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The Effect Of Colored Accent Marks In Music Notation During The Sight-Reading Process For High School And College Wind Instrumentalists

Eric Bradley Malone
University of Mississippi

THE EFFECT OF COLORED ACCENT MARKS IN MUSIC NOTATION DURING THE SIGHT-READING PROCESS FOR HIGH SCHOOL AND COLLEGE WIND INSTRUMENTALISTS

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ERIC B. MALONE

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ABSTRACT

The purpose of this study was to test new ways of improving the sight-reading process in music. This experimental study has been split into two identical studies completed in different settings. The first study utilized 56 volunteer wind instrumentalists from a high school band as subjects, while the second study utilized 30 volunteer wind instrumentalists from a college band as subjects.

The same pretest-posttest experiment was used for each study. The subjects were randomly divided into an experimental group and a control group, while two short musical excerpts were composed to use for the experiment. The pretest excerpt was unaltered to determine natural tendencies of accents during the sight-reading process for each group. The posttest excerpt had the accent marks printed in red ink for the experimental group only, while the control group read the excerpt in unaltered black ink. All of the tests were audio-recorded, and the subjects filled out a questionnaire of additional information after the posttest.

After the recordings were evaluated to determine if the subjects performed the accents, the results were revealing. The high school study showed that only 16% of subjects performed accents during the pretest, and the posttest showed 43% of subjects in the experimental group performed accents. The college study showed that 40% of subjects performed accents during the pretest, and the posttest showed 93% of subjects in the experimental group performed accents. The questionnaire showed that lessons, older

subjects (in high school only), and brass players typically performed accents more consistently. College subjects also clearly performed the accents more than did high school subjects.

DEFINITIONS:

1. Color, for the use of this study, is always red.
2. Accents are a type of articulation used to instruct the musician to place emphasis on a certain beat or note. For the use of this study, "accents" refer to normal (>) accent marks only.
3. Assistant, for the use of this study, applies to the person that the researcher used to administer the experiment with a second group of subjects to make the process more efficient and gain more subjects for the study.
4. Judge, for the use of this study, applies to the expert musicians that the researcher recruited to listen to the recordings and evaluate whether the subject performed the accents in the excerpts or not. These musicians were all in the process of completing a Master of Music degree in Music Education.
5. Location Director, for the use of this study, refers to the band director of each location.

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CHAPTER 1: INTRODUCTION

Sight-reading has always been one of the most important skills that a musician can have. The ability to look at notation on a piece of music and perform it proficiently the very first time helps greatly in future rehearsals of that piece. It allows the performer to spend less time working on basic fundamentals like rhythms, pitches, and pulse; while allowing him or her to spend more time on the details like musicality, articulation, and interpretation. Sight-reading is a skill that must be developed through practice. However, there are always musicians looking for simple tricks to help themselves and their students to sight-read more efficiently. While there is no trick to solve all of the mysteries of sight-reading, there are some things that have been discovered to help a musician along the process of improvement. Some of these activities have been discovered and passed along through the years, while others have still yet to be discovered.

Since over 60% of the problems in sight-reading (McPherson 1994) are typically identified as being rhythmic, it is no surprise that musicians have worked on ways to make rhythm more accessible to young musicians. One of the key ways that musicians have helped with the rhythmic aspect of sight-reading is through body movement. One way this can be seen is by the musician keeping pulse by tapping the foot when playing. This is something seen with most musicians from early years of study to the professional level. Another action that some musicians employ when sight-reading is the clapping of rhythms before they perform the excerpt (Boyle 1970). Pattern recognition exercises prove to be another action performed by musicians to aid in the ability to sight-read more proficiently. It has been found that using flashcards in the beginning years of music study can aid musicians in determining pitch names as well as the intervals that are being used in sight-reading materials (Fine et. al 2006).

These singular skills were found to be helpful, but not the only necessary skills when reading music. It was soon discovered that a true musician cannot be proficient at sight-reading with one singular skill, but must instead have a collection of skills that prove to be of importance to all musicians. Although rhythmic training is necessary along with pattern recognition, there are many other aspects of music training necessary as well. The ability to internally hear music before it has been played. This has been established as important by the research of Bobbitt (1970), Harris (2001), and Mishra (2014). These studies, along with others discussed in Chapter 2, also describe the necessary skills such as: attentive and rapidly moving eyes, musical style training, reading comprehension, psychomotor skills, and reaction time. Some of these skills are easily trained, while others take much time and dedication to improve, as they are not all physical skills, but cognitive abilities as well.

Some researchers have also looked at the possibility of changing music notation to involve the use of color. This use of color to alter music notation has gone through a period of experimental studies to discover if it has viable use in the future of music education. Some of these studies have been a bit too radical to be used as a new form of music notation, like Poast's (2000) Color Music technique used to make a painting that is read as music notation. Others have been simple in nature, like Kuo and Ming-Chuen's (2013) article describing the use of twelve colors and shape-notes instead of typical notation.

There have, however, been some worthwhile studies done using colors not to completely erase traditional music notation, but to highlight it instead. These studies show promising ways of how to help increase the proficiency of sight-reading by musicians with simple changes.

Even with the types of activities that have been attempted in order to improve the sight-reading process for musicians, none have been able to solve any problems on their own. It takes a collection of these studies and methods to truly improve the process for current and future musicians. The purpose of this study is to test new ways to improve the sight-reading process. As an accomplished musician, I have been asked to adjudicate many auditions. In my time as a judge, it seems that the last thing that musicians focus on during the sight-reading portion of an audition is the use of different articulations and accents that are present in the notation. These simple components to the music would improve the results of the audition exponentially, but the students still neglect these aspects of the music. Perhaps one of the reasons that these portions of the music are abandoned is because the notation is so cluttered.

Musicians must become experts at decoding symbols quickly, but it becomes difficult when a musician must read so many symbols at once in order to play a single beat of the music. The time signature, key signature, pitch-name, accidental, dynamics, articulation, accent, tempo, etc. must all be read and remembered for every single note-head in the notation. Parts of this notation can easily get lost in all of this black ink on the page. That is why I thought of a few simple changes to make to music notation over the past few years of my study that have shed new light on ways to improve sight-reading. Although this study is not the final step of the process, it is an important step. The smallest and most easily ignored part of notation is the accent mark either above or below the note-head. With that in mind, making a simple adjustment to the music notation to bring more attention to this small, but important symbol seems necessary.

It makes perfect sense to utilize the advances in technology to print music in color. As seen in previous studies, using color in notation can help to highlight certain aspects of notation. Perhaps the changing of one simple thing, like the color of the accent mark, can make a difference in the sight-reading process with minimal effort for the musician. Simply making the color of an accent mark in music notation red while it is surrounded by black ink may draw the attention of the musician to that mark while he or she is reading through the notation. This one adjustment, unlike many of the other ones being studied, would require no additional training for the musician since the work has already been done. If the musician has been taught properly to begin with, then this will just help to bring that training to the audition process more readily.

CHAPTER 2: REVIEW OF LITERATURE

Sight-reading

Sight-reading has been identified as one of the necessary skills of a musician. There are, however, many aspects of sight-reading that have been studied to determine how to improve this skill among current and future musicians. This research has shown that there are many aspects of sight-reading that must be improved to improve the overall ability of musicians. There have been studies that have shown a lack of ability with regard to rhythm, pitch, a general collection of musical abilities, select cognitive abilities, and even notation recognition.

Regarding Rhythm

Many studies have been completed with regards to improving rhythmic accuracy and showing that rhythm is a pitfall to the sight-reading process. Boyle (1970) showed that simple rhythmic movement, like the tapping of a musician's foot during the sight-reading process can make a major difference in accuracy. Boyle's study utilized a total of 191 subjects in the experiment. The subjects of the experimental group were trained to tap their foot to the pulse during the sight-reading process as well as clapping the rhythms before they begin playing. The results of the posttest showed that the rhythm reading skills and sight-reading scores were significantly higher for the experimental group than they were for the control group. This suggests that rhythmic movement is very advantageous to sight-reading efficiency.

This research by Boyle been expanded by other music researchers through the years as well. One music researcher that supported further the importance of rhythmic reading ability during the sight-reading process is McPherson (1994). McPherson's study showed that the majority of mistakes made during the sight-reading process were indeed rhythmic mistakes. His study included 101 high school clarinet and trumpet players as subjects for the experiment. This Australian study split the the subjects into two groups, Group 1 (grades seven through nine) and Group 2 (grades ten through twelve). There were little significant results in Group 1, mostly because of inconsistency between subjects. Group 2 showed that between 59% and 64% (average of 61.3%) of errors made during the sight-reading process were rhythmic. This number is directly in line with previous research studies citing more than 60% of errors made in the sight-reading process as rhythmic. The other categories of mistakes were not significantly consistent to make judgments.

It is clear to see from these studies that rhythm is an important aspect when it comes to reading music. With McPherson's study (1994) showing that over 60% of the mistakes made during sight-reading being attributed to rhythm, it is no wonder why research into rhythm reading is so important. Boyle's (1970) contributions show the possibility of physical actions could help rhythmic reading ability to be developed. These two studies show a very limited view of results, but both show that a good portion of the mistakes made during sight-reading can be attributed to rhythmic reading inaccuracies.

Regarding Pitch

Another important facet of sight-reading ability aside from rhythm reading, is clearly regarding pitch. This particular aspect of music reading is viewed by many to be the most important, which makes sense with the amount of research done to develop ways to improve pitch recognition in musicians. A study by Fine et. al (2006) showed the importance of pattern recognition in sight-reading. This study was done with vocalists, so it did include some more particular skill sets with regards to pitch accuracy. The study used two tests: an interval singing test and the singing of Bach chorales with alterations in melody, harmony, or both. The study's results showed that the vocalists were more capable of sight-singing the altered harmonies than they were of the other two versions. The study also showed that, as was expected, sight-reading ability of vocalists were directly related to the interval singing ability of the vocalists. This study did show that pattern recognition was extremely important to the sight-reading ability of vocalists. This pattern recognition ability can be directly related to instrumentalists as well because it describes the ability of realizing pitches before the musician performs them. This study shows that reading pitches is not always such a given when reading music.

