THE EFFECT OF EXPERT GUIDED EYE GAZE ON NOVICE INSTRUMENTAL MUSIC TEACHERS’ OBSERVATIONS OF MIDDLE SCHOOL BAND REHEARSALS

by

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ABSTRACT

The purpose of this study was twofold: (a) to examine and compare the eye gaze of novice and expert instrumental music teachers observing videos of middle school band rehearsals, and (b) to develop and evaluate a possible method for increasing novice music teachers’ situational awareness through systematic observation of training videos embedded with expert eye gaze and think aloud commentary. Novice teachers ($n=29$) completed a pre- and posttest where they observed 20 1-minute videos of middle school band rehearsals; experts ($n=5$) served as a referential comparison group. The researcher recorded the participants’ eye gaze using $iView$ eye tracking software. Novice teachers were randomly assigned to treatment ($n=15$) and nontreatment ($n=14$) groups; the treatment group participated in six expert guided video training sessions between the pretest and posttest. For analysis, six of the 20 video segments were randomly selected and gridded Areas of Interest (AOI) heatmaps were created and used to make comparisons between groups. Results showed that 90.6% of the average median dwell times for AOIs were similar between experts and novices. Subtle differences were illustrated when visually examining the gridded AOI heatmaps and making connections to the video contents. Novice teachers focused on easily identifiable teaching moments such as posture, instrument carriage, and overt student misbehavior; experts focused on these and more subtle areas that required technical evaluation, such as embouchure and playing technique. Additionally, expert guided eye gaze was not shown to be an effective training tool since the eye gaze of all participants improved from pretest to posttest, suggesting that repetition alone resulted in more expert-like observations for novice teachers.
DEDICATION

To my mother,

for the patience, love, and support she provides

during every life adventure,

especially this one.
**LIST OF ABBREVIATIONS AND SYMBOLS**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>AOI</td>
<td>Area of Interest</td>
</tr>
<tr>
<td>CAOI</td>
<td>Critical Area of Interest</td>
</tr>
<tr>
<td>EMME</td>
<td>Eye Movement Modeling Example</td>
</tr>
<tr>
<td>ms</td>
<td>Milliseconds</td>
</tr>
<tr>
<td>Mdn</td>
<td>Dwell time median</td>
</tr>
<tr>
<td>N</td>
<td>Number of participants</td>
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<tr>
<td>n</td>
<td>Number of sub-group participants</td>
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<tr>
<td>p</td>
<td>Probability associated with the occurrence under the null hypothesis of a value as extreme as or more extreme than the observed value</td>
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<tr>
<td>SD</td>
<td>Standard deviation</td>
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<tr>
<td>U</td>
<td>Mann Whitney U Value</td>
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<td>$x^2$</td>
<td>Kruskall-Wallis H Value</td>
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<td>z</td>
<td>Wilcoxon Test Value</td>
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<tr>
<td>&lt;</td>
<td>Less than</td>
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<td>=</td>
<td>Equal to</td>
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<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tr>
<td>Area of Interest (AOI)</td>
<td>A predefined area in a stimulus (e.g., video) used to determine if the observer views the area. The area is defined, but not indicated to the observer. Each time the observer looks in the defined area data is collected. (Holmqvist et al., 2011).</td>
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<tr>
<td>Critical Area of Interest (CAOI)</td>
<td>Areas of interest exhibiting a significant difference in dwell time between all groups.</td>
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<tr>
<td>Concurrent think aloud reporting</td>
<td>Verbalization of all thoughts while observing the video stimulus (Van Someren, Barnard, &amp; Sandberg, 1994).</td>
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<tr>
<td>Dwell time</td>
<td>The amount of time spent observing in a defined area of interest.</td>
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<tr>
<td>Eye movement modeling example</td>
<td>Eye gaze of the model expert superimposed over a recording of a middle school band rehearsal (Jarodzka, van Gog, Dorr, Scheiter, &amp; Gerjets, 2013).</td>
</tr>
<tr>
<td>Eye gaze</td>
<td>Where an observer looks while observing (Holmqvist et al., 2011).</td>
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<tr>
<td>Expert teacher</td>
<td>A music educator who is a current member of a professional association – Alabama Music Educators Association, has 10 or more years of teaching experience, is an experienced teacher with three or more years of experience at the middle school level, has high-performing students as measured by superior ratings at state-level music performance assessment, and was identified as an expert by a professional peer group—a panel of officers of the Alabama Bandmasters Association (Berliner, 2004; Palmer, Stough, Budenski, &amp; Gonzales, 2005).</td>
</tr>
<tr>
<td>Fixation</td>
<td>When the eye remains stationary, focusing on one defined location (Holmqvist et al., 2011).</td>
</tr>
<tr>
<td>Fixation duration</td>
<td>The period of time the eye remains stationary (Afonso, Garganta, McRobert, Williams, &amp; Mesquita, 2012).</td>
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Expert guided eye gaze: The process of following a prerecorded eye gaze of an expert teacher, represented by a translucent yellow dot, superimposed on a video recording of a middle school band rehearsal while hearing the expert’s think aloud comments.

