same process was repeated three times, so that each student learned one melody with each learning procedure and each of the four tempi was used in one performance. The results showed that rhythmic performance accuracy did not vary among the four learning procedures, though the time spent learning the example did vary. Sizzling was the most efficient learning procedure, while clapping and counting was the least efficient. Additionally, performance scores confirmed that more errors occurred when performance tempo was different from the learning tempo.

Both studies indicated that learning processes that most closely approximate the intended performance (maintaining the same tempo, sizzling) may be shown to best facilitate transfer of learning into performance, particularly when rhythms are involved.

A study by Caroline Palmer and Rosalee Meyer (2003) showcased similar findings within the context of motor skill research. Transfer of learning experiments were
designed to investigate the ability of skilled pianists to generalize knowledge of specific motor movements and temporal structure from one melody to another. Three experiments were designed: in the first, “meter and/or motor movements (hand and finger assignment) were altered from training to test melodies” (p.81), in the second, “rhythm and/or motor movements were altered” (p.81), and in the third, “meter and/or rhythm were altered” (p.81). In each experiment, performances slowed (indicating a weaker performance) when one of the three factors (melody, rhythm, or motor movements) was changed from one melody to the next. The authors concluded that “…the meter, rhythm, and motor movements that pianists learned for one musical sequence aided subsequent performance of another sequence, as demonstrated in a transfer-of-learning task” (p.99). As such, when the transfer task is similar to the learning task, the transfer increased, similar to the earlier studies (Palmer & Meyer, 2003).

Palmer and Meyer also found that transfer was easier for adults than for children in a 2000 study. Adult expert and novice child pianists participated in a transfer of learning task whereby participants practiced a piece of music and then performed a new piece that contained either the same or different motor and melodic relations. They found that young pianists could only transfer effectively to situations that contained identical motor and conceptual elements to what had been learned, while adult pianists were able to transfer learning to situations that contained different motor and conceptual elements than what had been learned. They noted that a mental plan for action, needed for the transfer task, only became independent of the motor movements at advanced skill levels,
so they concluded that “…results of transfer tasks may not generalize from skilled to
novice performers” (Palmer & Meyer, 2000, p.67).

G. Joshua Sanders (2004) reviewed literature regarding motor skills and practice
and noted that many studies in motor movement showed that transfer and skill retention
were increased through contextual inference, a learning process that increases variation in
a motor program over numerous trials. A highlighted example was that practicing piano
scales in multiple keys should theoretically improve transfer and retention better than
practicing the same scale repeatedly, though that hypothesis does not appear to have been
tested.

The literature thus far has focused on the need for learning tasks to be highly
similar to transfer tasks. An instructional technique that uses a similar approach is
modeling, where the teacher demonstrates a learning task for the student that the student
then imitates.

Frewen (2010) notes that “Modeling is effective because it allows learners to have
an accurate representation of their target goal and use that representation to guide their
practice, identify errors, and self-correct” (p. 321); she also cites many studies showing
the effectiveness of modeling (see Frewen, 2010). In particular, a finding of Siebenaler
(1997) was that piano teachers who used more frequent modeling episodes were viewed
more favorably by a panel of piano pedagogy experts who were judging teaching
effectiveness. Frewen’s own study used modeling as a successful teaching procedure
when teaching students (grades K-4) without piano experience how to play a short
melody on the piano. The effects of the modeling procedure were magnified when
students already had prior aural familiarity with the melody (Frewen 2010). Teachers using the Suzuki Method also focus heavily on modeling. Listening is a major component of the method (“Suzuki twinkler,” 1998), and modeling has shown to be a prevalent teacher behavior during the course of lessons (Duke, 1999; Colprit, 2000).

Many of the above studies focus on motor transfer in some capacity, though as was noted, knowledge in the cognitive domain can also be a focus of transfer in music. Strand (2005) developed a curriculum for music composition that was based on transfer theories and was designed to transfer learning from listening and performance tasks to composition. This curriculum was then taught to elementary school students during a four-week summer enrichment course where students received eight hours of instruction per week. Some of the teaching strategies that were incorporated into the teaching included direct instruction, guided discovery, modeling, encouragement of peer mentoring, and task scaffolding. She found that her students had success at transferring learning to their compositions when direct instruction and guided discovery teaching strategies were used, a finding that supported prior literature in transfer outside of the field of music.

Teaching strategies developed by Grashel also allowed for transfer of learning with middle school instrumentalists. In-class instruction, programmed instruction, and a combination of both were used to teach concepts of form to students, and it was found that each strategy successfully taught the concepts. A post-test was administered, and it was also found that students were able to transfer the same concepts to unfamiliar band pieces (Grashel, 1979).
John Brick (1984) studied an instructional strategy that made use of a computer program called TAP Pitch Master. The instruction was designed to teach pitch discrimination skills to trombone students through the use of programmed lessons. Based on ability, Junior High School trombone students were split up into two equal groups. One group received training using the Pitch Master in place of regular band instruction over the course of ten sessions. Part of the training involved singing tasks, so when the students participating in the Pitch Master program showed significant gains on the end trombone performance task, Brick was able to conclude that students made a transfer from the aural discrimination tasks to the performance task. It was noted by the author that this result was consistent with numerous prior studies that had suggested that vocal training can improve instrumental performance (see Brick, 1984, for more).

Both Pierce (1992) and Strand (2005) noted a dearth of specific literature regarding transfer of learning in music. However, there is related research in both pitch discrimination and sight-reading. The above study by Brick was one such example, in that it used an aural/listening method involving pitch discrimination to transfer knowledge into instrumental performance.

A 1974 study by Charles Elliott found that pitch discrimination abilities of band students improved when they regularly received instruction in vocalization. Band study itself was also found to improve pitch discrimination, but band students who used vocalization as a regular instructional strategy made even more significant gains during the course of the school year (Elliott, 1974).
The possibility that vocalization could also help to improve sight-reading abilities was one of the many points of discussion in an extensive review of literature by S. Daniel Galyen (2005). Ultimately, the results were mixed. Several studies were cited that stated no effect of vocalization on instrumentalists’ sight-reading abilities, while there were several other studies that did find effects of vocalization on sight-reading. One commonality among the studies that did find an effect is that the affected populations were generally younger or less-experienced musicians, so it is possible that vocalization only helps transfer knowledge to sight-reading for novice musicians.

In addition to studies on vocalization, some evidence of transfer exists in studies on sight-reading. Because the process of sight-reading a piece of music inherently involves the performance of novel material, prior musical knowledge must be transferred into the novel situation for sight-reading to occur. Sight-reading studies are thus relevant to any study that regards the transfer of musical learning.

The lit review by Galyen (2005) goes on to explore many different facets of sight-reading research. In addition to a look at the variables that influence sight-reading ability, other topics such as notational variables, computer-assisted instruction, characteristics of successful sight-readers, and sight-reading methods (see Galyen, 2005, for more) are discussed. Galyen summarizes his findings by stating that educators need to create a multi-faceted approach to sight-reading, including the usage of vocalizations, kinesthetic activities such as clapping or foot-tapping, and specific methods such as “sizzling” (see Pierce, 1992). Private lessons, composition, and rhythmic dictation were also noted to improve sight-reading, as was the practice of describing and modeling
conducting patterns for students. Additionally, it was noted that the best sight-readers often sight-read regularly, which lines up with previous transfer research that showed that learning tasks that are similar to performance tasks can assist transfer.

