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## The Effects of Three Seating Arrangements on Players' Preference of Sound in a String Orchestra

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The Effects of Three Seating Arrangements on Players'  
Preference of Sound in a String Orchestra

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A Thesis Submitted to the Graduate Faculty of  
GRAND VALLEY STATE UNIVERSITY

In

Partial Fulfillment of the Requirements

For the Degree of

Master of Education

College of Education

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## **Abstract**

The purpose of this exploratory, action research study was to investigate the effect of three seating arrangements on players' preference of sound in the string orchestra. Research questions included the following: (a) How was the players' perception of string orchestra sound affected by the repositioning of sections across the orchestra? (b) What seating arrangement do orchestra members prefer? (c) How do the preferences of orchestra members vary by section, gender, grade and years of playing experience? High school orchestra members recorded three different one-minute excerpts each in three different seating arrangements. After listening to the recorded excerpts, they chose which formation they preferred regarding the best overall sound. Survey results showed that the old German seating was the most preferred seating arrangement. This study is one example of how music educators can incorporate action research to engage students in a music classroom.

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## **Chapter One: Introduction**

### **Problem Statement**

Although orchestras around the world are experimenting with different seating arrangements and their effects on sound, school orchestras are not. Furthermore, while there have been many empirical studies conducted on the effects of choral seating arrangements on choral blend and sound (Atkinson, 2010; Daugherty, 1996; Ekholm, 2000; Lambson 2010; Langner, 2002; Tocheff 1990), no empirical studies have been done on seating arrangement in the orchestral setting. This holds true for both school and professional orchestras creating a gap in the research.

Quality of sound is of the utmost importance in any musical setting, and orchestras across the world are experimenting with seating arrangement to find the best outcome for their groups (Atkinson, 2010). No universal orchestral seating model exists; that is, what works for one orchestra does not necessarily work for another. Some orchestras will shift entire sections around within the ensemble, while others rotate the seating within sections. However, many musical ensembles remain in traditional seating arrangements (Knight 2006). Ford (2003) explains that some ensembles just follow tradition, which is especially true for school orchestras.

According to Scruggs (2009), music educators may teach in a predictable, teacher-centered classroom, without experimenting with different seating formations. Because many music educators have been trained traditionally, high school and middle school orchestras are not as likely to experiment with the seating arrangement. Most conductors now comply with standard layouts (Knight, 2006).

## **Importance of the Problem and Rationale for the Study**

Symphony orchestras around the world are experimenting with seating arrangement, but schools tend to stay with traditional arrangements. The variable of section placement is an important topic concerning the string sections of professional orchestras (Broughton, 2001; Knight, 2006). The 1<sup>st</sup> violins are always to the left of the conductor, but several accepted arrangements for the other sections are possible. The current traditional arrangement is cellos (with basses behind them) to the right of the conductor on the outside, violas next to the cellos, and 2<sup>nd</sup> violins next to the 1<sup>st</sup> violins. Cellos and violas may be switched for a richer, darker, or clearer sound (Knight, 2006). Some symphony orchestras use the old German seating where the cellos (with basses behind them) switch with the 2<sup>nd</sup> violins, which place the 2<sup>nd</sup> violins on the outside to the right of the conductor. (See Appendix A for seating diagrams.)

Johannes Muller-Stosch, conductor of the Holland Symphony Orchestra, experiments when doing different repertoires. “In Mozart with a lot of back and forth between 1<sup>st</sup> and 2<sup>nd</sup> violins I have 1<sup>st</sup> on the left, then in the middle: cellos, violas, and 2<sup>nd</sup> on the right. When the 2<sup>nd</sup> violins are more or less harmonic and play in thirds with the 1<sup>st</sup> (in a lot of late Romantic repertoire that is very harmonically oriented), placing the 2nds next to the 1<sup>st</sup> makes more sense” (personal communication, July 19, 2010). Other conductors of major symphony orchestras are utilizing the seating arrangement of 2<sup>nd</sup> violins on the outside. The antiphonal quality of this seating arrangement creates a musically and visually appealing effect in the audience. The term, antiphonal, is generally used to describe the musical effects drawn from groups of singers or instrumentalists stationed apart. Alan Gilbert of the New York Philharmonic moved to this seating plan when he began his tenure as music director in 2009. It also focuses the sound of the orchestra by having high strings next to low ones (Watkin 2009).

If symphony orchestras are experimenting with different seating arrangements, should music educators do so, also? Some ensembles may adhere to tradition for their seating, but this is not necessarily ideal for creating the best overall sound. While other plans may enhance the musical performance, some seating plans work well for rehearsal purposes only, giving group members a change in perspective. Experimental studies regarding choral formation and sound have been conducted by Atkinson, (2010); Daugherty, (1996); Ekholm, (2000); Lambson (1961); Langner, (2002); Tocheff (1990). An investigation on orchestra seating arrangement and its effect on string orchestra sound may provide awareness of this important, yet sometimes overlooked, facet of string playing. If experimentation in seating arrangement is not explored, the orchestra's best sound may never be achieved.

School orchestras tend to remain in the traditional seating arrangement, and teachers tend to remain in a teacher-centered classroom rather than a student-centered one. Scruggs (2009) explains that many conductors have been trained traditionally, which is why they teach this way. The conductor remains at the podium, and the students remain in the traditional set-up. Perception varies by piece and seating arrangement, and it behooves educators to find the best sound. Listening to and analyzing music is one of the National Standards in music (MENC, 1994). Experimentation with various seating arrangements allows the orchestra members to listen to the orchestra from different perspectives, and it enhances their learning experience and listening skills.

Incorporating different seating plans in the classroom is advisable (Cassie, 2008). Cassie experiments with different seating arrangements in a beginning orchestra classroom to enhance their musical experience. Experimentation with seating arrangements has increased student engagement in her classroom and has increased her students' knowledge of orchestral music.

She has noticed a positive difference in their skill with instruments and a joy in their higher levels of performance.

Scruggs explores the application of constructivist pedagogical theory in the orchestral music classroom setting and argues that such a constructivist approach may help to engage students and help students feel a sense of ownership. Utilizing students' strengths, whether musical or administrative, will enrich the classroom experience for everyone involved (Scruggs, 2009). Assisting with concert piece selection, having student conductors and allowing students to create concert programs are just a few ways to increase student involvement in an orchestral classroom. Scruggs also suggests incorporating varied seating layouts on a regular basis for rehearsal enhancement, such as having the cellos and basses sit in the front rows of the orchestra and placing the violins and violas in the back. Other scenarios that she suggests are mixed quartet seating, circular set-up, and parallel lines facing each other with the director in the middle. Each rehearsal set up would allow students to hear the ensemble from a different perspective.

Music teachers are busy. Many orchestras are performance-driven, and music teachers do not have the time to experiment with seating arrangements when the next concert performance date is imminent. Cassie (2008) explains that many barriers are present in the instrumental classroom such as interruptions in the learning process, lack of good instruments, limited class space, wide gaps in learners' skills on the instruments, and time constraints. "Practical and innovative teaching strategies, such as the seating arrangements, can be helpful in minimizing the effects of these barriers on learning" (Cassie, 2008, p. 51). It is worth the time and effort to experiment with different seating arrangements in a music classroom.

A review of the literature reveals that, while empirical studies have taken place regarding various choral formations and their effect on sound, a lack of research on various orchestral seating arrangements is evident. After searching databases, such as Academic Search Premier, ERIC, JSTOR, ProQuest Education Journals, and Sage Journals, no empirical studies on seating arrangement were found to have taken place in either the school or professional orchestral setting.

### **Background of the Problem**

Seating arrangements affect the sound quality of an ensemble and must be considered for both rehearsal and performance. It is important that conductors experiment with a variety of seating arrangements in order to find the optimal sound quality for their orchestras. Seating placement within the string sections may be done in a variety of ways. Many orchestras have a fixed seating placement with the strongest players sitting at the front of their sections. Broughton (2001) mentions that another common method of seating within the strings is appointing the principals or first stands of each section and rotating the rest of the players in each section. Yet, another approach is to arrange sections according to age and seniority. The Berlin Philharmonic is rotated on an informal basis. "Players decide freely among themselves, and often quite spontaneously, where they wish to sit in the section for a given program" (Broughton, 2001, p. 338).