Gridded AOI map: Area of interest maps consisting of eight rows and six columns, a total of 48 squares, based on average dwell time (Holmqvist et al., 2011); this map was created for post-hoc analysis.

Instrumental music educator: Music educator specializing in string or band instrumental music education.

Novice teacher: Preservice instrumental music education teacher enrolled at the University of Alabama prior to student teaching.

Saccade: Movement of the eye between fixations (Holmqvist et al., 2011).

Situational awareness: The ability to perceive the classroom environment, comprehend the meaning, and make immediate and future adjustments (Endsley, 1995).
ACKNOWLEDGMENTS

This project would not have been possible without the generosity of SensioMotoric Instruments (SMI), who graciously supplied the eye tracking equipment used in this study and provided prompt and helpful assistance throughout the entire process.

I am grateful to all of the participants involved during the various stages of this study. I would like to thank the middle school band directors and students, for welcoming me into their classrooms multiple days to record rehearsals and experiment with the camera setup; the expert teachers, for taking time out of their busy schedules to assist me with this project; and the music education undergraduate students at The University of Alabama, for eagerly participating in this study and showing continued support throughout the process.

I would like to express my deepest appreciation to my major professor and committee chair, Dr. Carl B. Hancock, for believing in me when I didn’t believe in myself and for providing unlimited support, time, and patience not only while writing this dissertation, but throughout my doctoral studies and career endeavors. As my teacher and mentor, he has taught me more than I could ever give him credit for here.

I was fortunate to have an exceptional and supportive committee, who were willing to assist when needed without hesitation. I would like to thank Dr. Kenneth Ozzello, for providing multiple opportunities for me to learn and grow as an educator and musician; Dr. Kenneth Bodiford, for continuously supporting me throughout my career and this process; Dr. Andrea Cevasco-Trotter, for motivating me and reminding me to celebrate the small victories; and Dr. Ellary Draper, for her guidance and advice throughout the editing process.
In addition, I would like to thank the many friends—new and old—that have supported me throughout this journey. Whether it was by providing words of encouragement, a listening ear, or distractions at just the right time, it was those moments that sustained me to the end.

Finally, I must express my most profound gratitude to my mom, Jo Ann Todd, for the countless ways she has supported me as a musician, teacher, and daughter. This journey simply would not have been possible without her.
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CHAPTER 1

INTRODUCTION

Background

The passing of the *Every Student Succeeds Act* of 2015 ensured that all students receive an education of the highest academic standards, affording all students the opportunity to attend college and enter successful careers, a mandate that is dependent upon the effectiveness of each and every classroom teacher. However, many classrooms are staffed by inexperienced teachers (Hancock & Porter, 2016; Ingersoll, Merrill, & Stucky, 2014) and many novice teachers enter the field at a deficit when compared to expert teachers who have years of training and teaching experience. Previous researchers have shown that the overwhelming number of details teachers must attend to during instruction and an inability to connect content knowledge with classroom situations is one recognizable difference between the abilities of novice and expert teachers in the classroom (Bennett & Flach, 2011).

*Effective teaching.* Managing and running an ensemble rehearsal is an extremely complex task that involves attending to multiple classroom events at the same time (Bender & Hancock, 2010). In an effort to ensure that the music teachers directing large ensembles have the skills necessary to provide effective instruction in this multifaceted environment, researchers have studied the qualities and techniques of effective music teachers and determined the importance of instructional pacing (Worthy, 2003), teacher presentation (Price, 1983), time use (Witt, 1986), and sequential teaching patterns (Bowers, 1997; Hendel, 1995; Price, 1992; Yarbrough & Hendel, 1993). Individual teacher mannerisms, such as the use of varying facial
expression (Silvey, 2013), appropriate eye contact (Fredrickson, 1992), and purposeful voice
inflection (Napoles, 2014), were also found to be consistent qualities of good music teachers.