Research in transfer of music has occurred, but there are certainly gaps in the literature. Much of the research has revolved around motor skill transfer, with less research involving cognitive processes. Some studies (particularly those involving modeling) have implications for both motor skill and cognitive transfer, as models can be applied to visual or aural material. In practice, modeling procedures often accompany listening procedures that are designed to familiarize the student with material to be learned. The present study is focused on prior aural familiarity as a key factor in transfer of learning; therefore, a deeper look into research involving prior aural familiarity and listening skills is appropriate.

**Prior Aural Familiarity**

Within music, aural methodology forms the basis for Suzuki’s “mother-tongue” approach to music teaching, which was patterned after native language learning. Not surprisingly, listening skills can also be shown to be an important part of education in language and reading. In the field of reading, a big topic is phonemic awareness. Phonemic awareness has been referred to as “the ability to recognize that a spoken word consists of a sequence of individual sounds” (Hempenstall, 2003). It is also sometimes referred to as phonological awareness. Some understanding of phonemic awareness is viewed as necessary for development of the alphabetic principle, which states that the
written word is composed of graphemes (visuals) that correspond to phonemes (sounds) (Hempenstall, 2003). In that sense, the students’ listening and aural abilities have an impact on their reading skills. Numerous other studies state that phonological awareness correlates with and can serve as a predictor for children’s reading ability (see Peynircioğlu, Durgunoğlu, & Öney-Küsefoğlu, 2002; Caravolas & Bruck, 1993 for more).

A 1993 study at McGill University looked at how phonological awareness develops (Caravolas & Bruck, 1993). It is apparently unclear if phonological awareness is developed prior to alphabetic literacy or alongside alphabetic literacy. English-speaking Canadian children were studied, as were Czech children (the Czech language has distinct differences to the English language that allow for easy differentiation), and results suggested that both oral and written language input played an important role in raising children’s phonological awareness.

On the other hand, a 2007 finding suggested not only that reading ability may have a strong aural component, but that music instruction that focuses on distinguishing musical patterns may also help children to hear the sounds that distinguish words (Lucas & Gromko, 2007). The study hypothesized that scores on a standardized test of tonal and rhythmic pattern discrimination would be related to scores on a standardized test of phoneme segmentation, and that aural perceptual ability could explain the transfer from music instruction to phonemic awareness. First grade students were tested, and a significant correlation was found. The authors suggested that the two factors were
correlated, and that aural components of instruction may play a role in developing each skill.

Gromko had similar findings in a 2005 study. Children in an experimental group received four months of music instruction as compared to a control group who did not. The experimental group showed significantly greater gains in phonemic awareness, which supported the hypothesis that music instruction that associated sound with appropriate symbols transferred to the development of similar processes that are necessary for phonemic awareness (Gromko 2005).

Peynircioğlu, Durgunoğlu, and Öney-Küsefoğlu also backed up this finding in another study involving phonological awareness (Peynircioğlu, Durgunoğlu, & Öney-Küsefoğlu, 2002). The relationship between phonological awareness and music among Turkish and American children was studied through the use of a phoneme deletion task (where children said parts of words) and a tone deletion task (where children sang parts of familiar melodies). All students involved had not yet learned to read, so any variance in abilities and results was based purely on auditory skills. The phoneme deletion tasks showed that success was reflected based on the characteristics of the language with which the children were familiar. For instance, final phoneme deletion (deleting a syllable at the end of the word) was easier for Turkish students than was initial phoneme deletion. It was explained that in the Turkish language, speakers use far more inflections and changes that are placed at the end of words (compared to English), so the students were better able to perform the task that was most similar to their familiar language skills. In general,
children who had previously been shown to have a high-musical aptitude also did well on all tasks, showing another correlation between musical ability and linguistic ability.

Familiarity with particular sounds has received extensive study in reading, as the fields of phonics and phonemic awareness have a broad research base. In music, familiarity occurs quite a bit in actual practice, but few studies have explicitly studied the variable. One key study to do so was written by Katherine Goins Frewen and looked at the formal effects that prior aural familiarity had on children’s ability to play a melody. (Frewen, 2010)

Prior Aural Familiarity in Music

In Frewen’s study, children in grades K-4 were split up into two groups. One group learned how to play an unfamiliar melody on the piano through a teaching method that incorporated teacher modeling, singing of finger numbers (designed to help students with no prior piano instruction determine which finger to play), and numerous repetitions. Immediately after the teaching session occurred, the student was tested on their ability to correctly play the melody. All children were then formally familiarized with the previously unfamiliar melody through a process of repeated listenings. Over the course of two weeks of music lessons, students listened to a particular melody 128 times to gain familiarity. To assess each child’s familiarity with the melody, a melodic error identification test was administered before and after performance of the melody. After the melody had been familiarized, the melody was then taught to each student in the second
group, and each student in the second group was tested on their ability to perform the melody directly after learning the melody, just as the first group had done.

The results were analyzed through a calculation of the number of correct notes that were played by each student. Overall results found that the students in the familiar (second) group had higher note scores than did students in the unfamiliar (first) group. Furthermore, it was found that familiarity had a significant effect on the ability of the students to perform correct notes. Additionally, age of the students was also found to have a significant effect on the performance ability, with older students scoring better. The author concluded that prior aural familiarity influenced the ability of the students to perform notes correctly, particularly in the second-half of the excerpt. The author suggested that prior aural familiarity might be even more advantageous when learning longer or more difficult melodies, and it was further noted that prior familiarity led to greater error detection and may have also increased student motivation.

Hargreaves, Castell, and Crowther (1986) looked at the way in which familiarity affected music conservation tasks such as pitch transposition and rhythmic inversion. Children in both Great Britain and the USA listened to familiar tunes such as *Happy Birthday to You* and *Twinkle Twinkle Little Star*, followed by a transformed version of the same tune that featured either a pitch transposition or a rhythmic inversion of the same piece. As a control, some tunes were followed by the exact same tune with no changes made. A similar process was repeated with unfamiliar tunes. The students were asked to explain whether each pair of pieces were the same (non-transformed) or different. Researchers overwhelmingly found that students were better able to identify whether the
two examples were the same or different with familiar pieces than they were with unfamiliar pieces, meaning that familiarity allowed students to “see through” transpositions and rhythmic inversions. As one of the tasks was a rhythmic inversion, it would be presumed that the familiarity of the melody (more so than the rhythm of the familiar tunes) mattered. Eight-year-old students also performed better on the task than did 6-year-old students, and results were similar between British and American students. The authors concluded that familiar melodies are processed differently by young children than are unfamiliar melodies. It was hypothesized that an additional stimulus (beyond those typically needed for the tasks at hand) might be at work when familiar melodies were involved, and it was suggested that further study in the area would be beneficial.