It is important to consider many variables concerning the inner workings of an orchestra; common variables such as using platforms to tier the performers or using a seating rotation, should be thought through. One factor that symphony orchestras must consider is the use of platforms. The Pittsburgh Symphony Orchestra conductor, Manfred Honeck, uses risers for his winds and brass. He feels that this will aid the strings, even if the louder brass is brought closer.

“When you are sitting equal, the trumpets are right behind you and it is a problem, but if they sit on risers, they play above you and not in your ear,” (Druckenbrod, 2008, p. C3). In contrast, the Utah Symphony Orchestra typically plays on a flat stage. The manager, Cecil Cole, admits that risers give the audience a better view of the orchestra, but is concerned that the trumpets would be overly dominating (Gudmundsen, 1995).

### **A Brief History of Orchestral Seating**

The orchestra has changed significantly over time. The Baroque orchestra from the 1700s had around 15 players and was the precursor to the full, symphony orchestra that we often see today which normally has between 70 and 110 members (Knight, 2006). The instrumentation of an orchestra varies according to the demands of the composer. Knight (2006) explains that no one absolute plan exists for the seating arrangement of the players in an orchestra. The size of the group as well as the size of the performance hall may be factors that affect seating arrangement.

According to Knight (2006), the seating arrangement of a chamber orchestra is straightforward and follows a pattern that has been in use for three centuries. The *Orchestra Set-Up* (2015) reveals that from the standpoint of the audience, the first violins are normally at the front left of the stage, and the cellos on the front right. The conductor stands at the front edge of the stage between the first two violinists and the first two cellos. Second violins are also on the left side but farther from the front of the stage, and violas are in a similar position behind the cellos on the right. Double basses are arrayed along the back of the cellos and violas.

Composers from the 19th and 20th centuries have experimented with composition and sound, breaking away from traditional seating and instrumentation. Sometimes the actual composer will indicate the formation of the symphony orchestra, or add extra brass players to

perform from a balcony rather than on stage. Henry Brant of the 20th century took seating experimentation to a new level. He once tried having the basses on the ground floor level, cellos on the 1st balcony level, violas on the 2nd balcony level, and the violins on the 3rd balcony level (Knight, 2006); this created a unique effect. Experimentation with seating arrangements in symphonies across the world became more widespread in the 20th century. Sometimes experimentation is simply in the arrangement of the string sections, and in other prepared formations it is more extreme.

### **Choral Arrangement**

According to Atkinson (2010), research suggests many things can influence choral tone and choral blend. Some of these are: vibrato, choral formation, strategic placement of singers, and spacing between singers. Careful placement of singers within the choir can solve blend and intonation problems. Ekholm (2000) agrees with this and explains that voice-matching trials are conducted to discover voices which naturally blend so they can be seated near one another. Only a handful of empirical studies have been conducted on optimal positioning of choral singers. Studies conducted by Atkinson (2010), Daugherty (1996), Ekholm (2000), Lambson (1961), Langner (2002), and Tocheff (1990) paved the way for more research in this area.

### **Statement of Purpose**

Many studies have been conducted regarding choral arrangements and overall sound, but the literature regarding orchestral seating and overall sound has not been studied. The main purpose of this study was to investigate the effect of three seating arrangements on players' preference of sound in the string orchestra. The three arrangements were traditional seating with cellos and basses on the outside, old German seating with 2<sup>nd</sup> violins on the outside with cellos

and basses next to the 1<sup>st</sup> violins, and violas on the outside with cellos and basses next to violas on the inside.

## **Research Questions**

The purpose of this study was to investigate the effect of various orchestral seating arrangements on players' preference of string orchestra sound.

The primary research question guiding the study was:

How was the players' perception of string orchestra sound affected by the repositioning of sections across the orchestra?

Additionally, two secondary questions were considered:

What seating arrangement did orchestra members prefer?

How did the preferences of orchestra members vary by section, gender, grade and years of playing experience?

## **Hypotheses**

Overall preference of string orchestra sound will be affected by the repositioning of sections across the orchestra.

## **Design, Data Collection and Analysis**

In this action research study, 28 members in Advanced Orchestra at Black River Public School between grades 9 and 12 were studied. The Advanced Orchestra students in the Large Ensemble Room at Black River Public School were recorded performing three different musical excerpts using three different seating arrangements. The Advanced Orchestra students were invited to complete a survey at [www.SurveyMonkey.com](http://www.SurveyMonkey.com), which consisted of a short demographic section followed by a listening section. The demographic variables were gender, grade, section within the orchestra, and years of playing experience (See Appendix B for the

Demographic section of the survey). The students completed the listening portion of the survey after listening to the recorded excerpts, and they chose which formation they preferred regarding the best overall sound (See Appendix C for the listening section of the survey).

Statistical analysis using Fishers Exact Test was utilized to test how each of the demographic variables (gender, grade, section, and playing experience) was associated with each of the three excerpts. It was determined if responses for each excerpt differed from one another as well as responses for all excerpts combined. Was there a general response pattern?

### **Definition of Terms**

**Constructivist pedagogical theory-** This theory focuses on student-centered learning. The learner and the teacher must work together to construct knowledge (Scruggs, 2009).

**Old German Seating-** This seating arrangement is used in some orchestras where the cellos (with basses behind them) switch with the second violins, which places the second violins to the outside to the right of the conductor (Muller-Stosch, 2010).

**Traditional seating arrangements-** Knight (2006) explains that from the standpoint of the audience, the first violins are normally at the front left of the stage, and the cellos on the front right. The conductor stands at the front edge of the stage between the first two violinists and the first two cellos. Second violins are also on the left side but farther from the front of the stage, and violas are in a similar position behind the cellos on the right. Double basses are arrayed along the back of the cellos and violas (Knight, p. 41).

### **Delimitations of the Study**

The Advanced Orchestra at Black River Public School participated in this study. This is the top orchestra at Black River Public School, and it is similar in ability to other strong, high school orchestras. I used the three most common seating arrangements for the orchestra:

traditional, old German seating, and cellos with basses behind them switched with violas. I chose three contrasting pieces from different musical eras for the one-minute long listening excerpts. The three different styles of music provided the students a variety for their recording and listening experience.

### **Limitations of the Study**

The sample size of 28 students was small. The survey for this study was taken by the orchestra members only, and results may be different if the survey were taken by music educators. Also, the recording session occurred in a rehearsal room, and the sound quality would be different in an auditorium.

### **Organization of the remainder of the Thesis**

Chapter two, the literature review, provides the theoretical framework and a synthesis of research literature. Chapter three explains the research design of the study, providing details on participants, instrumentation, data collection, data analysis and timeline, as well as Human Research Review Committee (HRRC) related concerns. Chapter four describes the data collection, data analysis, and findings of the study. Finally, chapter five concludes the thesis with discussion, recommendations for further study, and implications for practice.

## **Chapter Two: Literature Review**

### **Introduction**

While literature is available on both instrumental and choral formation, empirical studies have taken place regarding choral formation only. This review of relevant literature is divided into three sections: Theoretical Framework, Instrumental Group Formation, and Choral Group Formation. The theoretical framework section focuses on the constructivist, pedagogical theory, the instrumental section shows the importance of seating arrangement in a variety of ensembles, and the choral section presents studies that have taken place in various choral formations. Due to a lack of research on orchestral seating, the summary at the end of this chapter shows how my study is grounded in existing choral studies.

### **Theoretical Framework**

Constructivism is a theory of learning where learners take on a more active role in their own learning experiences; this creates a more student-centered, rather than teacher centered, classroom. It usually means encouraging students to actively experiment and problem-solve to seek new knowledge. The teacher guides students to build on preexisting concepts and discussion allows for reflection about how their understanding is changing (“Constructivism as a Paradigm,” 2004).

Lev Vygotsky introduced the concept of social constructivism which emphasizes the collaborative nature of learning. Social constructivism is based on specific ideas about reality, knowledge, and learning. Reality is constructed through human activity, knowledge is created through our interactions with one another in the environment that we live in, and learning is a social process. Social constructivist approaches involve learning with others through activities such as reciprocal teaching, peer collaboration, and problem-based instruction (Kim, 2001).