Regarding Collection of Necessary Skills

Sometimes the research into music sight-reading does not yield a single result of a necessary skill, but instead yields a collection of skills that are necessary to be a great sight reader. One study of this nature comes from Bobbit's (1970) study in which he introduces a system of teaching music reading skills to elementary-age children. His system of teaching was tested for nearly a year to get some good results. This study used a variety of helpful tools like tape-recorded clips, slideshows, as well as a very quick-paced movement from one item of instruction to the next. His system spent no more than five minutes on any item of instruction and was programmed so that each lesson could handle large groups of children, as well as separating each portion of the lesson into logically sequenced small steps. The concepts depended on being able to grasp the material with a limited amount of time and the use of repetition to reinforce it. He teaches intervals in an order not dependent on scales or keys, but instead basing his progression on intervals that are prevalent in music literature. His system depends on starting this programed curriculum no earlier than third grade and having each class split into two groups for singing and rhythm exercises. His results showed that after only twenty-five thirty-minute sessions, fifth graders that were previously unable to even recognize intervals were able to sing intervals of a perfect fourth, major third, minor third, and octave. He also used a simple analysis of worthwhile music literature with the class to find intervals that they were learning at the time. Bobbitt felt that continued use of this system would lead to much greater musical literacy and a greater appreciation of music literature.

Another study to determine the best predictor variables for sight-reading ability was done by Elliot (1982). He studied thirty college instrumentalists as subjects and looked at their technical proficiency, sight-singing ability, rhythm-reading ability, cumulative grade point average, cumulative music theory grade point average, cumulative performance jury grade point average, and major instrument grade point average. Various tests were used as well as the subjects' school records to obtain the required information for the study. The results showed that the most significant relationship with sight-reading performance is due to rhythm-reading and high performance jury scores. The combination of these two factors proved to be the most consistent predictors of high achieving sight-readers.

An article by Harris (2001) discusses the function of eyes when reading music, called rapid eye movement. His description is that the eye moves back and forth across the page as many as five or six times a second. This rapid eye movement is the key to sight-reading ability. He also discusses a basic combination of factors that are necessary to perform as a proficient sight reader: recognizing pitch, understanding rhythm, looking ahead, remembering the key signature, observing notational markings, and remembering fingerings. He also discusses more in-depth factors that are necessary in the sight-reading process like forming an aural understanding of the music, developing musical instrinct, and combining notes and rhythm, while still keeping a steady pulse. With the combination of all of these factors, Harris believes that anyone can perform impressively during the sight-reading process.

The meta-analysis done by Mishra (2014) was done to determine if studies using experimental measures to influence sight-reading ability had any effect. Mishra took 106 studies into account and analyzed their results as a whole to find more significant overall results. The treatments were separated into eleven categories by the author. The most effective treatment types proved to be aural training, controlled reading, creative activities, and singing/solfege. Since the treatment types were not all homogeneous and not treating the same subjects or the same subject size, it is hard to classify the results consistently throughout the analysis.

The study by Rayner and Pollatsek (1997) studied the movements of the eyes, the optimal span between the eyes and the hands, and the perceptual span during the sight-reading of music. The study uses pianists as subjects, since this type of study is more common with these musicians. The amount of pulses that the eyes read ahead of the hands while the musician is playing the instrument is the aim of the experiment. The results of the experiment show that the typical and optimal span of the eyes is about two or three pulses ahead of the hands for a skilled performer. The final aspect tested was the perceptual span, meaning how far ahead the eyes are actually viewing the notation. Since the eyes do scan so much faster than the motor functions can handle, researchers wanted to know just how far ahead the eyes are seeing. It was concluded through the experiment that the eyes typically see a little more than a single measure of musical time ahead of the hands.

The article by Saxon (2009) is a compilation of skills from various studies and articles telling the best ways to be a great sight-reader as a musician. Some of the suggestions include: keep the eyes moving forward, never look back at what could have been better; do not correct mistakes; count; and keep a steady tempo. The article presents strategies to help with these suggestions and others. It also presents educators with some tips to help students improve their sight-reading ability.

Zhukov (2014) did a study evaluating different approaches to the teaching of sight-reading skills to pianists. The researcher wanted to determine if pianists' sight-reading skills could be strengthened with training in any of the following teaching approaches: accompanying, rhythm training, and the understanding of musical style. The study utilized 100 pianists for the study and they were graded using software to give four scores on a pre/post test setup. The pianists were trained with their respective program for ten weeks before the evaluations took place. The results showed that rhythm training and musical style understanding were the most significant training programs and were worth further research. No significant results were found for any of the three, however.

From this collection of research, one can see that the best sight-reading musicians do not have one single skill that makes them so proficient, but instead they have a collection of many skills. According to research by Elliot, Zhukov, and others from above sections, clearly rhythm is an important skill that must be included in the mix along with a high musical style understanding resulting in proficient performance skills. The research of Rayner, Pollatsek, Harris, and Saxon shows that another necessary factor for sight-reading is the continual movement of the eyes looking ahead in the music and noticing important factors that are changing in the notation. These researchers discussed how the eyes move ahead of the hands, but must not be expected to move much faster than the hands are performing in order to be in the optimal eye-hand span. The research of Bobbitt, Harris, and Mishra show that another important factor in the sight-reading collection of a musician's skills is an aural understanding of the music. In order for a musician to be able to look at the music and be able to play it immediately, he or she must be able to look at the music and be able to hear the music internally before attempting to perform it. According to this research, the collection of skills includes: aural training, eyes that constantly move and notice everything, musical style understanding, and rhythmic training. With a collection of skills like these, any musician has a good chance of becoming a proficient sight-reader.

Regarding Cognitive Abilities

Although sight-reading depends on many factors like notes and rhythms, there are still some abilities that are essential to sight-reading that are not as easy to measure. These cognitive abilities are much more difficult to measure during a sight-reading performance, which is one reason why these abilities haven't been tested as much. Until recently, research into these areas involving music did not occur that often. Drai-Zerbib et. al (2011) did a study investigating these abilities along with the use of eye-tracking technology. This study utilized twenty-five pianists as subjects and used this eye-tracking technology to show that the more experienced pianists were able to look through sight-reading excerpts more quickly and find problem areas to look at more extensively before the inexperienced pianists were able to do the same. Overall, the experiment showed that the experts were able to analyze the problem areas in the music and discover solutions to these problems quicker than the non-experts as well as more efficiently. This use of cross-modality of mental actions shows the use of a cognitive ability that had never been examined until this point.

A study by Hayward and Gromko (2009) investigated even more predictors of sight-reading ability. The predictors tested were technical proficiency, spatial-temporal visualization, and aural discrimination. The study utilized seventy wind instrumentalists as subjects. They were assessed individually and in groups for all of these factors. The results supported other research that these four skills are indeed the best cognitive predictors of good sight-reading ability among musicians.

Other studies into cognitive abilities were done previously as well. One of these by Gromko (2004) tested mental capacities to find good predictors of sight-reading ability. Gromko enlisted the use of 98 subjects to test certain skills: reading comprehension, rhythmic/tonal audiation, spatial orientation, visual field articulation, and other more in-depth skills. Gromko found that music is indeed a composite intelligence that draws on several different cognitive skills when reading music. The skills that were found to have the most influence over the sight-reading abilities were reading comprehension, rhythmic audiation, and spatial orientation. Rhythmic audiation supports previous research that showed rhythmic reading as one of the best predictors of good sight-readers. Spatial orientation is best explained by saying that musicians read music as if they are reading an architectural blueprint. Reading comprehension is easily explained to be important because reading music and reading words are both rule governed and both depend on the ability to decipher symbols. This combination should prove to be the best prediction of sight-reading ability.

One of the studies by Kopiez et. al (2006) set out to classify sight readers as either low achieving or high achieving by testing twenty-seven predictor variables for fifty-two pianists. The pianists were taken through a series of tests and interview questions to make a determination of their skills for these variables. These variables could be categorized into three groups: general cognitive skills, elementary cognitive skills, and practice-related skills. Although the researchers were not able to clearly dillineate a way to classify the musicians into low/high achievers because of unclear results, they were able to discover other useful information to help predict better sight-reading abilities. One result showed that simple reaction time mixed with high accumulation of sight-reading practice tends to produce more efficient sight-reading musicians. Also, sight-reading ability in high-level pianists is partially determined by acquired expertise paired with other factors, like speed of information processing and psychomotor speed.

A very similar study by Kopiez and Lee (2006) used fifty-two pianists as subjects with only twenty-three predictor variables to test through different experiments and interview questions. This study was used to determine a model for musicians on which to base their practice to be a great sight-reader. Working memory and short-term memory proved to be the most important general cognitive skills present in a good sight-reader. These two cognitive abilities are clearly important in sight-reading music because of the ability to store information in the memory in an instant for a short period of time to be able to look ahead in the music to solve future problems before the instant of performance. The only elementary cognitive ability that was any significance for a good sight-reader appears to be trill speed. This cognitive ability directly relates to psychomotor skills. The model results also showed the most relevant expertise-related skill is the amount of time spent practicing sight-reading.

With the results of the Kopiez et. al studies, it is clear that psychomotor skills, short-term memory, working memory, and reaction time are the most important cognitive abilities to have in order to be a good sight-reader. Gromko's study shows the need for reading comprehension skills and spatial orientation as well. Further reinforcement of Gromko's research came with her colleague Hayward when they found that technical proficiency, spatial-temporal visualization, and aural discrimination proved to be the most helpful predictors. The idea of good reading comprehension goes along with Drai-Zerbib et. al's study, which also produced helpful results, saying that the ability to look ahead while playing and comprehending what music is ahead. The collection of all of these cognitive abilities makes for the potential of a great music sight-reader.