The pairing of familiar melodies with non-musical information has also been studied, though the results are more mixed. Silverman (2010) asked undergraduate music majors and non-music majors to listen to a series of nine digits paired with a variety of stimuli, including familiar melodies, non-familiar melodies, and rhythm only. It was found that pairing non-musical information with familiar melodies did not have any effect on the immediate recall of non-musical information. However, it was shown that pairing rhythm with non-musical information could facilitate the recall of the non-musical information.

Wolfe and Hom, on the other hand, did show that verbal material was recalled better when paired with familiar melodies. Preschool students learned telephone numbers that were then paired with a familiar melody, an unfamiliar melody, or just spoken word. On average, students learned the telephone numbers faster when paired with familiar
melodies, indicating that immediate recall of nonmusical information was increased by familiar melodies (Wolfe & Hom, 1993). The ages of the participants may have something to do with the discrepancy between the two studies, as research has shown that adults and children process transfer tasks differently.

Frewen’s study (2010) used repetition to familiarize students with a piece. Repetition has been shown to both increase familiarity with a piece and liking of the piece, at least in the short term (Hargreaves, 1984). Hargreaves studied the hypothesis that repetition would create an “inverted-U” curve in the liking of a piece, whereby liking would rise with repetition up to a critical point, at which point it would start to fall. Collegiate students listened to musical examples four times each in three weekly classroom sessions for a total of twelve listenings. On each listening, they were asked to rank their liking of the music and familiarity with the music on a 1 to 7 likert scale. He found that for a variety of types of music, the hypothesis regarding the “inverted-U” curve was shown to be correct. Additionally, familiarity increased drastically during the trial period, particularly within the first several listenings. Of secondary interest was that selections of popular music were considered to be the most liked music as well as the most familiar music (Hargreaves, 1984).

Popular Music

Popular music was also shown to be well-liked in a study by Dan Isbell, who reviewed literature on popular music in music education (Isbell, 2007). He cited numerous studies on music preference and young people in making the assumption that
popular music is “the preferred style of music of school-age children” (p.53). Under that assumption, he looked at many facets of popular music instruction. Much literature was devoted to teacher resources regarding popular music, as well as specific examples of popular music being used in the classroom. Less space was devoted to specific research studies involving music.

However, one interesting study out of 1979 carries some implications for popular music as an instructional tool. Grashel developed three instructional strategies that used popular music to teach concepts of musical form to intermediate band students. Using music from the Billboard Top 40 charts, a series of six units on musical form was developed and then taught to students. In-class instruction, programmed instruction, and a combination of techniques were all used, and a test that measured the knowledge of the formal concepts was administered before and after the six-unit instructional period. It was found that the band students were able to learn the concepts of form from all three of the instructional procedures, though programmed instruction was the most effective. More interesting was that the conceptual learning that occurred as a result of the instruction using popular music was able to be transferred to unfamiliar band pieces, as measured by the post-test (Grashel, 1979).

Summary

There are many variables that influence transfer of learning in music. These include tempo (Duke & Pierce, 1991; Pierce, 1992), melodic context (Duke & Pierce, 1991), learning procedure (Pierce, 1992; Palmer & Meyer, 2003; Sanders, 2004; Strand,
2005), skill level of the performer (Palmer & Meyer, 2000), and prior aural familiarity (Frewen 2010). Additionally, it has been shown that transfer occurs in conditions where the transfer task is most like the learning task (Duke & Pierce, 1991; Pierce, 1992; Galyen, 2005; Peynircioğlu et al., 2002). Modeling procedures can help to assist in transfer tasks; such procedures have been shown to be an effective teaching technique (see Frewen, 2010). Modeling is also component of the widely-distributed Suzuki Method (Duke 1999; Colprit 2000), as is prior aural familiarity through listening. Prior aural familiarity has been shown to influence student learning and transfer in music (Frewen, 2010; Hargreaves et al. 1986; Grashel, 1979). Listening skills are also important in reading (Hempenstall 2003; Caravolas & Bruck, 1993), and there are some connections between musical ability and reading (Lucas & Gromko 2007; Gromko 2005; Peynircioğlu et al., 2002) that can be attributed partly to listening skills. While transfer research has occurred in music, the field is very broad and there are gaps in the literature, particularly in regards to the effects that listening skills such as prior aural familiarity can have on transfer of learning in music.

The present study follows the line of questioning developed by Frewen (2010). Frewen studied the influence of prior aural familiarity on the ability of children to play a melody on the piano. The present study looks to extend the findings of the previous study by investigating the effects of prior aural familiarity on the transfer of rhythmic learning. The present study will use popular music (specifically, video game music) to accomplish this task.
It is hoped that the present study will help to fill gaps in the literature regarding transfer of learning in music, particularly those involving rhythms. Additionally, it is hoped that the present study can help to ascertain the effects that prior aural familiarity has on student learning in music, as it has implications for a number of areas of music, including studies related to popular music.
Participants

Study participants consisted of students who were taking private piano lessons in a music studio. The music studio was located in a suburb of a large Midwestern city, and all study activities took place at the studio. The ages and experience levels of each student varied greatly. Students ranged in age from 8 to 15, and ranged in grade level from 3rd grade to 10th grade. The average age of students involved in the study was 11.7, and the median age was 12. The minimum amount of piano experience of the students involved was 1 year of lessons and the maximum amount of piano experience was 10 years of lessons. The average experience level of the students was 4.2 years, and the median experience level was 3 years. Students from the studio were from a variety of different local communities, and did not necessarily comprise a representative sample of any local population. Each student received weekly private lessons that lasted either 20 minutes or 30 minutes, with 30 minute lessons being reserved for more experienced students. Many of the students also participated in school music activities, and some took private lessons on additional instruments.

This study was designed as action research, so all activities were conducted during regular lessons that were taught by the researcher. No study procedures involved
any teaching episodes on the part of the teacher, however. Students excluded from the
study included the researcher’s adult students, as well as students who were just
beginning lessons. Adult students were excluded because the study was designed to look
at the abilities of school-age students, and beginning students were excluded because of a
lack of exposure to eighth-note rhythms. Study tasks involved eighth-note or sixteenth-
notes as well as syncopated rhythms—all of which were viewed as being too difficult to
for beginning students to read. As such, any student who had not had exposure to eighth
notes was deemed a beginner. The teacher’s remaining students were considered to be
eligible for the study. Each eligible student (n = 45) under the teacher’s instruction was
placed into one of four groups based on their ability and was asked to complete a pre-
assessment task that established listening familiarity with a series of excerpts.
Participants from the study were then recruited from the group of students (n = 31) who
were considered to be extremely familiar with at least one of the listening excerpts. Each
potential subject was asked to participate in a voluntary sight-reading and practice task,
and all students who agreed to participate in the task (n = 26) were included in the study.
Participation was completely voluntary, and any parent or student had the option of
declining participation. Parents were informed in advance of key study procedures. Due
to missed lessons and other conflicts, full datasets were not collected for some (n=4) of
the students who initially began participating in the study. The final sample consisted of
22 students, including 18 male students and 4 female students.
Music Selections for Familiarity Survey