Vygotsky identified the “zone of proximal learning”, where the teacher and more experienced students have an important role in guiding and collaborating with the other students to solve problems (“Constructivism as a Paradigm,” 2004). Social constructivism and the zone of proximal learning can be applied to the orchestra classroom; student run sectionals are an excellent example of how this can work. The more advanced players in the orchestra can take on leadership roles by guiding the other students during sectional time in learning the music which strengthens the orchestra as a whole.

Rather than always relying on the conductor, constructivist principles in a musical ensemble may provide a safe environment for students to be more actively engaged in musical thinking and participate in decision-making processes, (Shively, 2015). Shively (2015) encouraged constructivism in musical ensembles, warning that the teacher should not step away, but rather to step along side of the students. It is up to the teacher to decide when to move in and when to move out of the learning process; this allows the classroom to become learner-centered, not student or teacher-centered.

Scruggs (2009) explored the application of constructivist pedagogical theory in orchestral music classroom settings. She discussed the need for engaging students in the classroom and trying different rehearsal techniques, and she suggested increasing student participation at every level, from repertoire selection to conducting the ensemble. Scruggs, an educator with 22 years of experience, had previously used a mostly teacher-centered classroom, but in the last seven years, she began utilizing constructivist techniques in her rehearsals. She reported that this was an amazing turning point in her teaching; students became more engaged in rehearsals and more actively involved in their learning. Constructivist practices “promote student musical

understanding and student engagement and provide a student-centered framework for the orchestra classroom” (Scruggs, 2009, p. 3).

Scruggs provided suggestions for student engagement. She encouraged giving leadership roles to students which are both administrative and musical; she explained that it is important to assess each student’s prior knowledge and utilize their strengths when assigning roles. This gives students a feeling of ownership in their program. Scruggs also encouraged incorporating varied seating layouts on a regular basis for rehearsal enhancement. For example, the violins and violas could sit in the back rows while the cellos and basses sit in the front. Another seating scenario is to allow students to sit wherever they would like within the orchestra—mixing the sections. Mixed quartet seating, circular set-up, and parallel lines facing each other with the director in the middle are all possible rehearsal setups allowing students to hear the ensemble from a different perspective. Finally, Scruggs recommended having players analyze the group’s performance, create rehearsal objectives, lead sectionals, create concert programs, and form small ensembles.

### **Instrumental Group Formation**

**European Orchestras.** Seating arrangement plays an important role in large and small ensembles, professional and amateur. Broughton (2001) compared the industrial relations practices in symphony orchestras in Germany and the United Kingdom. She examined trade union density, collective bargaining structures, power relations (with focus on seating arrangements), and experience of women. “One of the areas in which the two countries displayed more similarities than differences was that of decision-making within the orchestra itself. The specific issue examined in this study was the seating positions in the string sections” (Broughton, 2001, p. 336). Seating is a sensitive issue for string players, and arrangements differ according

to orchestra. Section leaders are typically assigned permanent positions leading their sections, while the other section members could be seated in a variety of ways. The North German Radio Symphony Orchestra does its seating mostly by rotation, organized by the principal players. Age and seniority are seating factors in the Hamburg Philharmonic, and the Berlin Philharmonic has a loose rotation. Players in the string sections freely decide where they wish to sit in any given program as no clear rules or systems are in place for determining the seating within sections, and this affects all positions including the first desk (Lehman, 1999). Many acceptable seating methods are used across Germany and the UK.

**Small Ensembles.** Ford (2003) conducted a study on members' roles in wind quintets. He gathered both quantitative and qualitative data about group formation, leadership, seating positions, communication, rehearsing and performing, audience effects. One of the issues in a wind quintet, according to Ford, is "experimenting with seating arrangement in order to achieve the best overall blend of sound" (Ford, 2003, p. 70). Ford sent questionnaires to all of the members of 27 professional and semi-professional woodwind quintets throughout the United Kingdom (130 total players). He found that the many woodwind quintets take on a similar seating approach to the string quartet with the flute regularly sitting in the equivalent seat to that of the first violin. The bassoon tends to sit in the middle, as is sometimes the case for the cello. However, the string quartet often keeps the inner parts on the inside, although not as strictly observed in woodwind quintets, probably because the part writing tends to share the inner parts around the group rather than limit them to certain instruments (Ford, 2003). Half of the quintets in this study experimented with their seating plan before settling with a plan that gave them their best sound, and 18% of quintets reported that they just followed tradition.

**Compositional Styles.** Compositional styles may have influence over the seating arrangement within the orchestra. Many compositions call for a break from tradition. Knight (2006) cited specific pieces that call for specific seating arrangements. Respighi's *Pines of Rome* (1924) calls for a brass quartet playing from the balcony during the last movement. Berlioz was concerned about placement and paved the way for future experimentation. In *Grande messe des morts* (1867), Berlioz has four brass bands each placed at a different corner surrounding the massive orchestra and choral group. When a balcony is available, conductors often place the brass choirs there; Berlioz states in his score, "to the north south, east, and west" (Knight, 2006, p. 44). In *Cortege* (1977), Schafer calls for the musicians to "march on, off and back again, and around the empty stage, repeated several times, playing as they march" (Knight, 2006, p. 44). The experimentation in composition in both the 19<sup>th</sup> and 20<sup>th</sup> centuries has encouraged experimentation in seating arrangements.

### **Summary**

Orchestras around the world are experimenting with the seating arrangement within sections, as well as switching sections around within the ensemble. Additionally, small ensembles such as quartets and quintets are also experimenting. Seating arrangements affect the sound quality of an ensemble and must be considered for both rehearsal and performance. Some ensembles may adhere to tradition for their seating, but this is not necessarily ideal for creating the best overall sound. Some seating plans work well for rehearsal purposes only, giving group members a change in perspective, while other plans may enhance the musical performance

## **Choral Group Formation**

Many studies have been done to investigate seating formation and choral blend. Both high school and college choirs have participated in past studies, and researchers have experimented with multiple variables in their studies.

Lambson (1961) conducted an experiment that tested and analyzed four different seating plans. These include: (a) sectional block plan; (b) quartet plan; (c) scatter or scramble plan; and (d.) the random distribution plan. He used members of a college choir as the control group. They performed two contrasting songs in each of the four formations. Ten adjudicators evaluated the performances, but were not allowed visual contact with the choir. They were unaware of which seating plan was used for any of the performances. Lambson concluded that the sectional block plan is superior for polyphonic music. However, the other formations are better for recording, radio broadcasting, or other microphone technique. He also found that the quartet plan is best for homophonic music, and that the random distribution plan is impractical for performance. Acoustically, the scatter plan is the least desirable plan.

Another investigation, on the effect of various choral formations on choral sound, was performed by Robert Dale Tocheff (1990). Tocheff's study had many similarities to Lambson's, such as use of college choirs and judges used to evaluate the choral sound in various acoustical placement of voices. However, Tocheff used a pair of college choirs instead of just one and had five judges rather than ten. Tocheff's study also allowed for comments from the judges to be included. Independent variables tested were: acoustical placement of voices, voice part placement in choral formations, and music texture. The judges' responses showed the acoustical placement of voices was beneficial to overall blend and expressiveness, especially related to homophonic music. It was also beneficial to the intonation and rhythmic precision of the choir.

Section formation was superior to mixed formation in producing overall blend of voices within the choir (Tocheff, 1990). Both choral directors stated a preference for acoustical placement of voices in performance of homophonic works, but were not as convinced of this for performance of polyphonic music.

Daugherty (1999) conducted another study on choral formations. Unlike Lambson and Tocheff, Daugherty assessed the preferences of auditors ( $N = 160$ ) and choristers ( $N = 46$ ) relative to choral sound of an SATB high school choir in two choral formations (block sectional and mixed) and three types of spacing (close, lateral, and circumambient). Daugherty incorporated more variables into his study, as well. He was careful to isolate variables such as consistency of tempo, conducting, chorister and auditor fatigue, uniform spacing of singers, and consistent profiles for choral formations (Daugherty, 1999). Auditor results indicated significant preference for excerpts sung with spread spacing and no consistent preference for formation. The choir as a whole significantly preferred mixed formation for all singing conditions, and females preferred mixed formation more than male singers. This was a different outcome than in studies by Lambson and Tocheff.