Regarding Notation

One topic of interest that gets little research into its effects on sight-reading is the effects of notation. Notational differences are rare in these times because all publishers and printers typically use the same style of software that are configured in the same ways to print music. This does not necessarily mean that conventional notation is the most effective style of notation when reading music, and research into this idea is certainly worth the effort. Gregory (1972) did a study regarding this idea. The study used sixty-three clarinet players as subjects for the study. The subjects were asked to sight read excerpts that were presented in four different ways: conventional notation, conventional notation with pulses indicated by visible markings, notation spaced proportionally to rhythmic duration, and a notation with stemless noteheads that are elongated proportionately to rhythmic duration. No significant results were noted in the study, but a survey of the subjects was also taken and the results were shown. The most comments were about the notation indicating pulse and the notation with stemless noteheads. The first one was rated well for the learning process, but distracting during the sight-reading process. The second notation style was marked as troubling because of lack of familiarity. This study shows mostly a lack of research into the topic, but shows the use of research like this. Although there were no significant results, it still showed an interesting idea that is worth more research.

Sight-reading is a necessary skill for any musician, and, like any other skill, needs to be practiced. Even though a musician should practice sight-reading in general, developing other skills can prove to be one of the most helpful ways to improve proficiency in the skill of sight-reading. Research shows that the most important skill involved in sight-reading is rhythm-reading ability. The research of McPherson, Boyle, Elliot, and Zhukov all support this claim of the importance of rhythm. Their research shows ways of improving these rhythmic abilities for things as easy as clapping rhythms before the performance and tapping the foot to the pulse. Another important skill is aural training, which relates directly to pitch control and accuracy. The necessity of pitch and aural training is presented by Bobbitt, Harris, Mishra, and Fine et. al. The development of certain cognitive abilities such as psychomotor skills, short-term memory, reaction time, reading comprehension, and spatial orientation are also evident because of the research of Kopiez, Gromko, and Drai-Zerbib et. al. There is also a desire to improve research into the effects of notation on sight-reading ability with the study of Gregory. The skills of an accomplished sight reader will directly translate to the necessary skills of a great musician and performer as well.

Research Utilizing Color

This article by Poast (2000) discusses the technique of Color Music and its possibilities for the future. Poast describes in detail some of his color music compositions. He discusses various studies done in color psychology and how different colors bring about specific connotations. He talks about how these connotations can be used in music to notate in a more artistic way using these colors and various shapes as opposed to normal notation. The scores to these color music pieces typically are works of art themselves to be shown at the performance. This article discusses the past and future uses of this technique in music notation.

The article by Colla (2001) is an educator's guide to introducing and teaching elementary-aged students with the use of "rainbow solfege." Colla describes this method as ideal for teaching children from beginning years of music until the third grade when they begin transitioning to traditional black-and-white notation. This idea is taken and adapted from Isaac Newton's assigning of the colors to the major scale in the eighteenth century.

This system assigns peaceful colors of the spectrum to the stable tones in the diatonic scale, while giving the more active tones a more intense color of the spectrum. Tonic 'do' is given blue, 'so' is yellow, 'mi' is green (mixture of blue and yellow), 're' is turquoise (mixture of blue and green), 'fa' is red, 'ti' is orange, and 'la' as purple. This system holds many connections between music and art based on how the colors were assigned. The tones that lead to each other are assigned respective colors that lead to them as well in the art world. It is best to use this system at such a young age because research shows that children are intuitive to color most during this time and are in the idea time period to learn to sing in tune. This article offers ways to use this system in the classroom and ways to use it even past the stages of elementary-aged children. Colla believes that this system offers creative teaching and research possibilities for the future of color in teaching strategies.

Kuo and Ming-Chuen (2013) use this article as a proposal to music teachers of beginners to try a new style of music notation that utilizes color. The article also presents a study used to help the authors invent this new notation based on problems presented by practicing musicians. It assigns twelve colors to the twelve individual tones that make up music. The system also utilizes shape-notes in the form of triangles to help distinguish between natural pitches and sharp/flat pitches. The article shows some examples of what certain musical selections look like in this new notation as well.

A study by Rogers (1991) was used to discover if instructional materials utilizing color-coded notation would positively affect students' performance of musical tasks in three areas: performing from memory, sight-reading, and naming letter names of notes. Ninety-two beginning wind players from the fifth and sixth grades were tested in this study. The experimental group used method books where each pitch was highlighted in a different color while the control group used the same books without the colored highlights. After twelve weeks, they were tested. Although the students stated that they favored the color-coded notation, the results did not show any significant difference on any of the tests one way or another.

Another study by Rogers (1996) was done to discover whether the use of colored rhythmic notation during instructional times would affect the rhythm-reading skills of sixty-four first and second graders, as opposed to the control group of seventy students. A twenty-three week trial period was used to fully integrate the experimental group into the program. Like the above study, a majority of the students preferred reading this colored notation. This study showed that the experimental group did have noticeably higher scores in their rhythm reading than the control group, but only on the colored notation. When Rogers tested the same subjects using traditional black and white music notation, the control group had a slightly higher sight-reading score than did the experimental group that was used to reading colored notation. This shows that with the new stimulus removed, no improvements were made. These results pose more research questions to be answered.

These studies show previous attempts to utilize color in music teaching. One use of color by Poast completely combines the worlds of art and music by composing a piece of music while composing a masterpiece of art. The performer interprets the painting and performs a piece of music based on the painting presented. This is a completely new innovation in which the musician is no longer performing a set of instructions from standard notation, but is instead interpreting a piece by an artist in musical format. In a sense, creating the sound to go along with the visual. This combination of music and art was continued in Colla's article about Rainbow Solfege and the possibilities that exist for the education of children with this system of pedagogy. The combination of colors and solfege were combined to evoke the visual and aural perceptions of children at such a young and impressionable age. This style of teaching leads straight into the research presented by Kuo, Ming-Chuen, and Rogers by utilizing color as different pitches. This idea was taken from centuries-old traditions and renovated to fit with the educational system of today to help children sight-read, perform from memory, and recognize pitches by sight. Though no significant results were found, the studies did show promise that deserved more testing. Rogers continued his study by presenting color with rhythmic figures instead of pitch. This study was met with more success and shows even more promise for future research into the use of color with music notation.

Synesthesia

A study by Bankieris and Simner (2015) was done to determine if there was a link between synesthesia and sound symbolism. Synesthesia is a condition that causes unusual cross-modal acuities, like sound triggering colors or words triggering taste. Sound symbolism is the property of some words for their meaning to be linked with their enunciations. Meaning that in some cases, non-native speakers can understand the meaning of foreign words. The study included nineteen synesthetes and fifty-seven non-synestheses. They listened to 400 words from ten unfamiliar languages and were asked the meanings of the words in a two-alternative forced-choice test. Synesthetes significantly outperformed their counterparts in this test, suggesting a link to sound symbolism. Synesthesia is not simply confined to the type of person that sees colors with sound or hears and word and tastes it. There are many different types of synesthesia that have presented the research world with many possibilities. Since synesthesia presents such a fascinating possibility of musicians looking at musical notation and seeing colors, more research into this field is necessary.

Research Regarding Articulations/Accents

This study by Geringer et. al (2006) used ninety music majors as subjects to consider the effects of articulation styles on the awareness of modulated tempos. The subjects heard excerpts from two pieces of music that contained both staccato and legato passages. The excerpts had been modified to gradually increase tempo, gradually decrease tempo, or not change tempo. The results show that the articulation style and the direction of the temporal modulation did affect the subject's perception of tempo significantly. All of the staccato selections were thought to be increasing in tempo more than that of the legato selections. This study shows how different articulation styles can affect the drive of a musical selection as well as what the natural preference for tempo fluctuations are for the human ear.

This article by Tolson (2012) is an educator's guide to reading and teaching articulations in a jazz ensemble setting. There are so many pieces of music in the jazz ensemble world with so many different jazz articulations, but it is difficult for the educator to decipher the best way to teach these articulations as very few are trained in jazz articulations during their education. This article provides a solid foundation to begin that education as well as guidelines to help understand how to teach this style to an ensemble with the use of articulation syllables.

Articulations and accents are an important part of the musical language. These small symbols can be used to drive music tempos forward or to hold them back without an audience even realizing that it is happening. This phenomenon is demonstrated by the study completed by Geringer et. al. That study demonstrated how staccato articulations can drive the tempo of a piece of music forward, as is the natural inclination perceived by the human ear. The legato articulations can do the exact opposite. In order to take advantage of these natural tendencies of articulations, a musician must be taught the proper way to perform these articulations. This lesson is taught by Tolson's article. He gives an instructional guide to strategies needed to teach musicians how to properly articulate and accent in a given piece of music.

CHAPTER 3: METHODOLOGY

Pilot Study

A pilot study of the same type was performed in April of 2015 for a research class. The pilot study contained one single sight-reading excerpt with two accent marks present in the notation. The experimental group read the notation with accents printed in red ink while the control group read the notation with accents printed in black ink. The subjects were recorded using an audio recording device. The researcher listened to each recording and judged whether the subject performed the accents that were present in the excerpt with a simple 'yes' or 'no' response. The results were then analyzed and organized. In the study of 125 high school subjects, only 34% of them performed accents during the sight-reading process. Of that 34%, 70% of them were in the experimental group. These results support previously stated material that most musicians do not seem to perform accents during the sight-reading process in general. This pilot study helped the researcher to develop the most efficient set-up for the methodology used in the present experiment.

Receiving Permission

This is an experimental research project involving a few simple processes. Since this project includes human subjects, the researcher first submitted a proposal for the experiment to the University of Mississippi Institutional Review Board (IRB) for approval. Once all of the requirements were met and approval was granted for the project, the researcher began the next steps.

The researcher then attempted to gain permission to work with three public high school band programs through their respective administrators as well as volunteers in a university band program. The researcher decided to focus on one public high school and the college students only because of scheduling difficulties. The researcher received permission to use an audio recording device with each subject in the study. Although the subjects were recorded, the subjects remained anonymous and no personal information was requested or displayed during this study. After permission was granted from the administrator, the researcher discussed the experiment with the high school band director (location director) and college director (location director) to gain permission from them as well as set up two separate days for the tests to be completed at each school. The researcher also scheduled a day before the testing began at each location to give a brief description of the project to the subjects, so there would be no false pretenses about the project.