A music familiarity survey was developed and administered to all non-beginning and non-adult students in the student population (n = 45) as a pre-assessment task that established each student’s level of familiarity with a series of musical examples. The musical examples chosen for this study were all pieces of video game music. Video game music was selected because video game music is often syncopated and because video games are highly-played by youth. 81% of students age 5-8 have played a console video game (Rideout, 2011), and 56% of American households have a modern video game console system (Nielsen, 2012). Additionally, a preliminary survey of the student population (n = 45) indicated that 78% (n = 35) of the eligible students enjoyed playing video games. As such, video games seemed likely to be a source of familiar music. Each example that was selected was short and highly syncopated

Music Selection Process

The video game music in the study was chosen very carefully to ensure that student familiarity was highly likely. Every selection came from one of the 50 highest selling games of all time in North America, and most selections came from one of the 10 highest selling games of all time in North America (“Game database,” accessed 5/27/12). This means that most selections came from games that had sold 10 million units or more in North America. Additionally, most selections were from games that had been released in the five years prior to the present study, which increased the likelihood that the games had been played by the student population. No games rated T (Teen) or higher by the
ERSB were used, as these games would be less likely to have been played by the study participants, who were generally pre-teens.

Additionally, the music met one or more of the following factors: 1) Used repeatedly within the game; 2) Used in multiple games; 3) Appeared early in the game; 4) Appeared in a memorable setting during the game; and 5) Mentioned by students as a “favorite” song during prior informal conversations.

Twelve selections that met the criteria were chosen, and a 16-beat segment of each selection (as it appeared in the actual game) was collected for use in the student familiarity survey. Four unfamiliar selections were also collected for use as a control. In general, these selections came from older or more obscure games that were less likely to have been played by school-age children. Seven items (five familiar and two unfamiliar) were selected for each group. Some selections were used in multiple groups.

Familiarity Survey

As a result of the procedure described above, the final version of the familiarity survey consisted of 7 items, each to be rated on a likert scale. Each survey included five selections from the familiar music list, as well two selections that were considered unlikely to be familiar. These additional selections were designed to serve as controls. Each item consisted of a 16-beat musical excerpt and participants were asked to circle a numerical value to express their degree of familiarity. Students were asked to rate their familiarity with each excerpt from 0-4, with “0” indicating no familiarity and “4” indicating a very high degree of familiarity.
The meaning behind each number (i.e., 0 means “that you’ve never heard this before”) was explained to each student, and then each of the seven excerpts was played. Examples were played on a Compaq Presario laptop using the computer’s internal speakers. After each excerpt, the student circled the number on the scale that they felt fit their level of familiarity with the piece. Students were allowed to request a repeat of the excerpt if needed.

After each student had completed the survey, the familiarity results were compiled. Any response where the student circled a “3” or “4” was considered to be a situation where the student was “familiar” with the musical example, while any response where the student circled a “4” was considered to be “extremely familiar” with the musical example. Of the 45 students surveyed, 91% (n = 41) were familiar with at least one musical example, while 69% (n = 31) were extremely familiar with at least one example. 60% (n=27) of students were extremely familiar with at least two examples, and 42% (n=19) were extremely familiar with 3 or more examples.

Any student who was not extremely familiar with at least one example was not considered for the remaining portion of the study. This allowed the researcher to exercise some control over the level of prior aural familiarity, since the familiarization process for each student was informal and had occurred during their video game playing experiences. One additional student was not considered because the only excerpt for which they circled “4” (extremely familiar) was a piece that the student had already learned to play.

All remaining students (n = 30) were asked to participate in the study. Of those, four elected not to participate, and the initial group consisted of 26 students. Due to lesson
conflicts, complete datasets were unable to be collected for four students, leaving the final group at 22 students.

The average score across all students (n=45) for the presumed familiar video game music was 2.5. The average score across all students (n=45) for the presumed unfamiliar video game music was 0.9. This indicates that the familiarity constructs worked as intended, and that the pieces that had been identified as likely familiar pieces were indeed familiar to the students. Of the twelve pieces on the familiar video game music list, four had an average score of 3 or higher, indicating a very high level of familiarity from students. These four pieces, along with the next two highest pieces (both of which had averages near 2.7), were used in the study, with the six pieces being made into ten different arrangements (some pieces were made into multiple arrangements of varying difficulty).

Construction of Performance Excerpts

The results from each of the four ability level groups were further analyzed. Based upon the extremely familiar selections for each student, two to three pieces from each group were arranged for use in the study. Each arrangement was 16 beats long, and was designed to be generally comparable to the performance ability of the students in the group. However, the arrangements were designed to be more difficult than each group member’s sight-reading ability. This was a deliberate function of the design that was put into place to avoid any potential ceiling effect that might occur. Ten total arrangements for piano were produced, representing a variety of difficulty levels and assuring that each
student received a piece that would be sufficiently challenging to sight-read and perform. This process also ensured that each student would have prior aural familiarity with the piece they were performing.

For each of the ten video game arrangements another “unfamiliar” piece was composed that was designed to be similar in length, style and difficulty level to the video game arrangement. Each original composition contained the same number of beats, notes and syncopated beats as the corresponding video game arrangement. Rhythms were also designed to be similar in nature. Some rhythms were reversed in the original arrangement, and certain rhythms were reused between the two pieces (though never in the exact same configuration). Note ranges and intervallic relationships were also designed to be fairly similar. In general, the tonal center and melodic contour were different from the video game arrangement to the original composition. Each pair of pieces was determined to be effectively equivalent in terms of difficulty level by seeking the opinion of an expert with many years of experience teaching similar levels of students.

Testing and Experimental Procedure

The testing and experimental procedure took place over the course of three consecutive weeks. Week 1 consisted of the initial testing procedure, Week 2 was a brief learning procedure, and Week 3 was the final testing procedure. Testing took place during regularly scheduled piano lessons. Many students have a second student in the room at the same time as their piano lesson, with the second student working with
headphones on a computer music theory program. The music studio used for the study employs multiple teachers, so lessons often occur simultaneously in multiple teaching rooms. As such, some students had extraneous background sounds occurring during the testing procedure due to other individuals within the studio and the room. However, these conditions were no different than an ordinary lesson for these students.

In the Week 1 initial testing procedure, each student was given two pieces to sight-read. One piece was an extremely familiar piece that the student had circled “4” for on the familiarity survey, while the other piece was an original composition (as described above) that was unfamiliar to the student. The order of the pieces was pre-determined, and approximately 50% of students received the familiar piece first. Students were not given any identifying information for either piece. Before each piece, the student was given a verbal instruction to find the first note of the piece. Each student was given a finger number on this first note to help determine proper hand position, but was not given any correction if they were unable to correctly find the proper hand position. Audio recording started, and the student was instructed to play each piece two times. A metronome was then briefly played to help the student determine the approximate tempo at which to play. The metronome was set at a tempo that was slower than the in-game tempo of the video game piece to account for the difficult nature of sight-reading an excerpt at tempo. The metronome setting and desired tempo were exactly the same for the video game and original pieces. Before the student began to play, the metronome was turned off, and the metronome remained off during the subsequent student performance. After the first performance trial, the student was reminded that they had one more attempt
to go. After the second attempt, the recording was turned off, and the student was reminded that they needed to practice the piece during the subsequent week. The same process was repeated for the second piece. Each student was then asked to write down the number of minutes practiced on each excerpt for each day of the week, which is also a normal lesson procedure at the studio. Students were not told that one piece was familiar, as it was hypothesized that students would recognize the familiar piece during either the sight-reading trial or the initial week of practice. Beyond the above procedures, no actual teaching involving the pieces occurred. The total test time for this procedure lasted approximately 5-6 minutes for each student.