Eckholm (2000) examined random versus acoustic choral seating arrangements on evaluations of choral blend and overall choral sound. Unlike the studies that preceded hers, Eckholm included voice-matching trials. For acoustic seating, she used voice-matching trials to place choristers whose voices blended naturally adjacent to one another. Thirty-seven choral conductors, 33 voice teachers, and 32 non-vocal musicians rated performances of four pieces by a choir of 22 voice majors. She concluded that acoustic seating positively affected evaluations of choral performance, individual vocal production, and choristers' vocal comfort and choral sound ratings. Choristers provided written comments on their experience. They preferred the acoustic

seating because of its “greater ability to hear oneself and/or other singers, less tendency to over-sing, apparent ease of singing in tune, and impression of blend allowed for greater vocal freedom” (Ekholm, 2000, p. 131).

Langner (2002) also examined the placement of singers in a mixed choir. He listed and described existing research in detail, as well as a multitude of choral formations. The music and size of the ensemble dictate which formation is ideal. “Placement significantly affects choral sound quality” (Langner, 2002, p. 7). The conductor must be careful when choosing the most effective formation for his or her ensemble. The art and science of placement is an essential choral technique, and individual placement in the choir should never be left to chance.

Atkinson (2010) stated that “research implies that the specific placement of voices within the ensemble based on vocal compatibility frequency of the tone, and a singer’s formant has definite effects on choral tone and blend” (Atkinson, 2010, p. 2-3). Her study was rooted in studies by Lambson, Tocheff, Daugherty, Eckholm and Langner. Atkinson conducted a study to determine the effects of choral formation (mixed or sectional) and spacing (close or spread) on the voices of four select singers in a 16-member college ensemble. The four formations used in this study were: sectional formation with one-inch spacing between the shoulders of the singers (Sectional-Close), sectional formation with 24-inch spacing between the singers (Sectional-Spread), mixed formation with one-inch spacing between the shoulders of the singers (Mixed-Close), and mixed formation with 24-inch spacing between singers (Mixed-Spread). All 16 singers were asked about their singing preferences in the four different formations. Each member of the ensemble was asked to rank the four choral formations from 1 to 4 (with 1 being the best and 4 being the worst). The Mixed-Spread spacing was considered the best spacing overall. Unlike other researchers, Eckholm randomly selected four singers (a soprano, alto, tenor,

and bass) to describe the differences they observed between solo and choral singing. The four singers agreed that private voice study improved their ability to sing in a choir, but that if there is a voice that is not blending with the ensemble, it is likely that it is “someone who has had formal lessons, because these singers can sometimes be unwilling to relinquish vocal color and beauty for the good of a more blended choral sound” (Atkinson, 2010, p. 5). All four singers agreed that singing in the choir affects their musicianship and sight-reading skills in a positive way. The singers in this study were used to singing in different formations.

### **Summary**

Choral studies, beginning with Lambson (1961), have transpired regarding seating formation and overall choral sound. Tocheff (1990), Daugherty (1999), Eckholm (2000), Langner (2002), and Atkinson (2010) conducted similar studies on choral formation and sound; all determined that placement or spacing of singers effects the overall sound. Variables considered in these choral studies were microphone placement, choral fatigue, uniform spacing of singers, placement of singers, texture of music, conducting and consistency of tempo.

### **Conclusion**

A constructivist approach has its place in a music classroom. While many conductors have learned and teach traditionally—where the conductor is always at the podium rehearsing the group, other approaches may engage the students more actively in the rehearsal process. Getting the student musicians involved in both musical and administrative tasks such as running their own sectionals, practicing in small groups, conducting the group, making decisions such as choosing music, creating programs and even planning rehearsals will allow them to have more ownership in their learning (Scruggs, 2009). When the students are invested in their own learning, they may create more meaningful experiences and gain deeper understanding. Varying

the seating layout within the orchestra, and even allowing the students to create different seating plans, gives them different perspectives within the orchestra, allows them to hear the music differently, and provides opportunities for discussion.

Professional orchestras as well as small ensembles are varying their seating plans in order to find their best sound. Seating arrangements may vary within sections of the orchestra or they may vary by switching the main sections around, and sometimes a particular piece or composer may determine the seating layout. Placement of the musicians within any musical ensemble does have an effect on the overall sound of the group. I was not able to find much research on seating arrangements within the orchestra, however choral studies have taken place to determine the arrangement for optimal choral sound.

I based my study on studies that have taken place in the choral setting. Guided by Tocheff (1990) and Lambson (1961) who determined that placement of the ensemble members affected the sound of the choir, I examined whether the placement of the ensemble members within the orchestra affected the sound of the orchestra. Like Lambson (1961) and Ekholm (2000) who found that microphone placement is the key to the success of any seating plan for recording purposes, I used high quality recording equipment and was meticulous with microphone placement during the recording process. Both Atkinson (2010) and Tocheff (1990) surveyed their ensemble members, so I surveyed my ensemble members. Like Ekholm (2000), who chose a variety of music in her study, I used a variety in mine.

In the following chapter, I discuss the action research design that was used in this study. I also provide details regarding the data collection and analysis procedures that were used.

## **Chapter Three: Research Design**

### **Introduction**

This study was an action research project that sought to understand the effects of three different seating arrangements on overall sound in the Advanced Orchestra at Black River Public School. In this chapter, I first discuss the Action Research Design that was used in this study. This is followed by a description of the participants, instrumentation, data collection and data analysis procedure.

### **Research Design**

Action Research occurs when educators identify an issue in their own classroom settings and search to find solutions to aid their own practice (Efron & Ravid, 2013). This action research, which includes a descriptive survey, allowed the students to be actively involved in this study, which fits the constructivist theoretical perspective. I wanted to determine which seating arrangement was preferred and I included students in the study as participants so we could be co-constructors of this new knowledge.

### **Participants**

There were 28 orchestra members in Advanced Orchestra between grades 9 and 12 who served as auditors. These participants were obtained using convenience sampling. I invited these students in my high school orchestra to participate in this action research project, and 100% of the students responded.

### **Instrumentation and Data Collection**

I recorded the Advanced Orchestra students from Black River Public School performing three different, one-minute musical excerpts using three different seating arrangements and used a Blue Yeti Microphone for recording. The excerpts were from Ase's Death by Edvard Grieg,

Eine Kleine Nachtmusik (first movement) by Wolfgang Amadeus Mozart, and Incantations by Richard Meyer. The method of data collection was grounded in studies by Atkinson (2010), Daugherty (1999), Ekholm (2000), Lambson (1961) and Tocheff (1990).

I used a Blue Yeti Microphone to record Advanced Orchestra for the listening excerpts, and my music stand was situated 98 inches from the wall behind me. The microphone was placed between my stand and the wall behind me and was 40 inches from the wall.

The survey completed by each student was created with the assistance of the Grand Valley State University Statistical Consulting Center using [www.SurveyMonkey.com](http://www.SurveyMonkey.com). The survey had three parts: demographic, closed-choice listening, and open-ended where students explained the rationale for their preference. The demographic variables were gender, grade, section within the orchestra and years of playing experience. See Appendix B and C for the demographic and listening sections of the survey.

The students completed the listening portion of the survey after listening to the recorded excerpts, and they chose which formation they preferred regarding the best overall sound. These students were asked to listen to the three excerpts, each of which was played three times in the three different formations. The options were as follows:

1. Ase's Death by Grieg in traditional seating
2. Ase's Death by Grieg with cellos and violas switched
3. Ase's Death by Grieg in old German seating
4. Eine Kleine Nachtmusik by Mozart in traditional seating
5. Eine Kleine Nachtmusik by Mozart with cellos and violas switched
6. Eine Kleine Nachtmusik by Mozart in old German seating
7. Incantations by Meyer in traditional seating

8. Incantations by Meyer with cellos and violas switched
9. Incantations by Meyer in old German seating

For each excerpt, based on overall sound, students were asked to choose the recording they preferred and explain why. The survey stated that the order of the seating arrangements was varied, but it was actually in the order listed above. The listening survey took one hour to complete during class.

### **Data Analysis**

I used Fisher's Exact Test, which is a statistical analysis used to test the statistical significance when the sample size is small. I was looking at response patterns to see if one seating arrangement was preferred over another and how gender, grade, section within the orchestra and experience related to response patterns. I tested how each of the demographic variables was associated with each of the three excerpts. Because I did four different tests for each of the excerpts, the level of significance was .05 divided by four, which placed the level of significance at .0125.