The researcher received a list of names organized by instrument from the high school location. At this point, the subjects were assigned to either the control group or the experimental group. The researcher assigned subjects into groups by making sure there was a balanced instrumentation for each group. The college group's subjects were assigned so that each group would have the same number of subjects. Each subject was given an identifier card with a four-digit code on it to keep the subjects anonymous during the recording process. This identifier card was used to aid in the analysis of the results from Excerpt A to Excerpt B. The cards were made for each subject to give to the moderator of the experiment at the start of the recording. The researcher arranged with the location director for the use of two rooms. Each room was set up with two chairs and two stands.

Preparation

The researcher developed two short sight-reading excerpts, Excerpt A and Excerpt B, which were made appropriate for all musicians being tested. Each excerpt contains at least two instances of an accent mark in the music notation. The researcher printed two copies of each excerpt. Excerpt A remains in traditional black ink for both the experimental and control groups. Excerpt B is in traditional black ink for the control group, but has been altered for the experimental group to contain accent marks printed in red ink. The excerpts were printed for every instrument type and placed into a folder for the appropriate group. There are two copies of each folder. One copy was made for the researcher and the other for the assistant.

The researcher also created a short questionnaire (Appendix 9) for the subjects to complete after the second excerpt was performed. The questionnaire only contains seven questions. There is a place to write the subject's identifier code, age, instrument, gender, number of years in band, number of years taking lessons (if any), and to report any colorblindness.

Recruiting Help

The researcher found two colleagues to use as judges in the study. The judges were graduate students pursuing a Master of Music degree in music education, just like the researcher. The researcher acted as the third judge for the study. Judge 1 plays saxophone, judge 2 plays trumpet, and judge 3 plays tuba. The three expert judges were trained to evaluate the recordings by replying with either a yes or no response to each recording based on whether the subject performed an accent at the specified time in the music. They were all given a clear definition of what an accent sounds like (as listed in the definitions portion). Seven recordings were created for reliability testing and were not included in the experiment's recordings. The reliability coefficient was calculated by dividing the total number of agreements by the total number of instances and resulted in a .90 agreement.

Once the experiment was completed, the judges listened to each of the recordings to do the same thing they did for the reliability test. They followed along with their copy of the musical excerpt and recorded either a 'yes' or 'no' as to whether the subject performed an accent.

The researcher also gained the aid of an assistant. This proved to be necessary in order to double the number of subjects tested. The high school band's student teacher was used as an assistant at the high school (no assistant was necessary at the college) to ensure that the assistant was present without fail. This is the most efficient design plan.

Testing-High School

A total of 56 high school wind instrumentalists completed the study. The first day of the test was devoted to Excerpt A for both groups (the experimental group and the control group). The researcher/assistant (moderator) distributed the identifier cards to the subjects as the entered the testing room on the first day. Each moderator tested half of the subjects, but both had an even mix of experimental and control group subjects. The moderator invited the subjects in one at a time. When entering the room, the subjects were given an identifier card by the moderator. The identifier code signaled which folder to use (either the experimental folder or the control folder). The subject was then presented with Excerpt A and given thirty seconds to view the excerpt without making any noise on the instrument. After thirty seconds passed, the moderator told the subject to begin the sight-reading. Once the subject finished the excerpt, they were asked to leave as the next subject entered to repeat the process. Once the tests for Excerpt A were finished, the researcher collected the results and filed them with the location name on a personal laptop in order to keep the recordings together and private.

A week later, the second test day was devoted to the altered Excerpt B. The moderators used the same setup and procedure that was used during the first testing day. The only difference in the procedure was that the subjects completed the questionnaire before coming into the testing room. They handed the completed questionnaire and identifier card to the moderator before sight-reading began. After Excerpt B tests were completed, the researcher collected the results and filed them on the laptop just as before.

Testing-College

A total of 30 college wind instrumentalists completed the study. The first day of the test was devoted to Excerpt A for both groups (the experimental group and the control group). The moderator tested all of the subjects, and had an even mix of experimental and control group subjects. The moderator invited the subjects in one at a time. When entering the room, the subjects were given an identifier card by the moderator. The identifier code signaled which folder to use. The subject was then presented with Excerpt A and given thirty seconds to view the excerpt without making any noise on the instrument. After thirty seconds passed, the moderator told the subject to begin the sight-reading. Once the subject finished the excerpt, they were asked to leave as the next subject entered to repeat the process. Once the tests for Excerpt A were finished, the researcher collected the results and filed them with the location name on a personal laptop in order to keep the recordings together and private.

A week later, the second test day was devoted to the altered Excerpt B. The moderator used the same setup and procedure that was used during the first testing day. The only difference in the procedure was that the subjects completed the questionnaire before coming into the testing room. They handed the completed questionnaire and identifier card to the moderator before sight-reading began. After Excerpt B tests were finished, the researcher collected the results and filed them on the laptop just as before.

Analysis/Results

The judges were reminded how to evaluate the recordings and instructed to provide a simple 'yes' or 'no' answer for each recording as to whether the subject performed the accent or not. The researcher then uploaded the recordings to a private storage drive online and gave the two judges access to it. The drive contained three folders, one for each judge. Each folder contained the recordings for each location and a spreadsheet to record the data. The judges listened to the recordings and documented their results. The judges did all of the data entry online and did not have to save any information to their own devices. All of the information was transferred to the researcher's personal laptop with the original recordings. The researcher deleted all of the information that is on the private storage drive according to protocol. The researcher compiled the results of the questionnaire. The questionnaire's results were analyzed and organized into a table, and then the questionnaires were shredded. Soon after, the original audio recordings were deleted as well.

The researcher also compiled the results from the recording results completed by the judges and used Chi-Squared Analysis to analyze the results of the evaluations. The results were organized and are displayed in the next chapter. There were some students who were only there for the first testing day, but their results were disregarded. The results were all compiled and are in the appendix. Table 1 shows all of the results for the recordings and questionnaire of the 56 high school wind instrumentalists that were used as subjects in the study. 28 of the subjects were in the control group and 28 were in the experimental group. Table 2 shows all of the results for the recordings and questionnaire of the 30 college wind instrumentalists used in the study. 15 of the subjects were in the control group while the other 15 were in the experimental group. These results were used to test the null hypothesis that was stated previously: The use of color to bring attention to the accent marks will have no effect on the performance of the desired accent during the sight-reading process than the use of standard music notation.

CHAPTER 4: RESULTS

Analysis

The analysis shows that with the two groups combined, the null hypothesis is rejected, which means that the use of color to bring attention to accent marks does have an effect on the performance of accents during the sight-reading process. Using the Chi-Squared Test for Cross-Categorized Frequency Data, Figure 1 shows the observed results for the two groups (high school and college) combined in a table necessary for Chi-Squared Analysis. Figure 2 shows the expected results for the combined groups in the same type of table. For this group of data, χ^2 (chi-squared) is calculated at 9.07 and the degree of freedom (df) value is 1. With this information, a significance value of .5% is given. This means that the difference between the experimental group's posttest yes value (26/31=83.9%) and the control group's posttest yes value (12/28=42.9%) must be within .5% for the results to be insignificant and the null hypothesis accepted. That is not the case, so the null hypothesis is rejected for the combined group.

Combined-Observed	Pretest Yes	Posttest Yes	Totals
Experimental	5	26	31
Control	16	12	28
Totals	21	38	59

Figure 1 Combined (High School and College) Observed Recording Results for Chi-Squared Analysis

Combined-Expected	Pretest Yes	Posttest Yes	Totals
Experimental	11.03	19.97	31
Control	9.97	18.03	28
Totals	21	38	59

Figure 2 Combined (High School and College) Expected Recording Results for Chi-Squared Analysis

The null hypothesis is also rejected in the high school group data, meaning that the use of color to bring attention to accent marks does have an effect on the performance of accents during the sight-reading process for high school subjects. Figure 3 shows the observed results for the high school group only in a table for Chi-Squared Analysis. Figure 4 shows the expected results for the high school group only. For this group of data, χ^2 (chi-squared) is 9.12 and the degree of freedom (df) value is 1. With this similar information, a significance value of .5% is again determined. This means that the experimental posttest value (12/12=100%) and the control posttest value (5/14=35.7%) must be within .5% in order for the results to be insignificant and that same null hypothesis to be accepted. Again, that is not the case, so the null hypothesis is rejected for the high school group as well.

High School-Observed	Pretest Yes	Posttest Yes	Totals
Experimental	0	12	12
Control	9	5	14
Totals	9	17	26

Figure 3 High School Observed Results for Chi-Squared Analysis

High School-Expected	Pretest Yes	Posttest Yes	Totals
Experimental	4.15	7.85	12
Control	4.85	9.15	14
Totals	9	17	26

Figure 4 High School Expected Results for Chi-Squared Analysis

The analysis shows that with the college group, the null hypothesis fails to be rejected, meaning that there is no data to suggest that the use of color to bring attention to accent marks has an effect on the performance of accents during the sight-reading process for college subjects. Using the Chi-Squared Test for Cross-Categorized Frequency Data, Figure 5 shows the observed results from the college group. Figure 6 shows the expected results for the college group. For this group of data, χ^2 (chi-squared) is 1.06 and the degree of freedom (df) value is 1. With this data, a significance value of 30.3% is determined. This means that the experimental posttest value (14/19=73.7%) and the control posttest value (7/14=50%) must be within 30.3% in order to show that the results are insignificant and accept the null hypothesis. These data verify the failure to reject the null hypothesis for college subjects.

College-Observed	Pretest Yes	Posttest Yes	Totals
Experimental	5	14	19
Control	7	7	14
Totals	12	21	33

Figure 5 College Observed Results for Chi-Squared Analysis

College-Expected	Pretest Yes	Posttest Yes	Totals
Experimental	6.91	12.09	19
Control	5.09	8.91	14
Totals	12	21	33

Figure 6 College Expected Results for Chi-Squared Analysis

Table 3 strengthens the findings discussed in previous paragraphs as it shows the statistics of both groups individually and combined. It also shows the posttest data broken down by control group and experimental group.