Informal feedback, however, indicated that students had difficulty recognizing the “familiar” pieces during the sight-reading trial. Many students played the pieces slowly and with errors. It is possible that the speed and errors contributed to the lack of recognition; in other words, they could not play it well enough at this point to recognize it. Informal conversations with the students seemed to reinforce that theory. Previous research showed that student performance was best when it occurred at the same tempo as it was learned (Duke & Pierce, 1991; Pierce, 1992). As students had originally heard the pieces at a much faster tempo during their gameplay experiences, it seems possible that familiarity may also be affected by tempo, and that this could be an area for future study.

Based on the informal feedback, a corrective learning procedure was instituted during Week 2 of the study to ensure that students recognized the familiar piece. Students were first asked in Week 2 if they had recognized either of the pieces in the study, and
only 14% (3/22) had recognized the “familiar” piece during the first week of practice, despite their high degree of recognition in the familiarity survey. Students were then asked to view both music examples while they listened to a MIDI arrangement of each piece that had been prepared using Finale. The examples were played on a Compaq Presario Laptop using the computer’s internal speakers. After one listening, students were asked whether they recognized either selection, and the number of students who then recognized the familiar piece increased to 86% (19/22). The timbre of the arrangements was a piano sound, while the original familiarity scale included examples directly from game soundtracks. Students were able to recognize the piece despite the change in timbre, so that seems less likely to be a cause for the lack of recognition that occurred during the first week. Students were then told the exact name of the familiar piece (i.e., what video game it came from, and what, if anything, was happening in the game when the music was being played). This ensured that students would recognize the familiar piece prior to their second week of practice. They were also told that the unfamiliar piece was an original composition, and therefore was not anything that they had heard before. The students then listened to each piece while viewing the score one additional time. After that, students were asked to practice the pieces for an additional week. They were once again asked to write down the number of minutes practiced each day for each of the pieces.

The Week 3 final testing procedure was a replication of the Week 1 initial testing procedure. After the Week 3 testing procedure had been completed, music was collected so that practice times and musical performance accuracy could be scored.
Scoring of Participant Responses

Participant performances were scored by comparing the audiotaped recordings of the performance to the notated versions of each test item. Four performance conditions (Familiar Pre-Test; Unfamiliar Pre-Test; Familiar Post-Test; Unfamiliar Post-Test) were given a rhythm score and a performance score. Performance score is defined as a measure where credit for a “correct” beat is only given if both the notes and rhythms are correct.

Each excerpt was 16 beats long, and each beat was analyzed individually for rhythmic correctness and performance correctness. For scoring the rhythm assessment, a beat was given 1 point if the rhythm was correct and 0 if it was incorrect; note errors were not considered in this assessment. For the performance assessment, a beat was given 1 point if both the rhythm and notes were correct and 0 if either or both were incorrect. Both scores were calculated simultaneously, so there were three options available on each beat for the scorers: 1) incorrect for both rhythm and performance, 2) correct only for rhythm, and 3) correct for both rhythm and performance. A total of 16 points was possible for both the rhythm score and the performance score. Students performed each excerpt twice, so the results of both trials were averaged for each student and each performance condition prior to statistical analysis. Each trial was able to be listened to multiple times for scoring accuracy. Scoring reliability was determined by having another independent scorer analyze the performances. This procedure and the reliability results are described in the next chapter.
Chapter 4: Results

As detailed in Chapter 3, scores were calculated by analyzing each beat in the recorded student performances. For each performance, a rhythm-only score and a performance score (rhythm and notes) were calculated. Beats were classified as one of three options: incorrect (0 points for rhythm and performance scores), rhythmically correct (1 point to rhythm score but 0 points to performance score), or correct (1 point to rhythm and performance scores). 16 points were possible for each score. Students performed each excerpt twice, so the results of both trials were averaged for each student and each performance condition prior to statistical analysis.

To control for potential order effects, two versions of the test were given out to students in alternation. Approximately half of all students received the familiar piece first on the pre-test, while the remaining students received the unfamiliar piece first. The order of the pieces was maintained on the post-test for each student.

The process of scoring the piece was performed by the researcher as well as an independent observer. Both scorers worked at the piano studio where the study took place, and both had bachelor’s degrees in music and multiple years of piano teaching experience. The researcher scored all (n=2816) beats involved with study, while the independent observer scored 21% (n=592) of the beats involved with the study. Each scorer selected one of three options (incorrect, rhythmically correct, and correct) for each
beat. Interobserver reliability was calculated by looking at the 592 beats that were scored by both observers. The number of agreements (where both judges selected the same option) were calculated, and this number was divided by the number of total beats (n=592) that both observers scored. Using this method, interobserver reliability was calculated to be .70.

Additionally, controls were put into place by the researcher to avoid any potential biases. For each of the 10 familiar pieces, all performance trials for the piece were placed in order on the researcher’s computer hard drive and then scrambled by an additional independent observer. In this manner, the researcher could not identify the student performing the piece. Additionally, the researcher could not identify whether the particular piece was a pre-test or post-test example prior to scoring the pieces. A similar process occurred for the 10 unfamiliar pieces.

Initial variables for study included Familiarity, Performance Trial, Student Age, and Student Experience. A Repeated Measures ANOVA was used to analyze the variables, and it was determined that Student Age and Student Experience were nonsignificant \( (p > .05) \). These variables were then eliminated from the study so that subsequent analysis could focus on Familiarity and Performance Trial. Student performance scores were then analyzed using a Repeated Measures ANOVA with two within-subject factors. Familiarity and Performance Trial served as within-subject factors. Levels of the Independent variables included: Familiarity; Familiar and Unfamiliar, and Performance Trial; Pretest and Posttest. Both the rhythm scores and the performance scores were separately analyzed using this same methodology.
To determine whether students sight-read the familiar piece better than the unfamiliar piece, a series of Paired Samples T-tests was used. The first T-test compared the mean pre-test rhythmic scores of the familiar piece to the mean pre-test rhythmic scores of the unfamiliar piece, while the second T-test compared the mean pre-test performance scores of the familiar piece to the mean pre-test performance scores of the unfamiliar piece.

An additional analysis was also performed on student practice times to help answer another research question. Student practice times for each piece were averaged, and a Paired Samples T-test was used to compare the mean scores.

Data

Students self-reported that they practiced the familiar piece (M= 29.00, SD =24.00) and unfamiliar piece (M= 28.61, SD= 23.44) nearly the same amount of minutes. 73% of students (16 of 22) reported that they practiced each piece equally. A Paired Samples T-test performed on the means showed that there was no significant difference for the practice time of the two pieces \([t(21) = .28, p=.78]\). Accordingly, practice time was not used as a variable in the analysis.