Moreover, the most effective teachers, regardless of subject area, have been shown to use
more sophisticated ways of observing, interpreting, and responding than less effective teachers.
When teaching daily lessons, effective teachers provide instruction, evaluate students, and offer
feedback to increase student learning (Price, 1989, 1992). However, more effective teachers
possess superior knowledge and understanding and apply it in a way that reduces uncertainty and
increases classroom efficiency (Bennett & Flach, 2011, p. 453). In other words, experts connect
the information they know with their observations allowing them to think more productively than
novices and thereby respond more appropriately to their students’ needs, which certainly seems
like an important characteristic of an effective music teacher.

Berliner (2004) explored the behaviors and accomplishments of expert and effective
teachers and identified their traits as possessing the ability to:

1. Develop automatic and routine operations needed to accomplish goals,
2. Recognize task demands and social situations when solving pedagogical problems,
3. Demonstrate flexibility in their teaching,
4. Represent problems qualitatively, and
5. Perceive meaningful patterns in an accurate and speedy manner.

Berliner also noted that expert teachers spent more time solving problems with richer
information and personal sources than novice teachers (p. 208).

In music education, researchers have explored numerous means to improve teaching
effectiveness. For example, researchers have directed students in finding causal relationships
between student behavior and surrounding events to evaluate teaching procedures (Standley &
Greenfield, 1987), facilitated understanding of teacher instruction by assessing teacher responses (Madsen & Duke, 1985), and narrowed preservice teachers visual scope through directed observation focus (Duke & Prickett, 1987; Madsen & Madsen, 2015). Furthermore, researchers have analyzed teachers’ observations to differentiate levels of expertise and experience. For example, Standley and Madsen (1991) instructed freshmen, juniors, novices, experienced teachers, and experts to observe 20 1-minute video experts from a variety of musical situations and simultaneously observe, analyze, and extemporaneously write about their observations. The authors analyzed participants’ responses and found a relationship between teaching expertise, where teachers focus their attention, and the sophistication of their interpretations of classroom content.

**Situational awareness.** Situation awareness is a cognitive process that depends on perceiving and interpreting critical events during a task (Saus et al., 2006) and involves understanding the current environment, while determining the most important aspect to attend to (Endsley, 2000). This cognitive process was first discussed during World War I by Oswald Boelcke, when assessing and training airplane pilots to recognize the enemy before the enemy recognized them (Press, 1986). Since then, researchers have focused on understanding the role of situational awareness and determined that situational awareness is a goal oriented process with predetermined desired outcomes and is related to an individual’s working memory (Ensley, 1995). Other studies have focused on determining errors in situational awareness and the circumstances involved to truly be situationally aware (Jones, 2000). For example, Bumgarner (2009) used simulated driving tasks to determine the effects of mental training tasks on the situational awareness of drivers and found that practice sessions related to concentration and mindfulness improved drivers’ situational awareness.
In education, situational awareness is comprised of a teacher’s ability to observe students’ interactions, performances, and responses; bring content knowledge and experience to bear to accurately interpret these observations; and quickly determine the steps and feedback required to promote student learning. This requires a high level of classroom cognizance, commonly referred to by researchers as teacher *with-it-ness* (Endsley, 1995). Indeed, the “hallmark of [an] expert…[teacher is overtly demonstrating the] ability to monitor [the] complex, chaotic environment of a classroom and home in on key features relevant to monitoring student understanding” (Sadler, 2006). If education stakeholders genuinely want to create optimal learning environments for students with direct benefits to student learning, prioritizing the development of situational awareness among all teachers is needed.

**Improving situational awareness.** Snoeyink (2010) explored improving effective teaching by employing video observation as a self-assessment tool to improve teacher *with-it-ness* (i.e., situational awareness) of preservice teachers. He compared preservice teachers’ perceptions of their teaching before and after watching a video recording of their lesson; videos of the lesson were recorded from the front of the room focusing on the students, and from the back of the room focusing on the teacher. After observing the video and completing a self-analysis of their teaching through written reflection, completion of a rating scale, and interviews, the preservice teachers moved around the room more and developed a “system of noticing” that involved recognizing an issue, reflecting, and responding. These findings suggest that seeing ourselves teaching from a different perspective may improve situational awareness.