I analyzed the qualitative data, the comments that the students wrote, by creating codes for key concepts. For instance, the key concept, balanced, referred to comments that discussed or alluded to the overall balance of the orchestra. I then counted the percentage of students making each of these comments. I did this for the most popular concepts mentioned by the students in the survey which were balance, sound quality and togetherness.

### **Summary**

This study was an action research project that sought to understand the effects of three different seating arrangements on overall sound in the Advanced Orchestra at Black River Public School. I recorded the Advanced Orchestra students from Black River Public School performing

three different, one-minute musical excerpts using three different seating arrangements. One hundred percent of the 28 Advanced Orchestra students responded to a survey at [www.SurveyMonkey.com](http://www.SurveyMonkey.com), which consisted of a short demographic section followed by a listening section. Students were asked to choose the recording they preferred based on overall sound and explain why; they did this for each excerpt. I then tested how each of the demographic variables was associated with each of the three excerpts.

### **Timeline**

Permission from Black River's Head of School was obtained in October of 2015 and permission from Grand Valley State University's Human Research Review Committee was obtained in November of 2015. The recording and surveys occurred in November of 2015. Completion of the thesis took place in December of 2015. See HRRC Exempt letter in Appendix D.

In the next chapter I discuss the major findings of this study.

## **Chapter Four: Findings**

### **Introduction**

This chapter begins with a description of the context of the study. Findings are then described in depth, and finally this chapter concludes with a summary.

### **Context**

The participants in this study were 28 Advanced Orchestra students at Black River Public School in grades 9 through 12. There was a 100% response rate for the demographic and listening survey. The demographic survey showed that respondents were 25% male and 75% female. 37.50% were violinists, 21.88% violists, 28.13% cellists and 12.50% bassists. Also, 9.38% played their instrument for 0-3 years, 81.25% for 4-9 years and 9.38% for 10 or more. Lastly, there were 34.38% freshman, 34.38% sophomores, 12.50% juniors and 18.75% seniors. Students listened to each piece three times, in each of the three seating arrangements. They also typed comments after each piece explaining the rationale for their choices.

### **Effect of Repositioning of Sections**

*Primary Research Question - How was the players' perception of string orchestra sound affected by the repositioning of sections across the orchestra?*

Survey results indicated that players' perception of string orchestra sound was affected by the repositioning of sections across the orchestra. In excerpt one, Ase's Death, 21.43% of the players selected traditional seating, 14.29% selected violas and cellos with basses behind them switched, and 64.29% selected old German seating. In excerpt two, Eine Kleine Nachtmusik, 21.43% of the players selected traditional seating, 53.57% selected violas and cellos with basses behind them switched, and 25% selected old German seating. In excerpt three, Incantations, 32.14% of the players selected traditional seating, 10.71% selected violas and cellos with basses

behind them switched, and 57.14% selected old German seating. A summary is presented in Tables 1, 2 and 3.

**Table 1.** Total Percentage of Seating Arrangement Preferences for Excerpt 1, Ase’s Death.

Answer Choices	Traditional Seating	Violas Switched with Cellos and Basses	Old German Seating	Total
Preferences	21.43% (n=6)	14.29% (n=4)	64.29% (n=18)	n=28

**Table 2.** Total Percentage of Seating Arrangement Preferences for Excerpt 2, Eine Kleine Nachtmusik.

Answer Choices	Traditional Seating	Violas Switched with Cellos and Basses	Old German Seating	Total
Preferences	21.43% (n=6)	53.57% (n=15)	25.00% (n=7)	n=28

**Table 3.** Total Percentage of Seating Arrangement Preferences for Excerpt 3, Incantations.

Answer Choices	Traditional Seating	Violas Switched with Cellos and Basses	Old German Seating	Total
Preferences	32.14% (n=9)	10.71% (n=3)	57.14% (n=16)	n=28

The students provided thoughtful comments in the survey; it is evident from those comments that they were listening for specific elements in the music. The most common reasons for choosing excerpts were based on balance, sound quality or playing together. Excellent comments resulted from all grade levels, and there were just as many eloquent comments from

freshman and sophomores as there were from juniors and seniors. The majority of the students listened to the orchestra as a whole and did not focus mainly on their own section. I was impressed that so many of my students were listening for the big picture of orchestral sound.

Comments that show this big picture thinking are:

- “All of the instruments blended together well and there was an equal amount of sound coming from each section. There wasn't a section that was unnecessarily covering up another.”
- “Overall, this recording sounded more powerful and energetic, and I like how all of the sections blended together. It is very close however to choice A.”
- “Everything is more balanced. In the two other recordings, there would be too much of one instrument.”

There were many similar comments made by the students. 65.476% of students surveyed said that they preferred a selection because it sounded the most balanced, or they alluded to it being the most balanced. Some comments were:

- “All the instruments seemed to play in balance to give a rich tone to the orchestra.”
- “All of the parts could be heard.”
- “I like how the sections blended.”
- “The violins did not stand out too much and the lower notes could be heard better it was a well-rounded sound.”

9.524% preferred a selection because it had the best sound quality. I used the term, sound quality, to represent comments that mentioned tone, sound, and sound quality. Comments included:

- “This recording had the most depth to the sound, and all the instruments seemed to play in balance to give a rich tone to the orchestra.”
- “The sound quality was not that good in the first one, it was pretty good in the second, but it came out the best in the third”
- “The sound quality in all of them was not that bad, this time I thought second was the worst, first was the second best, and third had the best sound quality”.

7.143 % said that they preferred a selection because it sounded the most together.

Togetherness is different than balanced or blended. Togetherness denotes that the musicians are playing their rhythms in time at the same rate or tempo, while balanced or blended, has to do with the volume of the various different parts of the ensemble and how they relate to one another. Students that did mention this, reported:

- “The rhythm and togetherness was the best in this recording.”
- “It sounds the most together.”
- “I preferred this particular recording because as a group, we were most together and had and matching tone.”

## **Overall Preference**

*Secondary Research Question 1 -What seating arrangement did orchestra members prefer?*

The survey results showed that a majority of 64.29% of students preferred old German seating for Ase’s Death, 53.57% of students preferred violas and cellos with basses behind them switched for Eine Kleine Nachtmusik, and 57.14% of students preferred old German seating for Incantations. Students selected traditional seating, but not as much as the other two arrangements. Comments aligned with students’ seating preferences indicated that, overall, students chose the arrangement that had the best balance of all instruments.

## Impact of Gender

*Secondary Research Question 2 - How did the preferences of orchestra members vary by section, gender, grade and years of playing experience?*

I tested how gender was associated with each excerpt. Because I did four different tests for each of the excerpts, the level of significance was .05 divided by 4; the level of significance was .0125. As shown in Table 4, no statistical association between preferences of males and females and the three options for Ase's Death was found.

**Table 4.** The Association between Gender and Excerpt 1

Gender	Excerpt 1 - Ase's Death			Number of Students
	Traditional Seating	Violas Switched with Cellos and Basses	Old German Seating	
Male	14.29% (n=1)	0.00% (n=0)	85.71% (n=6)	n=7
Female	23.81% (n=5)	19.05% (n=4)	57.14% (n=12)	n=21
Total	n=6	n=4	n=18	n=28
Fisher's Exact Test for Gender and Excerpt 1 – Ase's Death				
Table Probability (P)			0.0941	
Pr<=P			0.5627	

Table 5 shows that the majority of male and female students preferred violas switched with cellos and basses in Eine Kleine Nachtmusik. However, no statistical association exists between preferences of males and females and the three options for Ase's Death.

**Table 5.** The Association Between Gender and Excerpt 2

Gender	Excerpt 2 – Eine Kleine Nachtmusik			Number of Students
	Traditional Seating	Violas Switched with Cellos and Basses	Old German Seating	
Male	0.00% (n=0)	57.14% (n=4)	42.86% (n=3)	n=7
Female	28.57% (n=6)	52.38% (n=11)	19.05% (n=4)	n=21
Total	n=6	n=15	n=7	n=28
Fisher's Exact Test for Gender and Excerpt 1 – Eine Kleine Nachtmusik				
Table Probability (P)			0.0403	
Pr<=P			0.2718	

Table 6 shows that the majority of male and female students preferred the old German seating in Incantations. However, there was no statistical association between preferences of males and females and the three options for Incantations.