The remaining study data consisted of the assessments of student performances, which were split into two segments: rhythm-only scores and performance scores (rhythm and notes). This data was used to determine whether student sight-reading and student performance were influenced by familiarity.
Student sight-reading was measured by analyzing the scores of only the first trial from the pre-test condition. These scores were broken into rhythm scores and performance scores. Rhythm scores were higher for the familiar piece (M = 6.05, SD = 3.18) than for the unfamiliar piece (M = 5.27, SD = 2.49). However, a paired samples T-test of the means showed that this difference in student rhythm scores was not statistically significant [t(21) = 1.57, p=.13]. Performance scores for the familiar piece (M = 3.82, SD = 2.79) and unfamiliar piece (M = 3.59, SD = 2.15) were very similar, and a paired samples T-test of the means showed that there was also not a statistically significant difference [t(21) = .49, p= .63] between the performance scores.

The remaining data were used to analyze the student learning that occurred during the study. A repeated measures analysis was used with the pre-test and post-test data to determine any effects of familiarity on student rhythm and performance scores. First, rhythm-only scores were analyzed. The means and standard deviation for two factors, familiarity level and performance trial, were calculated; data from both variables were collapsed across each other to determine the effects of each variable.

When comparing performances on familiar and unfamiliar pieces, collapsed across performance trial, subjects scored higher on the familiar piece (M=7.49, SD = 3.21) than on the unfamiliar piece (M = 5.73, SD = 2.56), and this difference was statistically significant \[F(1,21) = 24.37, p <.001, \eta^2 = .54\].

The means and standard deviation for performance trial were also calculated and collapsed across familiarity level, and it was found that subjects scored higher on the posttest (M= 7.58, SD = 3.03) than on the pretest (M=5.64, SD = 2.71). This difference
between trials was also found to be statistically significant \([F(1,21) = 13.82, p = .001, \eta^2 = .40]\).

The interaction of familiarity level and performance trial was calculated. A significant effect was found \([F(1,21) = 5.22, p = .03, \eta^2 = .20]\), indicating that these two variables are not independent from one another. Closer examination indicated that

![Mean Scores: Rhythm-Only Score](image)

**Figure 1. Mean Scores: Rhythm-Only Score**
familiarity with the pieces helped raise the post-test scores for subjects, which accounts for the interaction. Figure 1 above shows that while the pre-test and post-test scores increased for both familiarity conditions, the increase for the familiar piece was larger than the increase for the unfamiliar piece.

In the next analysis, performance scores, which calculated the number of beats that contained both correct notes and correct rhythms, were treated statistically using the same procedure that was used for the rhythm-only scores. The means and standard deviation of familiarity level and performance trial were calculated and then the data were collapsed across each other for analysis of the primary variables.

For familiarity, when collapsed across performance trial, it was again found that subjects scored higher on the familiar piece (M=5.63, SD = 3.26) than on the unfamiliar piece (M = 4.31, SD = 2.57). A significant difference was found for this familiarity level factor on the performance score analysis \[F(1,21) = 11.05, p = .003, \eta^2 = .35\]. Likewise, the means and standard deviation for performance trial were also calculated and collapsed across familiarity, and it was found that subjects scored higher on the posttest (M = 6.15, SD = 3.04) than on the pretest (M = 3.78, SD = 2.46). This difference between performance trials on performance scores was found to be statistically significant \[F(1,21) = 31.98, p < .001, \eta^2 = .60\]. The interaction of familiarity and performance trial was also calculated. Again, a significant effect was found \[F(1,21) = 25.67, p =< .001, \eta^2 = .55\], indicating that, like the rhythm scores, the variables were not independent from one another. Both pre-test conditions started with a similar mean, but the average post-test score for the familiar piece was much higher, as can be seen in
Figure 2 above. This indicates that familiarity influenced post-test scores on the performance measure, just as it did for the rhythm measure.
Chapter 5: Discussion

The present study was designed to investigate how prior aural familiarity with a piece of music impacted music learning and performance. Specifically, the study examined how accurately piano students played an excerpt of a familiar piece of video game music compared to unfamiliar music of similar style and difficulty. Students were given a sight-reading pre-test and an identical post-test following two weeks of practice. The study also examined whether students would practice a familiar piece of music more than an unfamiliar piece of music. Age and experience level of the participants were also investigated to see if they would have any effect on student performance.

Student performances were recorded and scored, with each student receiving a rhythm-only score (only correct rhythms) and a performance score that indicated correctness of both notes and rhythms. The scores were then analyzed using Repeated Measures ANOVAs, as was detailed in Chapter 4.

For rhythm-only scores, a statistically significant relationship was found for familiarity, meaning that students performed the familiar piece of music better than the unfamiliar piece of music. A statistically significant effect was also found for performance trial, indicating that students improved from pre-test to post-test on both the familiar and unfamiliar pieces. Finally, a statistically significant interaction was found between familiarity and performance trial, indicating that prior aural familiarity with a
piece of music helped improve the rhythmic accuracy of the post-test performance even more than the improvement on the unfamiliar piece.

Similar results were found for the performance score measure that incorporated both note and rhythm correctness, with statistically significant effects for familiarity, performance trial, and the interaction between familiarity and performance trial. As with rhythm-only results, the data indicated that prior aural familiarity with a piece of music helped increase the performance accuracy of the post-test performance notably more than the unfamiliar piece.

These results were unaffected by practice time, as it was found that there was no statistically significant difference between the amount of time students reported practicing the familiar piece of music and the amount of time that students reported practicing the unfamiliar piece of music. There were also no significant effects for either age or experience level of the students on performance and rhythm-only scores.

General Discussion

When considered generally, the results of the study indicate that prior aural familiarity with a piece of music positively influences students’ musical performance. This effect occurred for both rhythm scores and performance scores. These results generally concur with those found in several previous studies, which have shown that prior aural familiarity influences student learning and transfer in music (Frewen, 2010; Hargreaves et al. 1986; Grashel, 1979). However, the specific effects of prior aural familiarity on students’ ability to perform rhythms had not been previously studied, so
this result indicates another possible benefit to having prior aural familiarity with a piece of music. Student rhythm scores were higher for the familiar piece than the unfamiliar piece even on the pre-test, and the familiar piece scores gained even more substantially from pre-test to post-test than did unfamiliar piece scores. Prior aural familiarity therefore seems strongly related to students’ rhythmic accuracy. What is perhaps most interesting is that students were not instructed to focus on rhythms during their performances. Rather, they were simply asked to perform the piece, so there were many other factors (including note accuracy and the positioning of both hands) that required student focus in addition to the rhythms of the piece. However, even with students focusing on many factors of performance, rhythmic accuracy increased. It may well be that the very rhythmical nature of the video game music made rhythm a prominent feature in the subjects’ musical memory, thus compelling them to at least get this known feature correct even on the pretest.