Other professions have experimented with ways to develop situational awareness by supplementing established pedagogical methods with eye tracking techniques. In these cases, eye tracking technologies were used to measure and direct people where to look (i.e., eye gaze) when
performing complex tasks and noticeable improvements to performance were realized. In medicine, O’Meara et al. (2015) used eye tracking and video debriefing techniques to increase situational awareness among nursing and paramedicine students. Students observed medical situations while their eye gaze was recorded. Afterwards, the students watched a video replay of their eye movements superimposed while receiving feedback from an expert in the field. This process increased participants’ situational awareness. In aviation, Sarter et al. (2007) examined the monitoring strategies of airline pilots when observing highly automated commercial flight decks during a flight simulation task, while collecting pilots’ cognitive and eye gaze behaviors. Pilots responded to questions after the simulation task to demonstrate understanding. This method showed areas pilots observed and those they ignored, allowing pilots to know which areas they attend to and those that need more attention. In sports, Afonso et al. (2012) combined eye tracking data with verbal think aloud reports to examine situational awareness between skilled and highly skilled athletes. Volleyball players wore eye tracking glasses while participating in volleyball practice, leaving the court between sessions to provide retrospective think aloud comments. Results indicated that high skilled players scanned the court more than lower skilled players and the researchers recognized a link between participants’ visual search behaviors and the sophistication of their knowledge base as portrayed in their verbal reports; these findings suggested that eye tracking data can be used as a measure of procedural knowledge. With the success demonstrated in medicine, aviation, and athletics for using eye tracking to determine and advance situational awareness, it stands to reason that other fields such as education could benefit as well.

**Eye tracking in education.** Education researchers have used eye tracking techniques to learn more about where students look when completing specific tasks. Researchers examined
students’ eye gaze while solving math problems to understand how students prioritize their time (Susac, Bubic, Kaponja, Planinic, & Palmovic, 2014), investigated cognitive processes used when reading to understand visual search tasks (Raynor, 2009), and evaluated students’ focus of attention to determine where they look when viewing teacher presentations (Slykhuis, Wiebe, & Annetta, 2005).

Recently researchers have used these techniques to understand more about teachers’ eye gaze and behaviors in the classroom. For example, Wolff, Jarodzka, den Bogert, and Boshuizen (2016) explored and identified connections between teachers’ eye movements (i.e., where they look), observations, and level of expertise in secondary education. Novice and expert teachers observed various classroom environments while the researchers used eye tracking technology to record the teachers’ eye gaze. The researchers’ findings showed that expert teachers scanned the classroom and repeatedly returned to areas with student activity, while novice teachers focused on areas without student activity (e.g., walls) and repeatedly returned to areas unrelated to instruction (e.g., bright neon shoe laces). When observing classroom disruptions, novice teachers focused on the student causing the disruption, while experts observed the area surrounding the disruption and the effect it had on the other students. Novice teachers often ignored areas that experts spent time observing, possibly missing valuable information. These findings indicated that where teachers look and the aspects of the classroom they attend to vary by level of expertise.

In music, researchers have used eye tracking to evaluate sight-reading skills of beginning pianists (Penttinen & Huovinen, 2011), compare eye movements of skilled and less skilled piano players when playing four different melodies (Goolsby, 1994), and assessed expert and novice musicians’ eye movements when completing simple music reading tasks (Waters & Underwood,
1998) to survey eye movements and make comparisons about skill development. The area of music teacher education and the use of eye tracking has not received as much attention.

Even though eye tracking studies are limited in music education, especially concerning teachers, the role of eye gaze has not been completely ignored. Music educators have explored the role of teacher eye contact to effective instruction for years. For example, Fredrickson (1992) investigated eye contact between students and teachers and suggested that appropriate eye contact leads to better communication, higher student achievement, and more effective teaching. Whitaker (2011) discussed where directors look while conducting their top ensembles, noting that many of them spent most of their time looking down at their music and lacked appropriate eye contact with students. Kurkul (2007) cited eye contact when examining non-verbal teaching behaviors and suggested connections to teacher effectiveness. Yarbourgh and Price (1981) examined teachers’ behaviors to determine the effects teacher behavior had on student attentiveness. The researchers found that students’ level of on-task and off-task behaviors were related to the teachers’ level of eye contact. The more eye contact the teacher had with students, the more on-task the students were during instruction. Another study, by Orman (2016) examined music conductor eye contact and directional focus, and explored ways to initiate improvements. In this study, virtual reality conducting environments were used during score study practice sessions to help develop conductor eye contact and directional focus of novice teachers. The researcher found that all participants increased eye contact and directional focus from pretest to posttest and determined that the improvement was not related to the implementation of the virtual reality environments.