**Table 6.** The Association between Gender and Excerpt 3

Gender	Excerpt 2 – Incantations			Number of Students
	Traditional Seating	Violas Switched with Cellos and Basses	Old German Seating	
Male	0.00% (n=0)	14.29% (n=1)	85.71% (n=6)	n=7
Female	42.86% (n=9)	9.52% (n=2)	47.62% (n=10)	n=21
Total	n=9	n=3	n=16	n=28
Fisher’s Exact Test for Gender and Excerpt 1 – Incantations				
Table Probability (P)			0.0203	
Pr<=P			0.0764	

### Impact of Grade

I tested how grade level was associated with each of the excerpts. Because I did four different tests for each of the excerpts, the level of significance was .05 divided by 4, meaning the level of significance was .0125. Table 7 shows no statistical association between preferences of freshman, sophomores, juniors and seniors and the three options for Ase’s Death.

**Table 7.** The Association between Grade and Excerpt 1

Grade Level	Excerpt 1 - Ase's Death			Number of Students
	Traditional Seating	Violas Switched with Cellos and Basses	Old German Seating	
Freshman	50.00% (n=4)	0.00% (n=0)	50.00% (n=4)	n=8
Sophomore	9.09% (n=1)	18.18% (n=2)	72.73% (n=8)	n=11
Junior	0.00% (n=0)	0.00% (n=0)	100.00% (n=4)	n=4
Senior	20.00% (n=1)	40.00% (n=2)	40.00% (n=2)	n=5
Total	n=6	n=4	n=18	n=28
Fisher's Exact Test for Gender and Excerpt 1 – Ase's Death				
Table Probability (P)			0.0004	
Pr<=P			0.1268	

The comparison between grade level and seating arrangement preference for excerpt two shows that there was a significant relationship. I compared the resulting p-value of 0.006 to  $.05/4 = 0.0125$ . This was adjusted for multiple testing; I took the .05 and divided it by the number of tests which was 4. The p-value for this test was still significant ( $0.006 < 0.0125$ ) and is presented in Table 8.

The analysis in Table 8 revealed that seniors did not pick old German seating, and the majority of seniors picked cellos with basses behind them switched with violas. The majority of freshman and juniors picked cellos with basses behind them switched with violas, and the majority of sophomores picked old German seating. Sophomores were the only ones to pick old German seating.

**Table 8.** The Association between Grade and Excerpt 2

Grade Level	Excerpt 2 – Eine Kleine Nachtmusik			Number of Students
	Traditional Seating	Violas Switched with Cellos and Basses	Old German Seating	
Freshman	12.50% (n=1)	87.50% (n=7)	0.00% (n=0)	n=8
Sophomore	18.18% (n=2)	18.18% (n=2)	63.64% (n=7)	n=11
Junior	25.00% (n=1)	75.00% (n=3)	0.00% (n=0)	n=4
Senior	40.00% (n=2)	60.00% (n=3)	0.00% (n=0)	n=5
Total	n=6	n=15	n=7	n=28
Fisher's Exact Test for Gender and Excerpt 2 – Eine Kleine Nachtmusik				
Table Probability (P)			0.0001	
Pr<=P			0.0060	

The majority of students in all grades preferred the old German seating. This is apparent in Table 9. However, no statistical association between preferences of freshman, sophomores, juniors or seniors and the three options for Incantations is evident.

**Table 9.** The Association between Grade and Excerpt 3

Grade Level	Excerpt 3 – Incantations			Number of Students
	Traditional Seating	Violas Switched with Cellos and Basses	Old German Seating	
Freshman	50% (n=4)	12.50% (n=1)	37.50% (n=3)	n=8
Sophomore	18.18% (n=2)	9.09% (n=1)	72.73% (n=8)	n=11
Junior	25.00% (n=1)	25.00% (n=1)	50.00% (n=2)	n=4
Senior	40.00% (n=2)	0.00% (n=0)	60.00% (n=3)	n=5
Total	n=9	n=3	n=16	n=28
Fisher’s Exact Test for Gender and Excerpt 3 – Incantations				
Table Probability (P)			0.0025	
Pr<=P			0.6843	

## Impact of Section within the Orchestra

I tested how sections within the orchestra were associated with each of the excerpts. For Excerpt 1, all bassists, and 85.71% of violists preferred the old German seating over the other two arrangements. However, Table 10 shows that there was no statistical association between preferences of violinists, violists, cellists or bassists and the three options for Ase's Death.

**Table 10.** The Association between Section Within the Orchestra and Excerpt 1

Grade Level	Excerpt 1 – Ase's Death			Number of Students
	Traditional Seating	Violas Switched with Cellos and Bases	Old German Seating	
Violin	27.27% (n=3)	18.18% (n=2)	54.55% (n=6)	n=11
Viola	14.29% (n=1)	0.00% (n=0)	85.71% (n=6)	n=7
Cello	33.33% (n=2)	33.33% (n=2)	33.33% (n=2)	n=6
Bass	0.00% (n=0)	0.00% (n=0)	100.00% (n=4)	n=4
Total	n=6	n=4	n=18	n=28
Fisher's Exact Test for Section Within the Orchestra and Excerpt 1 – Ase's Death				
Table Probability (P)			0.0011	
Pr<=P			0.3753	

The majority of students in each section within the orchestra preferred violas switched with cellos basses. However, Table 11 shows that there was no statistical association between preferences of violinists, violists, cellists or bassists and the three options for Ase’s Death.

**Table 11.** The Association between Section Within the Orchestra and Excerpt 2

Grade Level	Excerpt 1 – Eine Kleine Nachtmusik			Number of Students
	Traditional Seating	Violas Switched with Cellos and Basses	Old German Seating	
Violin	27.27% (n=3)	45.45% (n=5)	27.27% (n=3)	n=11
Viola	0.00% (n=0)	57.14% (n=4)	42.86% (n=3)	n=7
Cello	33.33% (n=2)	66.67% (n=4)	0.00% (n=0)	n=6
Bass	25.00% (n=1)	50.00% (n=2)	25.00% (n=1)	n=4
Total	n=6	n=15	n=7	n=28
Fisher’s Exact Test for Section Within the Orchestra and Excerpt 2 – Eine Kleine Nachtmusik				
Table Probability (P)			0.0009	
Pr<=P			0.5581	

The upper strings, the violinists and violists, preferred the old German seating for Incantations, the cellists preferred traditional seating, and the bassists preferred violas switched

with cellos and basses. No statistical association between preferences of violinists, violists, cellists or bassists and the three options for Incantations, as shown in Table 12, was found.

**Table 12.** The Association between Section within the Orchestra and Excerpt 3

Grade Level	Excerpt 3 – Incantations			Number of Students
	Traditional Seating	Violas Switched with Cellos and Basses	Old German Seating	
Violin	27.27% (n=3)	9.09% (n=1)	63.64% (n=7)	n=11
Viola	14.29% (n=1)	0.00% (n=0)	85.71% (n=6)	n=7
Cello	66.67% (n=4)	0.00% (n=0)	33.33% (n=2)	n=6
Bass	25.00% (n=1)	50.00% (n=2)	25.00% (n=1)	n=4
Total	n=9	n=3	n=16	n=28
Fisher’s Exact Test for Section Within the Orchestra and Excerpt 3 – Incantations				
Table Probability (P)			0.0002	
Pr<=P			0.1019	

### Impact of Years of Playing Experience

I tested how years of playing experience was associated with each of the excerpts. The majority, 23 out of the 28 orchestra members, have played their instruments between 4 and 9

years. 65.22% of the students in this category preferred the old German seating. Table 13 shows that there was no statistical association between years of playing experience and the three seating preferences for Ase's Death.