An even stronger interaction between familiarity and performance trial occurred within the performance score measures. These measures showed statistically equivalent mean scores for the familiar and unfamiliar piece on the pre-test and a notably higher mean score for the familiar piece on the post-test. Such a result aligns with prior research (Frewen, 2010), which has indicated that elementary school students perform the notes of a melody better when they have prior aural familiarity with the melody. In the present study, students performed far better on the familiar piece when both rhythmic and note accuracy were measured, and the fact that this effect was even stronger than the rhythm-only effect implies that prior aural familiarity, in addition to increasing the rhythmic
accuracy, also increased students’ note accuracy. It is not known which component (note accuracy or rhythmic accuracy) is more strongly influenced by prior aural familiarity.

That both rhythmic and note accuracy increased due to prior aural familiarity indicates that prior aural familiarity may help students to perform better on complex material, a hypothesis previously suggested by Frewen (2010). Students in this study were performing piano selections that at a minimum involved performing with both hands and using 8\textsuperscript{th} note rhythms. Many of the more difficult examples also included chords and 16\textsuperscript{th} note rhythms, and were quite complex at times. Much of the complexity stemmed from the use of realistic music examples within the study, and thus the study also effectively indicated that effects of prior aural familiarity could be transferred to a realistic piano performance context. This performance context, it should be noted, simulated video game music that students had listened to during repeated gameplay. Such game music consisted of a multitude of musical information, including melody lines and bass lines as well as occasional countermelodies, percussion tracks, and the usage of various timbres. Piano arrangements used for the study often contained a similarly large amount of musical information. Forsythe and Kinney, in a 2007 study involving rhythmic recall, hypothesized that more musical information might hurt rhythmic recall in adults initially but might help recall over time (Forsythe & Kinney, 2007). A similar study from Van Bibber (2008) found evidence that the same effect occurred with middle school students. The evidence in the present study lends further support to the previous research, as students were able to improve rhythms over a two-week period, despite the presence of a large amount of musical information involved with the performance.
Student scores on sight-reading tasks indicated that there was no significant difference between the familiar and unfamiliar pieces. This was the case for both the rhythm and performance scores, indicating that the original pieces and the comparable video game arrangements were effectively equivalent in terms of difficulty. This indicates that prior aural familiarity does not lead to an immediate transfer of learning to a sight-reading situation. Rather, prior aural familiarity may need to be amplified by aural factors, such as repeated playings of the piece and additional practice time, to cause an increase in student performance. There was a difference between the rhythm scores of the familiar and unfamiliar pieces, but it was not statistically significant and may be attributable to slight differences in the location of rhythmic features (such as syncopations) in the two pieces.

Another finding of the study was that both student age and student experience level did not have any significant effect on performance scores. This slightly differs from Frewen’s previous (2010) research, which found an effect for familiarity as well as an effect for grade level. In the previous study, subjects were in grades K-4 and had no formal piano training. As student grade level rose, scores were significantly higher. A key difference in the two studies is that Frewen’s study used the same testing apparatus for all students in the study, while the present study selected a testing apparatus for each student that was designed to fit that student’s current ability level. It is possible that if the current study had given the same testing apparatus to each student, a further effect of age would have been shown. Additionally, the present study’s subjects, though varied in age, were generally older than the subjects in Frewen’s study. Both studies showed that at all age
levels, prior aural familiarity increased student performance, but it is difficult to draw any further conclusions regarding the relative strength of effect at particular age range or experience level. However, it does seem reasonable to state that prior aural familiarity has the potential to benefit student performance at all ages and ability levels, though further study would be needed to confirm that hypothesis.

Another research question investigated whether students would spend more time working on the familiar piece of music than the unfamiliar piece of music. A comparison of self-reported practice times showed that students did not practice the familiar piece more than the unfamiliar piece. This result was somewhat surprising, as it was hypothesized that students would spend more time practicing the familiar piece.

This may indicate that students do not necessarily practice a piece harder just because they are familiar with the music. Perhaps other factors such as student enthusiasm towards the musical example have more influence in determining practice time. Additionally, familiarity with the music and enthusiasm for performing the music are not necessarily correlated, and though such a correlation would seem plausible, it has not been studied in either previous studies or the present study. An argument could be made that a student who was unenthusiastic about a piece of music would not be likely to practice harder, even if they happened to be familiar with the excerpt. Moreover, it is possible that since the study showed that familiarity had a positive effect on playing the familiar piece, the amount of practice time necessary to play the piece might actually have been less, compared to the unfamiliar, yet the enjoyment of playing something familiar might have resulted in longer practice time spent on this piece; these two factors,
coupled together, may have resulted in a similar amount of time spent on the familiar piece compared to the unfamiliar piece, which may have simply taken more time to learn.

This study cannot necessarily conclude that prior aural familiarity has no effect on student practice time. Practice time is likely influenced by many internal and external factors, some of which (parental influence, student reporting accuracy, busy schedules) could not be controlled under the design of the current study. Additionally, the pieces were designed to be somewhat difficult for the students, and this difficulty level may have affected student motivation to practice. While the mean practice scores for both the pieces were statistically equivalent, the average practice time for the familiar piece was marginally higher. In general, the average practice time for each excerpt was small (just over 2 minutes per day), though this is understandable since the excerpts were also small (16 beats). A study that measures practice time and makes use of longer excerpts would provide further clarification.

Though student practicing was not more intensive for the familiar piece, it was certainly more effective. The reason for this effectiveness is unknown. Perhaps prior aural familiarity helped students to better realize and correct mistakes that were made, or perhaps prior aural familiarity helped students to be better focused or in some way more efficient when practicing the familiar piece. Future research may consider investigating the nature of practicing that occurs within the confines of a familiar piece.
Implications for Teachers

Given the results outlined above, there are some practical implications for teachers that can be taken from the results. Such implications include repertoire selection, use of modeling as a teaching method, and the usage of prior aural familiarity to aid learning of complex material.

Repertoire selection

One implication from the results is that teachers should carefully consider the repertoire that they select for use in classroom or lesson settings. Given that familiarity can lead to a stronger performance, familiar pieces have the potential to promote student success. A familiar piece with little musical value does not necessarily become a great asset just because it is familiar, but there are certainly familiar pieces of music that do possess characteristics and concepts that are desired by teachers. When used in an appropriate manner, such pieces may help teachers deliver concepts more efficiently and may lead to higher levels of performance achievement. No actual teaching was included in the study procedures, but a performance effect was still shown, so it is possible that teaching could further strengthen such effects. Teachers should make efforts to search for familiar pieces that have good teaching attributes.

Additionally, teachers should think about giving video game music greater consideration when looking for familiar pieces. Student survey data indicated that 69% of students were extremely familiar with at least one of five pieces of popular video game music, and that 42% of students were extremely familiar with three or more pieces of
popular video game music. If selected from the most popular games, video game music may be highly familiar to a substantial percentage of students.

Careful and varied repertoire selection can have great benefits for music teachers, and it is recommended that they consider familiar music, including popular music and video game music, as part of that repertoire selection process.