One study, recently shared at a national music education conference did investigate eye gaze during individualized instruction using eye tracking techniques to determine teachers’
focus. Duke and Marcum (2016) explored the eye gaze of a master violin teacher and skilled graduate student during one–on–one instruction of a familiar and novel violin student. Eye fixation data was collected to determine where the teacher was looking during instruction and compared with the teachers’ instructional goals. The researchers found that the eye fixations of the master teacher were related to the goals defined for the lesson when teaching both students, however, the eye fixations of the skilled graduate student were aligned to the lesson when viewing the familiar student, but were not always aligned when viewing the novel student. The researchers recognized relationships between music teachers’ eye gaze and expertise suggesting they are related. The findings of Duke and Marcum provide further evidence that eye gaze focus is an important component of situational awareness and that novice teachers could benefit from additional training in the area.

**Eye gaze modeling.** Traditionally, classroom teachers use modeling as a tool to demonstrate new ideas and concepts to students in an effort to promote learning (Worthy & Thompson, 2009) and researchers have recognized a need for increased modeling when learning new skills (Yarbrough, Wapnick, & Kelly, 1979), so it is not surprising that eye gaze modeling is an effective tool that may advance situational awareness for educators through the implementation of expert eye gaze modeling using eye tracking technology. Expert eye gaze modeling is a technique used to enhance learning by providing expert eye movement examples of specific tasks. Researchers have successfully used this technique as a training tool in the medical field to increase the skills of surgeons (Vine, Masters, McGrath, Bright, & Wilson, 2012), and recently it has been used in education as a tool for training students (Jarodzka et al., 2013; Mason, Pluchino, & Tornatora, 2016). For instance, biologists implemented eye gaze modeling to improve students’ recognition of fish locomotion patterns, showing significant
improvement in visual search strategies (Jarodzka et al., 2013); other researchers used eye gaze modeling with middle school students to promote better reading processing skills, resulting in deeper levels of comprehension (Mason et al., 2016). Both of these methods developed eye movement modeling examples (EMME) that used the eye gaze of a model expert to guide students to look in the appropriate area and resulted in increased skills. This method could provide a way to increase the teaching effectiveness of novice teachers in the area of situational awareness and help them learn to observe in a more expert-like way.

**Conclusion.** Considering other researchers’ eye gaze modeling outcomes for learning skills (Jarodzka et al., 2013; Mason et al., 2016; Wolff et al., 2016), it is reasonable to believe that eye tracking technology can be used to determine differences in teachers’ eye gaze at different levels of experience and expertise, and provide a method for developing situational awareness, thereby increasing teacher effectiveness for music teachers. Limited study using eye gaze tracking in music has focused on music reading (Goolsby, 1996; Penttinen & Huovinen, 2011), and one-on-one instruction (Duke & Marcum, 2016); however, researchers performing studies of teacher effectiveness in the large ensemble setting have not used eye gaze to discern where teachers look during instruction nor have they used guided eye gaze as a tool to improve teacher effectiveness (e.g. Price, 1992; Witt, 1986). Standley and Madsen (1991) identified differences between novice and expert music teachers when observing similar teaching situations that when combined with eye gaze techniques used by Tien et al. (2014) and Mason et al. (2016) to guide learning could result in an appropriate training tool to increase music teachers’ situational awareness.
Purpose

The purpose of this study was to examine and compare the eye gaze of novice and expert instrumental music teachers when observing videos of middle school band rehearsals and to develop and evaluate a possible method for increasing situational awareness through the use of expert guided eye gaze with think aloud commentary in an effort to facilitate novice teachers to view rehearsal situations more effectively in complex authentic learning environments.

Research Questions

1. How does the eye gaze focus of novice and expert instrumental music teachers compare when observing videos of middle school band rehearsals?
2. Can expert eye gaze replay be used as an effective training method for novice teachers in the area of situational awareness?
3. Does novice teachers’ eye gaze begin to look more similar to experts’ through repetition?
CHAPTER 2

REVIEW OF LITERATURE

In preparation for this study, the researcher examined select articles, dissertations, and books to understand the development, application, and research surrounding eye-tracking technologies. Of particular interest were those studies that applied eye tracking to the development of expertise. The researcher explored additional sources to understand recent arguments surrounding teacher preparation, characteristics, and opportunities for professional development.