**Table 13.** The Association between Years of Playing Experience and Excerpt 1

Years of Playing Experience	Excerpt 1 – Ase's Death			Number of Students
	Traditional Seating	Violas Switched with Cellos and Basses	Old German Seating	
0-3	50.00% (n=1)	0.00% (n=0)	50.00% (n=1)	n=2
4-9	17.39% (n=4)	17.39% (n=4)	65.22% (n=15)	n=23
10 or more	33.33% (n=1)	0.00% (n=0)	66.67% (n=2)	n=3
Total	n=6	n=4	n=18	n=28
Fisher's Exact Test for Section Within the Orchestra and Excerpt 1 – Ase's Death				
Table Probability (P)			0.0747	
Pr<=P			0.8007	

For Eine Kleine Nachtmusik, the majority of students in the orchestra chose violas switched with cellos and basses. One Hundred Percent of students who have only played their instrument 0-3 years chose violas switched with cellos and basses; there were only two students in this category. No statistical association between years of playing experience and the three seating preferences for Eine Kleine Nachtmusik was discernible from the data.

**Table 14.** The Association between Years of Playing Experience and Excerpt 2

Years of Playing Experience	Excerpt 2 – Eine Kleine Nachtmusik			Number of Students
	Traditional Seating	Violas Switched with Cellos and Basses	Old German Seating	
0-3	0.00% (n=0)	100.00% (n=2)	0.00% (n=0)	n=2
4-9	21.74% (n=5)	47.83% (n=11)	30.43% (n=7)	n=23
10 or more	33.33% (n=1)	66.67% (n=2)	0.00% (n=0)	n=3
Total	n=6	n=15	n=7	n=28
Fisher's Exact Test for Section Within the Orchestra and Excerpt 2 – Eine Kleine Nachtmusik				
Table Probability (P)			0.0500	
Pr<=P			0.6545	

The majority of students preferred the old German seating for Incantations. The seating arrangement that was the least preferred was violas switched with cellos and basses. From the data, no statistical association between years of playing experience and the three seating preferences for Incantations was found.

**Table 15.** The Association Between Years of Playing Experience and Excerpt 3

Years of Playing Experience	Excerpt 3 – Incantations			Number of Students
	Traditional Seating	Violas Switched with Cellos and Basses	Old German Seating	
0-3	50.00% (n=1)	0.00% (n=0)	50.00% (n=1)	n=2
4-9	30.43% (n=7)	8.70% (n=2)	60.87% (n=14)	n=23
10 or more	33.33% (n=1)	33.33% (n=1)	33.33% (n=1)	n=3
Total	n=9	n=3	n=16	n=28
Fisher’s Exact Test for Section Within the Orchestra and Excerpt 3 – Incantations				
Table Probability (P)			0.0527	
Pr<=P			0.5872	

**Summary**

The participants in this study provided a 100% response rate for the demographic and listening survey. Survey results indicated that players’ perception of string orchestra sound was affected by the repositioning of sections across the orchestra. A majority of students preferred old German seating for Ase’s Death, violas and cellos with basses behind them switched for Eine Kleine Nachtmusik, and old German seating for Incantations. Students selected traditional seating but not as much as the other two arrangements. The overall comments by the orchestra

members indicated that balance was an important factor when choosing which seating arrangement they preferred.

Analysis of data through Fisher's Exact Test showed that for excerpts one and three, there was no significant association between gender, grade, section in the orchestra or years of playing experience and choice of seating arrangement. For excerpt two, no significant association between gender, section in the orchestra or years of playing experience and choice of seating arrangement was found. However, significance was found between grade level and choice of seating arrangement for excerpt two. The analysis in Table 8 revealed that seniors did not pick old German seating, and the majority of seniors picked violas with cellos and basses behind them switched. The majority of freshman and juniors picked old German seating, and the majority of sophomores picked violas with cellos and basses behind them switched. Sophomores were the only ones to pick violas with cellos and basses behind them switched.

Chapter five provides a summary of the entire study, conclusions, discussion and recommendations for further study.

## Chapter Five: Conclusion

### Summary of the Study

Orchestras around the world are experimenting with different seating arrangements to find the best overall sound for their groups (Atkinson, 2010), but school orchestras are not. Furthermore, while there have been many empirical studies conducted on the effects of choral seating arrangements on choral blend and sound (Atkinson, 2010; Daugherty, 1996; Ekholm, 2000; Lambson 2010; Langner, 2002; Tocheff 1990), no empirical studies have been done on seating arrangement in the orchestral setting. This lack of empirical studies is evident for both school and professional orchestras; this creates a gap in the research.

Many musical ensembles remain in tradition seating arrangements (Knight, 2006). Ford (2003) explains that some ensembles just follow tradition, and this is especially true for school orchestras. Scruggs (2009) indicates that music educators may teach in a predictable, teacher-centered classroom without experimenting with different seating formations. High school and middle school orchestras are not as likely to experiment with the seating arrangement because many music educators have been trained traditionally.

I conducted an exploratory study on the effects of three different seating arrangements on players' preference of sound. Research questions included the following: (a) How was the players' perception of string orchestra sound affected by the repositioning of sections across the orchestra? (b) What seating arrangement do orchestra members prefer? (c) How do the preferences of orchestra members vary by section, gender, grade and years of playing experience?

There were 28 members in Advanced Orchestra at Black River Public School between grades nine and twelve. I recorded my Advanced Orchestra students performing three different

musical excerpts using three different seating arrangements. I had Advanced Orchestra students from Black River complete a short demographic survey and listening survey at [www.SurveyMonkey.com](http://www.SurveyMonkey.com). The demographic variables were gender, grade, section within the orchestra and years of playing experience. The respondents listened to three one-minute excerpts each in three different seating arrangements and chose which formation they preferred regarding the best overall sound. They also provided rationale for their choices.

Survey results indicated that students preferred the old German seating for excerpts one and three, and they preferred violas and cellos with basses behind them switched for excerpt two. I did a Fisher's Exact Test to test the independent variables such as seating arrangement, gender, grade, section and years of experience. I determined if responses for each excerpt differed from one another as well as responses for all excerpts combined. Fisher's Exact Test showed that for excerpts one and three, there was no significant association between gender, grade, section in the orchestra or years of playing experience and choice of seating arrangement. For excerpt two, no significant association between gender, section in the orchestra or years of playing experience and choice of seating arrangement was found. However, there was significance between grade level and choice of seating arrangement for excerpt two.

## **Conclusion**

Survey results indicated that players' perception of string orchestra sound was affected by the repositioning of sections across the orchestra. Comments that went along with students' seating preferences indicated that, overall, students chose the arrangement that had the best balance of all instruments. Traditional seating was not chosen by the majority of students for any of the three excerpts, which shows that alternate seating arrangements should be considered

for the string orchestra layout. It would benefit school orchestras as well as professional orchestras to try different seating arrangements to determine which works best for overall sound.

The demographic variables generally did not have an effect on the orchestra members' preference of seating arrangement. However, there was significance between grade level and choice of seating arrangement for excerpt two.

## **Discussion**

Players' perception of string orchestra sound was affected by the repositioning of sections across the orchestra. The survey results showed that the players in the Advanced Orchestra at Black River Public School preferred the old German seating and violas and cellos with basses behind them switched more than traditional seating. The majority of students did not pick traditional seating for any of the three excerpts, which signifies that traditional seating is not necessarily the best arrangement for the orchestra.

Like the choral studies that have been conducted regarding seating formation and sound (Atkinson, 2010, Daugherty, 1996, Ekholm, 2000, Lambson 1961, Langner, 2002, Tocheff 1990), this study in a string orchestra setting showed that different formations affected the overall sound of the group. Lambson (1961) and Daugherty (1996) both found that spacing between the singers in the choir was more significant than formation. However, spacing was not a factor in this study in this orchestral study. Daugherty (1996) also found that female preference for mixed formation was greater than that of male singers, and gender did not affect the seating preferences in this study. The only demographic variable that was significant was grade level, and this only occurred with excerpt two, *Eine Kleine Nachtmusik*. I believe this was a chance occurrence, and does not have an impact on this study, but further studies are recommended to find out if there is some relevance to this.

Being participants in this study has helped the Advanced Orchestra students at Black River Public School have an authentic experience by being critics of their own music. All of the students involved took this study seriously and provided thoughtful comments in the survey. Many of them preferred the excerpts that had the best overall balance of the orchestra, and I was impressed with their insight which was evident in their comments. I was surprised that more students did not include togetherness in their comments; this was also affected by the seating changes.