High School	Pretest Yes	Pretest Yes %	Posttest Yes and Post Test Yes %			
			Control	Control %	Experimental	Experimental %
Total	9 of 56	16.1%	5 of 28	27.8%	12 of 28	42.9%
College	**Pretest Yes**	**Pretest Yes %**	**Posttest Yes and Post Test Yes %**			
			Control	Control %	Experimental	Experimental %
Total	12 of 30	40%	7 of 15	46.7%	14 of 15	93.3%
Combined	**Pretest Yes**	**Pretest Yes %**	**Posttest Yes and Post Test Yes %**			
			Control	Control %	Experimental	Experimental %
	21 of 86	24.4%	12 of 43	27.9%	26 of 43	60.5%

Table 3 High School, College, and Combined-Experimental v. Control Group Data

The information in Tables 4, 5, and 6 show the analysis of gender, age, and number of years in band, respectively. These tables were used to analyze each aspect of the questionnaire completed by each subject as well as the overall results. The data from Table 4 show no significant advantage to either gender during either phase of the experiment.

Gender Analysis						
High School	Pretest Yes	Pretest Yes %	Posttest Yes and Post Test Yes %			
			Control	Control %	Experimental	Experimental %
Male	3 of 21	14.3%	1 of 11	9.1%	4 of 10	40%
Female	6 of 35	17.1%	2 of 18	11.1%	8 of 17	47.1%
College	Pretest Yes	Pretest Yes %	Posttest Yes and Post Test Yes %			
			Control	Control %	Experimental	Experimental %
Male	10 of 21	47.6%	6 of 10	60%	9 of 11	81.8%
Female	2 of 9	22.2%	2 of 4	50%	5 of 5	100%

Table 4 High School and College Gender Analysis-Experimental v. Control Group Data

In the high school group, the data do suggest that age is significant significant overall. The data in Table 5 show the analysis of the different ages of the two groups during the experiment. During the pretest phase of the high school group, the percentage of subjects performing accents rises exponentially higher for each additional year in age for the subjects. This continues until reaching the age of eighteen. Looking at the posttest phase for the high school group, a very similar trend can be seen. Age fourteen has the lowest percentage of subjects performing accents, and each successive age gets a higher percentage than the one before. This time, however, even the eighteen year-old subjects perform better overall. It is also worth noting that the experimental group for each age did better than did the control group for each age. No clear pattern can be seen in the college group's performance of accents among ages. The experimental group does still appear to perform accents more than does the control group. This will be discussed further in the next chapter.

Age Analysis						
High School	Pretest Yes	Pretest Yes %	Posttest Yes and Post Test Yes %			
			Control	Control %	Experimental	Experimental %
14	0 of 4	0%	1 of 2	50%	0 of 2	0%
15	1 of 17	5.9%	0 of 6	0%	4 of 11	36.4%
16	4 of 19	21.1%	1 of 10	10%	4 of 9	44.4%
17	4 of 13	30.8%	1 of 8	12.5%	3 of 5	60%
18	0 of 3	0%	2 of 2	100%	1 of 1	100%

College	Pretest Yes	Pretest Yes %	Posttest Yes and Post Test Yes %			
			Control	Control %	Experimental	Experimental %
18	1 of 2	50%	1 of 2	50%	N/A	N/A
19	2 of 4	50%	2 of 2	100%	2 of 2	100%
20	3 of 6	50%	1 of 2	50%	4 of 4	100%
21	1 of 5	20%	1 of 2	50%	2 of 3	66.7%
22	3 of 6	50%	1 of 5	20%	1 of 1	100%
23	1 of 5	20%	1 of 1	100%	N/A	N/A
24	1 of 3	33.3%	0 of 1	0%	2 of 2	100%
25	1 of 2	50%	N/A	N/A	2 of 2	100%
26	1 of 1	100%	N/A	N/A	1 of 1	100%

Table 5 High School and College Age Analysis-Experimental v. Control Group Data

Aside from a few separate years of standout, no significant pattern can be found that suggests that the number of years in band affects a subject's ability or tendency to perform accents more readily. The information in Table 6 shows an analysis of the number of years in band for each of the subjects during the experiment. Since it did not seem relevant to split the data into groups, these data are combined for the two groups. It can be seen, however, that the experimental group does have higher percentages than does the control group.

Number of Years in Band Analysis						
Combined	Pretest Yes	Pretest Yes %	Posttest Yes and Post Test Yes %			
			Control	Control %	Experimental	Experimental %
1	0 of 1	0%	N/A	N/A	0 of 1	0%
3	1 of 5	20%	0 of 3	0%	1 of 2	50%
4	2 of 13	15.4%	0 of 4	0%	1 of 9	11.1%
5	4 of 18	22.2%	1 of 10	10%	7 of 8	87.5%
6	1 of 13	7.7%	0 of 6	0%	3 of 7	47.9%
7	2 of 6	33.3%	4 of 5	80%	1 of 1	100%
8	4 of 6	66.7%	3 of 5	60%	1 of 1	100%
9	1 of 5	20%	1 of 3	33.3%	2 of 2	100%
10	3 of 7	42.9%	1 of 1	100%	5 of 6	83.3%
11	1 of 2	50%	1 of 1	100%	1 of 1	100%
12	0 of 2	0%	0 of 2	0%	N/A	N/A
13	2 of 2	100%	0 of 1	0%	1 of 1	100%
14	1 of 3	33.3%	0 of 1	0%	2 of 2	100%
15	0 of 1	0%	N/A	N/A	1 of 1	100%
16	0 of 1	0%	N/A	N/A	1 of 1	100%

Table 6 Combined Number of Years in Band Analysis-Experimental v. Control Group Data

The results show that brass players, and more specifically trumpet players, perform accents more consistently than others. The next set of information displays an analysis of the subjects by type of instrument and is presented in Table 7. Although there is no data that say definitively that one instrument performs accents more frequently than any other, these data do suggest that trumpet players tend to accent more consistently than do other instrument types. No matter the phase of the experiment or the group (high school or college), the percentage of accenting trumpet-playing subjects tend to be close to 50%, whereas, all other instrument types seem to fluctuate quite a bit. When it comes to instrument families, results present themselves a little more clearly. In the high school group pretest, the brass players performed twice as well as the woodwind players did

(21.4% v 10.7%). However, during the posttest phase, the two families were almost even with 28.6% of the brass compared to 32.1% of the woodwinds.

Instrument Analysis						
High School	Pretest Yes	Pretest Yes %	Posttest Yes and Post Test Yes %			
			Control	Control %	Experimental	Experimental %
Flute	0 of 12	0%	0 of 5	0%	4 of 7	57.1%
Clarinet	2 of 9	22.2%	1 of 5	20%	2 of 4	50%
Saxes	1 of 6	16.7%	0 of 4	0%	1 of 2	50%
Bassoon	0 of 1	0%	N/A	N/A	1 of 1	100%
Trumpet	3 of 7	42.9%	1 of 4	25%	1 of 3	33.3%
Horn	1 of 7	14.3%	1 of 4	25%	0 of 3	0%
Trombone	1 of 11	9.1%	2 of 5	40%	2 of 6	33.3%
Euphonium	0 of 1	0%	N/A	N/A	1 of 1	100%
Tuba	1 of 2	50%	0 of 1	0%	0 of 1	0%
Brass	6 of 28	21.4%	4 of 14	28.6%	4 of 14	28.6%
Woodwind	3 of 28	10.7%	1 of 14	7.1%	8 of 14	57.1%
College	Pretest Yes	Pretest Yes %	Posttest Yes and Post Test Yes %			
			Control	Control %	Experimental	Experimental %
Clarinet	1 of 2	50%	1 of 1	100%	1 of 1	100%
Saxes	2 of 9	22.2%	2 of 4	50%	4 of 5	80%
Bassoon	0 of 1	0%	0 of 1	0%	N/A	N/A
Trumpet	4 of 7	57.1%	2 of 3	66.7%	4 of 4	100%
Horn	1 of 5	20%	2 of 3	66.7%	2 of 2	100%
Trombone	2 of 3	66.7%	N/A	N/A	3 of 3	100%
Euphonium	2 of 3	66.7%	0 of 3	0%	N/A	N/A
Brass	9 of 18	50%	4 of 9	44.4%	9 of 9	100%
Woodwind	3 of 12	25%	3 of 6	50%	5 of 6	83.3%
Combined Brass	15 of 46	32.6%	8 of 23	34.8%	13 of 23	56.5%
Combined Woodwind	6 of 40	15%	4 of 20	20%	13 of 20	65%

Table 7 High School and College Instrument Type Analysis-Experimental v. Control Group Data

The college group was very similar in results. Exactly 50% of the brass players performed accents during the pretest phase while exactly 25% of the woodwinds performed accents during the same phase. Again, the posttest presented the families as almost even with 72% of the brass family performing accents compared to 66.7% of the woodwind family. Since the same trend is seen in both groups, there is no need to look at the combined statistics. The experimental group did show improvement for both instrument families, but the woodwind family increased its numbers significantly more during the posttest phase than did the brass family. This will also be discussed in the next chapter.

Results indicated that music lessons do have a positive affect on the experiment. The last collection of information, Table 8, displays an analysis of the number of years in music lessons for the combined group of subjects. By examining the data of the pretest phase, no definitive pattern seems to arise to suggest that lessons make a difference. A similar lack of a pattern occurs when viewing the data for the posttest phase of the experiment. When looking at the data at the bottom of the table, however, a clear pattern does seem to arise. Although it does not appear to matter how many years the subjects took lessons, a significant pattern is visible when looking at the simple fact if the subjects have taken music lessons or not. The subjects who have taken lessons performed accents 240% more than did those who had not taken any music lessons during the pretest phase. During the posttest phase, the subjects who had taken lessons performed accents 300% more than did those who had not taken any lessons. It is also noteworthy to mention that the experimental group did perform significantly better than did the control group again.