*Modeling*

Another implication is that teachers should consider using modeling and listening activities more often when teaching. Modeling activities are already a key component of Suzuki method lessons (Duke, 1999; Colprit, 2000) and can also be incorporated within a variety of teaching methods. Both aural modeling and listening can help to establish prior familiarity with a musical example. Given the increase in performance results, and given that stronger teachers model more frequently (Siebenaler, 1997), modeling seems to be an effective use of lesson time, particularly when the learning goal is performance-based. However, studies involving prior aural familiarity have not addressed any explicitly cognitive aspects of music study, so the data does not imply that prior aural familiarity leads to a higher cognitive understanding of music. Teachers may consider cognitive aspects of music to also be important, and will have to weigh the benefits of various methods of instruction to find a balance that appeals to them. Regardless, modeling should be considered as a potential part of that balance.

*Complexity*

The familiar material that was used as part of the study was somewhat complex, which implies that prior aural familiarity might be beneficial when used with complex
material. Additionally, the resulting effects occurred over a two-week period, suggesting that a long-term effect occurred along with sustained practice. Teachers therefore might find that gaining prior aural familiarity with particularly difficult passages of music well prior to the performance of the piece may assist students in learning those passages as they practice.

Future Research

Prior aural familiarity has had an impact on student piano performance, both in elementary school students with no piano experience and in a group of private piano students who varied in age and experience.

Future research should focus on the following areas: establishing generalizability of prior aural familiarity as a factor of musical performance, and adding to the robustness of the available literature on transfer of learning and prior aural familiarity. This would likely necessitate the study of prior aural familiarity on students of various ages and experience levels, particularly advanced high-school or collegiate musicians, who have received little study within the topic to this point. It would also be beneficial for studies to use a random sampling of a given population, which was beyond the scope of previous studies. Future studies might involve instrumentalists, vocalists, or those participating in an ensemble, as only keyboard students have been studied thus far. Prior aural familiarity may also affect other factors of musical performance such as dynamics, phrasing, and emotional inflections, and future study might focus on these areas. The length of
retention of any prior familiarity effects would also be potentially important, and should be considered.

Additionally, it would be beneficial to determine both the level and context of familiarity that is necessary to show the desired transfer effects to performance. The present study selected pieces that students were estimated to have heard dozens if not hundreds of times during the course of their own free time, while the Frewen study played the musical example 128 times as a familiarization procedure. It may be the case that effects are only seen when pieces are extraordinarily familiar, as in the Frewen study, or if experienced in a very informal context, as in the present study.

A different but related area of research would be a study of the factors that are involved with student familiarity of music. An interesting aspect of the present study was that a large percentage (86%) of students did not recognize the familiar piece of music despite a prior familiarity survey and a week’s worth of practice. It was hypothesized in the study that student tempo and performance errors had impacted students’ ability to recognize the piece. A formal study of the factors that influence student recognition of music could provide some very intriguing insight into the way that students perceive musical examples. Factors such as key changes, incorrect notes, tempo changes, melodic contour changes, and changes in timbre could have the potential to affect student perception of a supposedly familiar piece. Similarly, studies could be conducted to determine what parts of a musical example (melody, bass line, full musical context, etc.) have the greatest impact on student familiarity.
It has been well established that students prefer popular music, and there is also research that has shown educational benefits of popular music instruction. There does not, however, appear to be much research into the external aspects (social implications, motivational implications) of popular music instruction. Future research could attempt to determine whether popular music provides higher degrees of student motivation, for example, or if students indicate increased social interaction and satisfaction through participation in popular music instruction. Popular music may also increase student abilities or transfer in other facets of music learning. Such an idea could be another helpful area of study.

Conclusion

The purpose of the present study was to investigate how prior aural familiarity with a piece of music impacted music learning and performance. Specific research questions were as follows:

1) Do piano students sight-read a piece of music better if they are previously familiar with the music?

2) Do students learn a piece of music more effectively if they are previously familiar with the music?

3) Do students practice more on familiar music than on unfamiliar music?

4) Do student age and experience level further influence the effects of prior aural familiarity?
Based on the data collected, several conclusions were made. First, students who had prior aural familiarity with a piece of music learned the piece more effectively than they did a similarly-difficult unfamiliar piece. This transfer effect occurred when both rhythmic accuracy and performance accuracy (both rhythms and notes) were measured. The results indicated that prior aural familiarity had a significant effect on students’ performance. Additionally, it was found that students did not practice the familiar piece of music any more than the unfamiliar piece of music, though there are many possible explanations for this result. Finally, it was found that student age and experience did not have any additional effects on student performance. Suggestions for future research as well as implications of the results for teachers were also discussed. It is hoped that the results shown within this study will help contribute to literature in transfer of learning, rhythmic learning, and popular music in education. Additionally, it is hoped that future literature will continue to build upon the results regarding prior aural familiarity that have been shown both in this study and previous research.
References


Silverman, M. J. (2010). The effect of pitch, rhythm, and familiarity on working memory...


Appendix A: Student Familiarity Survey

Name ____________________________________________

Circle the number (0 – 4) that best matches how well you know each song:

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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</thead>
<tbody>
<tr>
<td>#1</td>
<td>(I’ve never heard this song in my life)</td>
<td>(I might have heard this before)</td>
<td>(I’ve heard it, but don’t remember where)</td>
<td>(I know what game this is from)</td>
<td>(I can name the game and level this is from)</td>
</tr>
<tr>
<td>#2</td>
<td>(I’ve never heard this song in my life)</td>
<td>(I might have heard this before)</td>
<td>(I’ve heard it, but don’t remember where)</td>
<td>(I know what game this is from)</td>
<td>(I can name the game and level this is from)</td>
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<td>#3</td>
<td>(I’ve never heard this song in my life)</td>
<td>(I might have heard this before)</td>
<td>(I’ve heard it, but don’t remember where)</td>
<td>(I know what game this is from)</td>
<td>(I can name the game and level this is from)</td>
</tr>
<tr>
<td>#4</td>
<td>(I’ve never heard this song in my life)</td>
<td>(I might have heard this before)</td>
<td>(I’ve heard it, but don’t remember where)</td>
<td>(I know what game this is from)</td>
<td>(I can name the game and level this is from)</td>
</tr>
<tr>
<td>#5</td>
<td>(I’ve never heard this song in my life)</td>
<td>(I might have heard this before)</td>
<td>(I’ve heard it, but don’t remember where)</td>
<td>(I know what game this is from)</td>
<td>(I can name the game and level this is from)</td>
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<tr>
<td>#6</td>
<td>(I’ve never heard this song in my life)</td>
<td>(I might have heard this before)</td>
<td>(I’ve heard it, but don’t remember where)</td>
<td>(I know what game this is from)</td>
<td>(I can name the game and level this is from)</td>
</tr>
<tr>
<td>#7</td>
<td>(I’ve never heard this song in my life)</td>
<td>(I might have heard this before)</td>
<td>(I’ve heard it, but don’t remember where)</td>
<td>(I know what game this is from)</td>
<td>(I can name the game and level this is from)</td>
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Appendix B: Musical Excerpts

Sample Familiar Piece

Write down how many MINUTES you practiced this song

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<th>Monday</th>
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Sample Unfamiliar Piece

Write down how many MINUTES you practiced this song

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<th>Monday</th>
<th>Tuesday</th>
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