We have had many class discussions about what they think of the various seating arrangements that we have tried. Some seating arrangements have been more popular than others, but all of them provided the orchestra members a new perspective on orchestral sound. It should be noted that the old German seating was one of the least popular among the students when tried and discussed in class, and it was the overall most popular seating arrangement in the listening survey. This has been an eye-opening experience for all of us involved in the study. I foresee it inspiring us to question tradition and stay open to different seating arrangements.

Scruggs (2009) explored the application of constructivist pedagogical theory in the orchestral music classroom and suggested incorporating varied seating layouts on a regular basis for rehearsal enhancement. Varying the seating allows the students to hear the music they are playing with different perspectives, and getting them actively involved in the process engages them. Getting the students involved listening to and analyzing which seating arrangement works best for achieving the orchestra's best sound gives them ownership in the rehearsal process. It also satisfies one of the National Standards in music (MENC, 1994).

## **Recommendations**

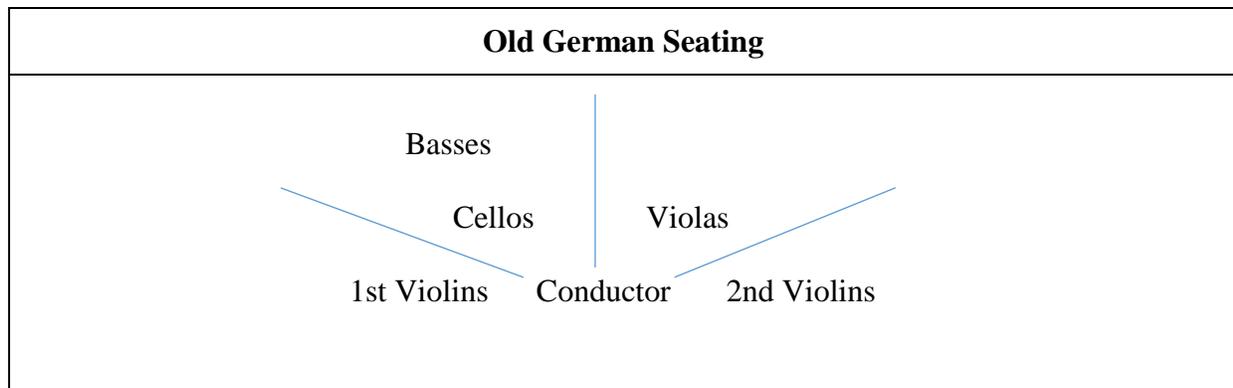
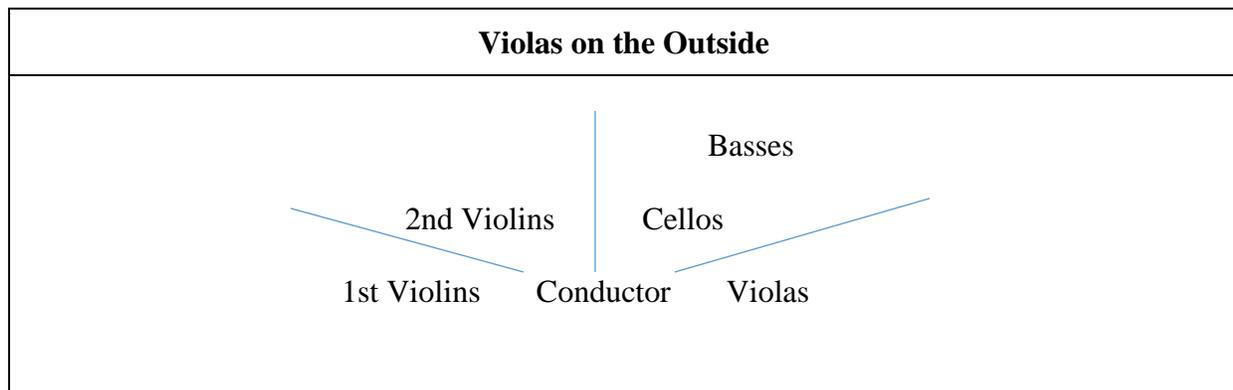
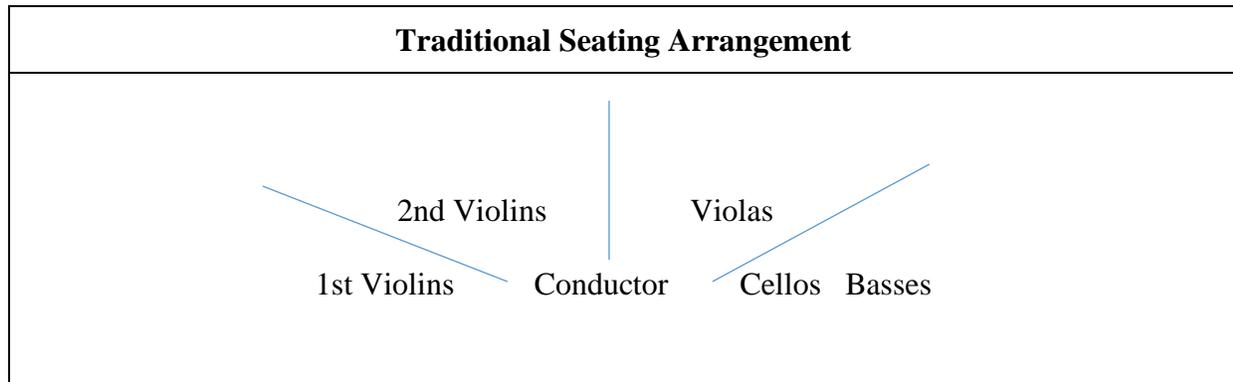
Further research on seating arrangement within the string orchestra is needed. Information from this study is relevant, but conducting a similar study on a larger scale may yield different results. Other factors to consider for further study are the size of the orchestra, recording space, microphone placement, and style of music. It would be beneficial to survey music educators as well as orchestra members as there is a possibility that this may lead to different results. Lambson (1961) found that certain formations worked better for recording than live. It would also be beneficial to have live judges hear the orchestra play the excerpts as well as auditors who listen to recordings of the excerpts.

Despite these limitations, this action research study has had benefits which will broaden my teaching and rehearsal style in the future. It has given both me and my students opportunities for reflection and discussion both in and out of the classroom, and I plan to continue pursuing constructivism not only Advanced Orchestra, but in all of my orchestras at Black River Public School. Experimentation with seating arrangements is one of many constructivist approaches that I can utilize in my classes. I am eager to have my students become more invested in their music education, overall. I already incorporate student-run sectionals, chamber groups and music selection into my classrooms, but I can get my students actively involved in other areas such as creating concert programs, organizing the music library, creating rehearsal strategies and conducting the orchestra. The more actively involved the students are, the more they will gain from their experience in orchestra.

Constructivism in the music classroom has many positive outcomes; I recommend that other music educators consider including constructivism in their classrooms. Varying the seating arrangements provides students a new perspective on the ensemble in which they belong. They

hear things differently sitting next to different instruments, get to know other members of the ensemble better, and gain a fresh perspective when making music. Altering the seating arrangements also provides an excellent opportunity to listen to and analyze the music they are working on, as well as an opportunity for in depth discussions during rehearsal. Finding the seating arrangement that creates the orchestra's best overall sound was my goal in this action study, but the process along the way was most important and meaningful part.

# Appendix A: Seating Arrangement Diagrams



# Appendix B: Student Demographic Survey

## 1. Gender

- Female
- Male

## 2. Instrument

- Violin
- Viola
- Cello
- Bass

## 3. Years of playing experience

- 0-3
- 4-9
- 10 or more

## 4. Grade

- Freshman
- Sophomore
- Junior
- Senior

# Appendix C: Listening Survey

Which of the three formations do you prefer for the following excerpts? Please choose one answer for each excerpt based on the overall, orchestral sound.

(Order of formations may vary)

1. Excerpt #1

- A
- B
- C

Explain why you preferred this particular recording:

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2. Excerpt #2

- A
- B
- C

Explain why you preferred this particular recording:

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3. Excerpt #3

- A
- B
- C

Explain why you preferred this particular recording:

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## **Appendix D: HRRC Exempt Letter**

Project Title: [827938-1] The effects of three seating arrangements on players' preference of sound in a string orchestra.

Principal Investigator: Tammy Clark

Action: EXEMPT

Effective Date: November 10, 2015

Review Type: Exempt Review

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