Number of Years in Lessons						
Combined	Pretest Yes	Pretest Yes %	Posttest Yes and Post Test Yes %			
			Control	Control %	Experimental	Experimental %
0 Years (0<1)	7 of 47	14.9%	4 of 27	14.8%	7 of 20	35%
Years	1 of 3	33.3%	0 of 1	0%	2 of 2	100%
1 Year	1 of 11	9.1%	1 of 2	50%	6 of 9	66.7%
2 Years	4 of 6	66.7%	2 of 3	66.7%	3 of 3	100%
3 Years	2 of 4	50%	0 of 1	0%	3 of 3	100%
4 Years	2 of 5	40%	2 of 3	66.7%	1 of 2	50%
5 Years	1 of 5	20%	2 of 3	66.7%	2 of 2	100%
6 Years	2 of 4	50%	1 of 2	50%	2 of 2	100%
9 Years	1 of 1	100%	0 of 1	0%	N/A	N/A
No Lessons	7 of 47	14.9%	4 of 27	14.8%	7 of 20	35%
Lessons	14 of 39	35.9%	8 of 16	50%	19 of 23	82.6%

Table 8 Combined Number of Years in Music Lessons Analysis-Experimental v. Control Group Data

CHAPTER 5: DISCUSSION

Based on all of the information presented, the following claims can be made about the combined groups: the use of color does make a difference in the performance of accents; the pilot test data match with the current experimental data; gender does not appear to make a difference in the performance of accents; brass players tend to perform better initially, but perform evenly with woodwinds with the treatment added; the number of years in band is insignificant; and those who have had music lessons (no matter the timeframe) perform accents more than those who have not had lessons. Additionally, age only makes a difference in the high school group. The information reported through the questionnaire topics presents a lot of data to sift through, but analyses of all of these data do not definitively prove any of these claims. They do, however, present some interesting discussions that can be argued for or against in this chapter.

Implications

Overall, the high school group in the current experiment strengthens the findings from the pilot study. When comparing the current experiment to the pilot test, only the posttest results can be considered, since the procedure during that phase matches the pilot test procedure. In the high school data, only 30.4% (17/56) of the subjects performed the accents during the posttest phase. However, 70.6% (12/17) of those who performed the accents in the posttest were part of the experimental group. The figure 30.4% is insignificantly less than the 34% of subjects who performed accents in the pilot test. The 70.6% matches almost perfectly with the pilot test data of 70%.

The combined data set shows slightly mixed results when compared to the pilot test data. The data show that 44.2% (38/86) of the subjects performed accents during the posttest phase of the experiment. That number is significantly higher than the 34% observed during the pilot test. Also, 68.4% (26/38) of those accenting subjects during the posttest phase were members of the experimental group. That number is insignificantly smaller than the pilot test number of 70%.

The conclusions for the college group definitively show that color does not make as much of a difference as it does in the high school group. In the college portion of the study, an astounding 70% performed the accents in the posttest phase. That is more than double the percentage of high school subjects of 30.4%. That is also a drastically higher number than the pilot test data of 34%. A very similar 66.7% (14/21) of those accenting subjects in the posttest were members of the experimental group. That number is insignificantly less than the 70% of accenting subjects who were part of the experimental group in the pilot test.

Based on the results and their comparisons to the pilot test data, it is definitive that the addition of color positively affects the high school group of subjects. The results are however inconclusive for the college group. The college subjects clearly perform accents more than do high school subjects overall, but the experimental group was on the same level regardless of the group identification.

The gender analysis was interesting because of the lack of significance one way or another. The results showed a relatively even percentage of subjects accenting during the performance. The high school data were very similar throughout both phases of the experiment. The college group, however, showed a significant difference in the pretest portion of the study. Here, 47.6% of the males accented compared with 22.2% of the females. That seems very significant since the males performed accents twice as much as the females did. However, during the posttest phase of the experiment, the results evened out again. Therefore, the female data increase much more than did the male data during the posttest phase.

The age factor of the results proved to make a difference for the high school group, but did not seem to matter at all in the college group. It makes perfect sense for an older musician to perform accents more consistently than a younger musician because of experience and training. The older subject most likely would have been taught the different areas of importance in music and would have more experience sight-reading music with a lot of musicality in it compared to a more inexperienced, younger subject. The posttest showed that the youngest subjects did the poorest with each advancement in age performing better.

When trying to discover which instrument family and type performed accents the most consistently throughout the subjects, the brass family and trumpet-playing subjects seemed to have the best outcomes. Although it is difficult to pick any one instrument as being the most consistent among the wind instrumentalists, one instrument type does seem to be the most consistent in performing accents. That instrument is the trumpet. The trumpet group either had the highest percentage or was in the top percentile for each phase of the experiment in the high school, college, and combined groups. Trumpet players often have to play the melody or sometimes fanfares, and these parts of music frequently have accents. This is probably a reason that trumpet subjects did better overall than other subjects. The instrument family research seemed to follow suit with the trumpet data. The brass family of instruments performed accents more consistently during every phase of the experiment except the experimental group during the posttest for the high school subjects. This data shows that brass players are more likely to perform accents overall, but also that woodwind players may not notice them as easily.

The questionnaire results show that the subjects who took lessons performed accents more consistently than did those who had not taken lessons. Curiously, these data do suggest that it does not matter the number of years that a subject has taken lessons, it only matters that the subject took lessons at some point. The results show that those who have taken lessons perform between 240% and 300% better than those who have not had lessons. Those are absolutely staggering numbers to consider.

Limitations and Future Research

As discussed, the gender analysis showed no significance for either gender. The data did show an inconsistency during the college pretest portion of the study, however, with the 47.6% of males accenting compared to the 22.2% of females. Since the male number is more than double that of the female, it is significant to an observer. The male sample size was also more than double that of the female sample size. Statistically, that could have skewed the results slightly. With these drastic differences in the number of subjects, this represents an interesting experiment to replicate on a larger and more balanced scale to determine if there is a significant difference one way or another.

The college group results for age showed a complete lack of significance, which is unexpected. Much like the gender analysis, the numbers of subjects for each age was quite different and could have skewed the numbers slightly. Basically, the sample sizes were not large enough or balanced enough to gain any meaningful outcome. This area of the experiment should be replicated to determine if the results are accurate or not.

There is no discernable pattern found in the data that suggests any number of years in band is better than any other The data for the number of years in band was expected to match up with the age results. The subjects that were in band longer were expected to be older and would have more experience. This expectation proved to be true in that there was no significant pattern of importance, much like the age data in college. Again, the sample size for each data point is quite small overall, so there is an opportunity for more study.

The reason that I did not include percussionists in this study is because accents are a very necessary and basic component of percussion music. Percussionists are definitely going to perform accents more consistently than wind instrumentalists. This experimental design keeps the data from getting skewed by percussionists. This idea does represent an area of further study, however. One could easily replicate the study only looking at instrument types and comparing performances of accents among the different instrument types and families.

When looking at the collective data, lessons do have a positive affect in the performance of accents as well. Much like age and number of years in band, it was expected that the number of years taking music lessons would make a difference in the data because of the obvious experience playing multiple types and difficulties of music. The data suggest otherwise seeing as there was no obvious pattern that arose by looking at the data. Again, it could be due to the fact that the number of subjects for most of the data points is quite low. This could be another aspect of the experiment that should be studied further.

The final aspect of the survey, color-blindness, cannot be definitively proven from this study either. There were only three subjects that were color-blind. Two of them were in the control group, so they were non-factors. The other one was in the experimental group, but performed accents appropriately during both the pretest and posttest. The one in the experimental group was also 25 years of age and had taken lessons. Therefore, based on previous results, he would be expected to perform the accents. Overall, no definitive statements can be made about color-blindness based on this study.

Another aspect of this experiment that should be tested is the use of other colors besides red. Red was chosen for this experiment because accent marks are meant to be played forcefully and make an impact in the music. I could not think of another color that signifies the same kind of reaction. Red seemed to be the most applicable to this particular aspect of music. The experiment could easily be replicated using other colors to see if a different color brings about more positive results. Other studies could also be done adding color to different forms of articulation. This was a simple experiment and should be replicated in many different ways.

Conclusion

The most important part of this study is the fact that the color made a difference in the performance by the subjects. Using color like this seems pretty limited for its purposes, but truthfully, the uses are quite numerous. Some educators might use this research to validate the use of highlighters during score study or music rehearsals to draw attention to certain parts of the music for both the conductor and the musicians. This is certainly a valid point. Others may use this material to suggest a way of keeping the attention of young musicians during music class by using different colors in the music. Still others may suggest that the research is simply a way of utilizing technology more in the classroom. I think this research is valid for all of these reasons, but also for others.

I think this research is not only valid, but necessary. I do not think that the use of color in music notation is something that is just a good idea for the future. I think it is an idea that needs to be implemented in music notation now. We, as musicians, are limiting ourselves to one simple color to show so many important things. Just because music notation has been done this way for such a long time is no reason to keep following the tradition. If there are clear advantages to using simple advances in technology, then there is no reason not to use them. Musicians are ready to go paperless with an attempt to using tablets instead of copying music, but no one has utilized the possibility of colored ink on a piece of music. It seems as though musicians are trying to skip a few technological steps that could make a huge improvement in the craft that is music.

It seems clear through this study that many things can influence a musician's ability to notice and perform accents during the sight-reading process. The most influential ones during this study were age during high school, instrument type, and whether a musician takes music lessons. There is opportunity for more testing to see if other colors, the ages of college students, number of years in lessons, gender, and the number of years in band make a difference during the sight-reading process. One thing is clear; however, and that is the fact that the addition of color to accent marks does make a significant positive difference in the performance of accents during the sight-reading process.

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LIST OF APPENDICES

APPENDIX A: QUESTIONNAIRE RESULTS

Table 1: Questionnaire Results Sheet---High School								
Identifier Code	Instrument	Age	Gender	# Years in Band	# Years in Lessons	Colorblind?	Accent? Attempt 1/Attempt 2	
PC09	Clarinet	14	Female	3	0	No	No	Yes
PC11	Flute	16	Female	4	0	No	No	No
PC12	Trombone	18	Male	7	0	No	No	Yes
PC13	Flute	15	Female	3	0	No	No	No
PC15	Flute	16	Female	6	0	No	No	No
PC18	Trumpet	17	Female	7	5	No	Yes	Yes
PC22	Trumpet	17	Male	6	0	No	No	No
PC24	Trumpet	16	Female	5	0	No	Yes	No
PC26	Saxophone	17	Male	7	0	No	Yes	No
PC28	Flute	17	Female	6	0	No	No	No
PC29	Saxophone	17	Male	6	0	No	No	No
PC32	Clarinet	15	Female	4	0	No	Yes	No
PC34	Flute	16	Female	5	0	No	No	No
PC36	Clarinet	17	Female	6	0	No	No	No
PC40	Trumpet	16	Female	5	0	No	Yes	No
PC43	Saxophone	16	Male	5	0	No	No	No
PC45	Horn	16	Female	5	0	No	No	No
PC46	Tuba	17	Male	6	0	No	Yes	No
PC47	Horn	16	Female	5	0	No	No	No
PC52	Trombone	17	Female	5	9	No	Yes	No
PC53	Clarinet	16	Female	4	0	No	Yes	No
PC54	Trombone	18	Male	7	0	No	No	Yes
PC55	Clarinet	14	Female	4	0	No	No	No
PC56	Saxophone	15	Male	5	0	No	No	No
PC57	Horn	15	Female	5	0	No	No	No
PC58	Horn	16	Male	5	0	No	Yes	Yes
PC59	Trombone	15	Male	3	0	Yes-Red/Blue	No	No
PC60	Trombone	15	Female	4	0	No	No	No
PE09	Flute	16	Female	5	0	No	No	Yes
PE10	Horn	16	Male	6	0	No	No	No
PE11	Flute	17	Female	5	0	No	No	Yes
PE13	Flute	15	Female	4	0	No	No	No
PE15	Trombone	15	Male	4	0	No	No	No
PE17	Flute	14	Female	4	0	No	No	No
PE20	Trumpet	15	Male	5	0	No	No	Yes

PE22	Trombone	16	Female	5	1	No	No	No
PE24	Clarinet	17	Female	6	4	No	No	Yes
PE26	Flute	17	Female	6	0.5	No	No	Yes
PE28	Flute	15	Female	4	1	No	No	Yes
PE30	Flute	15	Female	4	1	No	No	No
PE33	Saxophone	14	Female	4	0	No	No	No
PE38	Tuba	16	Male	6	0	No	No	No
PE40	Trombone	15	Female	1	0	No	No	No
PE41	Horn	15	Male	4	0	No	No	No
PE42	Trumpet	16	Female	6	0	No	No	No
PE43	Trombone	17	Male	3	3	No	No	No
PE44	Bassoon	15	Male	5	1	No	No	Yes
PE45	Clarinet	15	Female	3	0	No	No	No
PE46	Euphonium	16	Female	5	0	No	No	Yes
PE47	Clarinet	16	Female	4	0	No	No	No
PE52	Trombone	18	Female	7	0	No	No	Yes
PE53	Horn	15	Male	4	0	No	No	No
PE54	Trombone	16	Male	6	0	No	No	Yes
PE55	Clarinet	16	Female	5	0	No	No	Yes
PE56	Trumpet	17	Male	6	1	No	No	No
PE60	Saxophone	15	Male	5	0.25	No	No	Yes

Key
PE-Experimental
PC-Control
28-Experimental
28-Control

Appendix 1: Table 1: Questionnaire Results Sheet---High School

Table 2: Questionnaire Results Sheet---College								
Identifier Code	Instrument	Age	Gender	# Years in Band	# Years in Lessons	Colorblind?	Accent? Attempt 1/Attempt 2	
OC01	Saxophone	23	Male	7	5	No	No	Yes
OC02	Euphonium	22	Male	13	2	No	Yes	No
OC03	Trumpet	19	Female	8	4	No	Yes	Yes
OC04	Clarinet	22	Male	9	4	No	Yes	Yes
OC05	Saxophone	19	Male	8	6	No	Yes	Yes
OC06	Trumpet	22	Male	12	5	No	No	No
OC07	Bassoon	21	Male	9	3	Yes-Blue/Purple	No	No
OC08	Euphonium	22	Male	8	0.5	No	Yes	No
OC09	Euphonium	20	Female	9	0	No	No	No
OC10	Saxophone	22	Male	12	4	No	No	No
OC11	Trumpet	18	Male	8	2	No	Yes	Yes
OC12	Horn	21	Female	11	1	No	No	Yes
OC13	Saxophone	24	Male	14	6	No	No	No
OC14	Horn	18	Female	8	1	No	No	No
OC15	Horn	20	Male	10	2	No	Yes	Yes
OE01	Saxophone	25	Male	14	3	Yes-Red/Green	Yes	Yes
OE02	Trombone	19	Male	8	1	No	No	Yes
OE03	Trombone	20	Male	10	1	No	Yes	Yes
OE04	Horn	21	Male	10	2	No	No	Yes
OE05	Trombone	20	Male	10	3	No	Yes	Yes
OE06	Saxophone	21	Male	10	0	No	No	No
OE07	Trumpet	22	Female	10	5	No	No	Yes
OE08	Trumpet	24	Male	13	6	No	Yes	Yes
OE09	Clarinet	20	Female	9	1	No	No	Yes
OE10	Horn	20	Male	10	2	No	No	Yes
OE11	Trumpet	19	Female	9	1	No	No	Yes
OE12	Saxophone	25	Female	15	5	No	No	Yes
OE13	Trumpet	21	Female	11	2	No	Yes	Yes
OE14	Saxophone	24	Male	14	6	No	No	Yes
OE15	Saxophone	26	Male	16	4	No	No	Yes

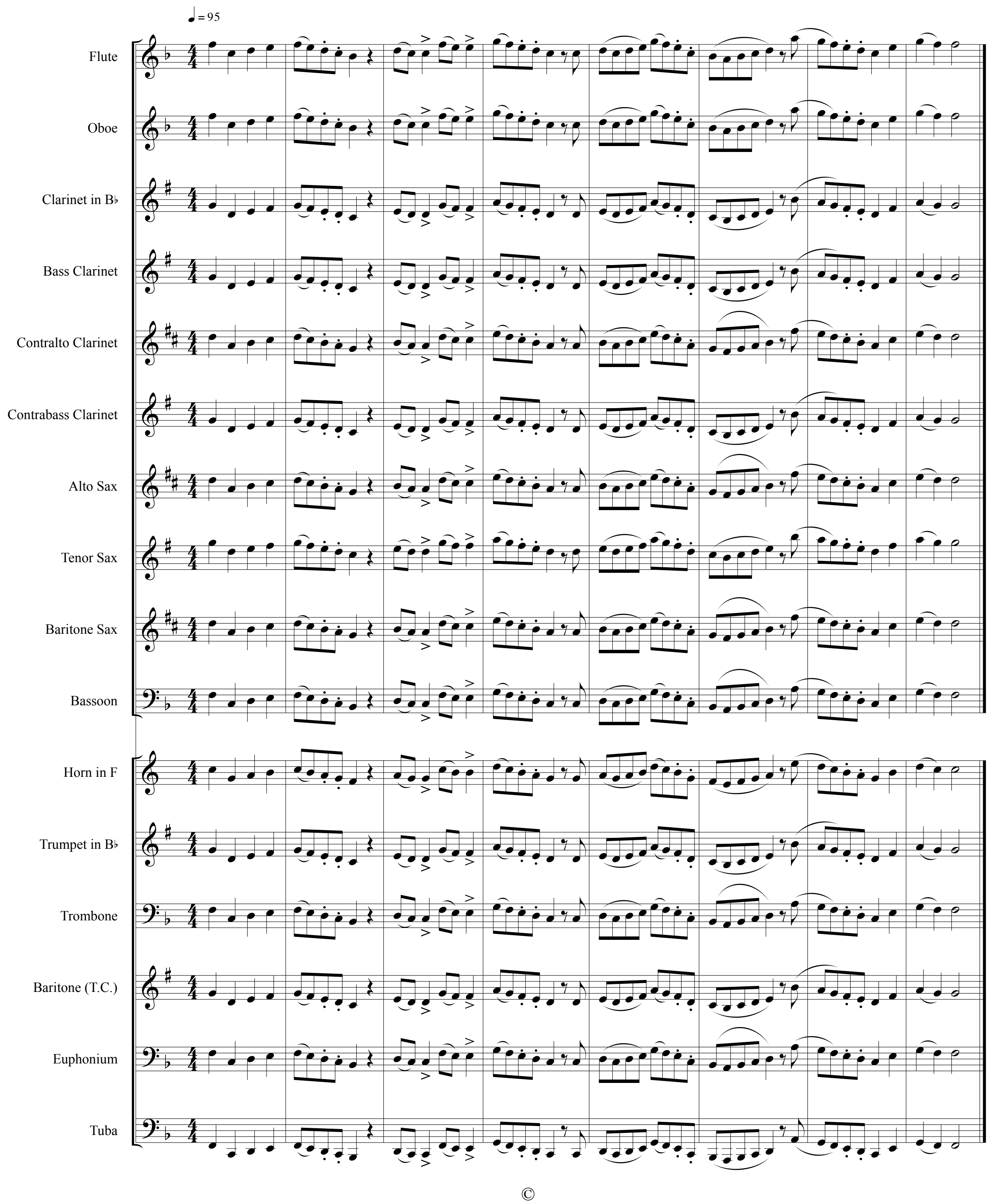
Key	
OE-Experimental	15-Experimental
OC-Control	15-Control

Appendix 2: Table 2: Questionnaire Results Sheet---College

APPENDIX B: SIGHT-READING EXCERPTS

Score

Pretest Sight-Reading Excerpt



Appendix 3: Pretest Sight-Reading Excerpt in Score Notation

Flute

Pretest Sight-Reading Excerpt

Appendix 4: Pretest Sight-Reading Excerpt Flute Subject Example

Score

Posttest Control Group Sight-Reading Excerpt

Eric Malone

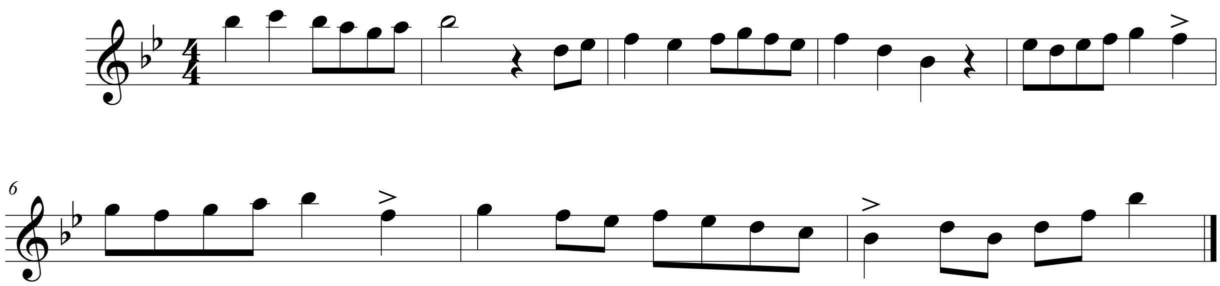
Appendix 5: Posttest Control Group Sight-Reading Excerpt in Score Notation

Flute

Posttest Sight-Reading Excerpt

C2

Eric Malone

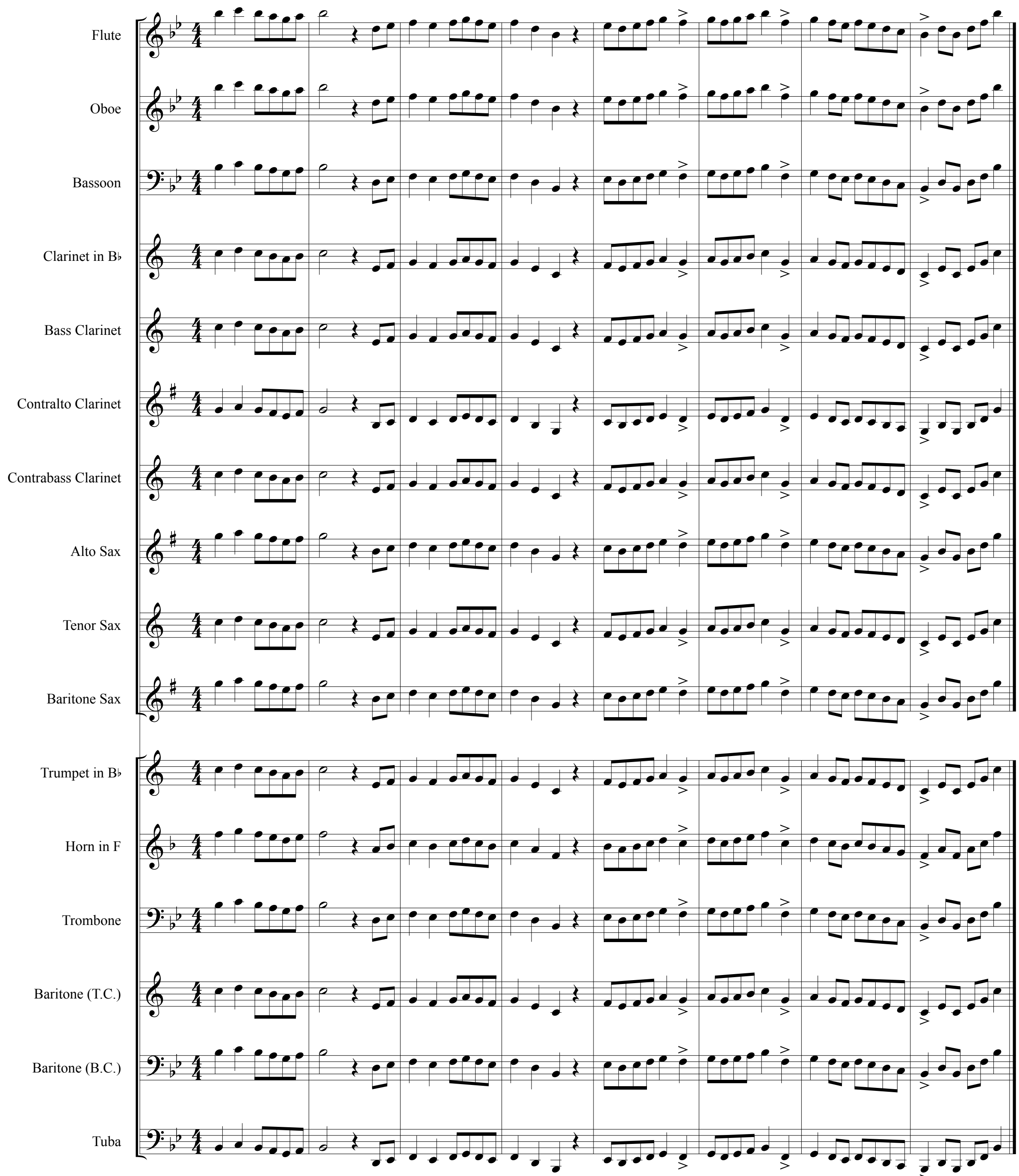


Appendix 6: Posttest Control Group Sight-Reading Excerpt Flute Subject Example

Score

Posttest Experimental Group Sight-Reading Excerpt

Eric Malone



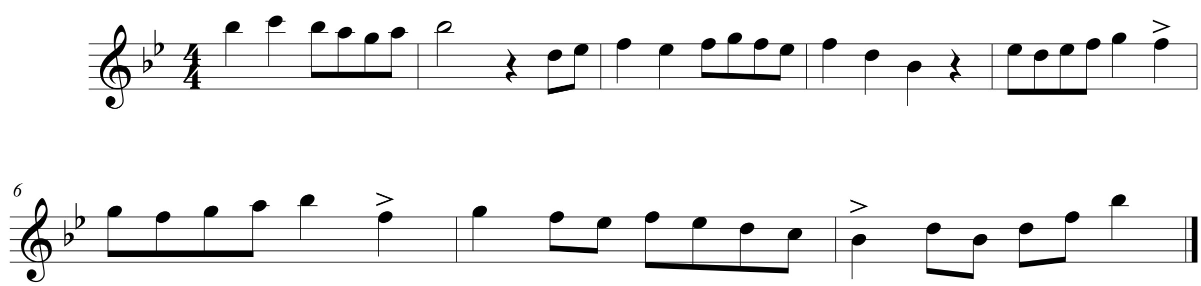
Appendix 7: Posttest Experimental Group Sight-Reading Excerpt in Score Notation
Note: All (>) marks are printed in red ink.

Flute

Posttest Sight-Reading Excerpt

E2

Eric Malone



Appendix 8: Posttest Experimental Group Sight-Reading Excerpt Flute Subject Example
Note: All (>) marks are printed in red ink.

APPENDIX C: BLANK QUESTIONNAIRE

Subject Questionnaire

Identifier______________________________ Instrument____________________________

Age___________________________________ Gender________________________________

How many years (including this year) have you been in band?______ Have you ever taken lessons? If so, how many years____

Are you colorblind? ____________________If so, please explain what form of colorblindness

---

Appendix 9: Blank Subject Questionnaire

APPENDIX D: IRB APPROVAL EMAIL

THE UNIVERSITY OF MISSISSIPPI

Eric Malone <ebmalon1@go.olemiss.edu>

IRB Exempt Approval of 16x-228

1 message

irb@olemiss.edu <irb@olemiss.edu> Tue, Mar 15, 2016 at 9:35 AM
To: Eric Malone <ebmalon1@go.olemiss.edu>, ANDREW PANEY <apaney@olemiss.edu>

Mr. Malone:

This is to inform you that your application to conduct research with human participants, "The Effect of Colored Accent Marks in Music Notation During the Sight-reading Process for High School Wind Instrumentalists" (Protocol #16x-228), has been approved as Exempt under 45 CFR 46.101(b)(#1).

Please remember that all of The University of Mississippi's human participant research activities, regardless of whether the research is subject to federal regulations, must be guided by the ethical principles in The Belmont Report: Ethical Principles and Guidelines for the Protection of Human Subjects of Research.

It is especially important for you to keep these points in mind:

- You must protect the rights and welfare of human research participants.

- Any changes to your approved protocol must be reviewed and approved before initiating those changes.

- You must report promptly to the IRB any injuries or other unanticipated problems involving risks to participants or others.

If you have any questions, please feel free to contact the IRB at irb@olemiss.edu.

Ashley S. Crumby, PharmD

Graduate Student Assistant, Research Integrity and Compliance

Appendix 10: IRB Approval Email

VITA

Education:

Itawamba Community College Fulton, MS
Associate of Art-May 2011
Major: Music Education
Overall GPA in Residency: 3.77/4.00

The University of Mississippi University, MS
Bachelor of Music-May 2014
Major: Music Education (Instrumental)
Bachelor of Arts-May 2014
Major: Mathematics
Overall GPA in Residency: 3.68/4.00

Overall GPA: 3.74/4.00

Honors and Activities:

Recipient of Outstanding Graduate Student in Music Education 2016
Recipient of Outstanding Graduate Student in Music 2016
Participated in University of Notre Dame's 58th Collegiate Jazz Festival
Member of Sigma Alpha Lambda [Leadership and Honors]
Member of Phi Kappa Phi [Honors Society]
Member of Phi Kappa Lambda [Music Education Honors]
Member of Mississippi Professional Educators
Presented original research project at Missouri Music Educators Association
Member of National Association for Music Educators
Winner of the University of Mississippi Concerto Competition-2012/2013
Chancellor's Honor Roll-2011-2014
Drum Major (Itawamba Community College)-2008-2010
Member of Phi Theta Kappa [Leadership and Honors Society] (Chapter Vice President-2009/2010, Chapter President-2010/2011, Golden Key Award-2011, Member of the Year Award-2009-2011)
Itawamba Community College Fine Arts Division Most Outstanding Student-2010/2011
Salutatorian at Caledonia High School-2008
Member of various performing ensembles including jazz band, steel drum ensemble, wind ensemble, saxophone quartet, etc.

Work Experience: New Hope High School, Columbus, MS
Summer Band Camp Worker 2011-2013

New Albany High School, New Albany, MS
Band Staff July 2014-May 2016

University of Mississippi, University, MS
Graduate Assistant with Band Department August 2014-June 2016

Houston High School, Houston, MS
Director of Bands July 2016-