Teacher Education Research

The decision to enter a career in music education is often based on a genuine love for music, desire to share music with others, or a new-found superiority as a musician (Hellman, 2008). These decisions are made while in secondary music programs and influenced by music educators (Madsen & Kelly, 2002), but are also impacted by music faculty and preservice teachers’ academic goals (Curtis, 2012), as higher education institutions develop programs to recruit the best musicians and educators, and strive to produce the most prepared teachers for society. To gain insight and a better understanding of the skills and techniques music educators are exposed to, those they exhibit, and those that require more attention, the current researcher explored research related to teacher preparation, teaching characteristics, professional development, experience, and evaluation techniques.

Teacher preparation. To ensure that curriculum offerings suit the needs of future music teachers, music education curriculum leaders gather information from influential leaders,
inservice teachers, and current students to help guide their decisions. Influential educators from years past provide insight about offerings and changes made (Claudsen, 1969; Schmidt, 1989), while practicing teachers provide information about the music education programs that prepared them (Bridges, 1993). Preservice teachers can also provide information about current programs and their direction. For example, Conway, Eros, Pellegrino, and West (2010) examined undergraduate music education instrumental majors’ descriptions of experiences within the instrumental education community through questionnaires, interviews, and documented interaction. The researchers found that students viewed themselves as different from other music students, had specific reasons for attending (e.g., to play better, to teach), and faced challenges (e.g., time management, high-performance standards). Evidence suggested that schools of music and departments have a great influence on music student identity; therefore, Conway et al. suggested music education professors and others work together to build a community that accepts and emphasizes all areas positively.

To ensure that preservice teachers receive the best training, Mishra, Day, Littles, and Vanderwalker (2011) examined courses to determine how offerings and content covered compared between different institutions. Schmidt (1989) examined undergraduate music education courses at four-year institutions and found consistency for classes developing teaching techniques (e.g., conducting), classroom techniques (e.g., classroom management), and student pedagogy (e.g., instrumental/vocal methods classes). Schmidt found that professors allotted time for curriculum content focused on choral and instrumental techniques, materials and methods, and curriculum, but found shortcomings in areas, such as special education and instrument repair. Other researchers have addressed shortcomings concerning at-risk students (Chipman, 2004), deaf students (Darrow, 1993) and even elementary and jazz music to determine if
Preservice teachers were learning techniques and applying them in the classroom as teachers (Battersby & Cave, 2014). This detailed attention to curriculum offerings helps ensure preservice teachers receive the best training and showed areas that need more attention.

Teacher education program leaders must find reliable ways to supplement course offerings for preservice teachers to gain hands-on experience. Abrahams (2011) argued that “education policy should support school-university partnerships that place preservice music teachers with college professors in a laboratory school environment” (p. 108). The investigator reasoned that for preservice teachers to be more prepared, comfortable, and better equipped to teach, experience in schools should occur early in the program through partnerships between schools and universities. These types of experiences supplement training by providing preservice teachers with a realistic environment for practicing their teaching skills.

Experience, preparation, and interpretation (Schmidt, 2010) are important to teacher development and expertise, however, cannot serve as the sole source of information. Even with the recognizable similarities between preservice and inservice teachers (Teachout, 1997), teachers themselves have a large degree of control regarding the outcome (Conway, 2012) as they tend to embrace their own experiences and resist change (Thompson, 2007), which causes variability in skill level and expertise. As such, researchers have investigated ways to overcome limited curriculum offerings, time restraints, and knowledge gained and have found connections across areas of learning (i.e., the ability to make a cognitive transfer) to be most beneficial, yet difficult (Madsden & Geringer, 1983) and should therefore be addressed more specifically when taught (Peterson & Madsen, 2010). Subject area knowledge is important for preservice teachers; however, the ability to transfer ideas from one area to another expands teachers’ ability to
connect to more students and enhances their ability to retain knowledge, skills that are important when considering teacher effectiveness.

**Teaching characteristics.** Teaching characteristics play an important role in teacher effectiveness and expertise. The skills teachers exhibit and the practices they use in teaching have a direct impact on the students they teach and provide additional information related to teaching expertise. To learn more about teaching characteristics contributing to expertise in music education, research in effectiveness, acquired skills, and teaching practices were investigated.

**Effectiveness.** To understand more about the development of effective teachers, researchers have turned to supervising teachers for discernment. Kelly (2010) examined specific skills and behaviors deemed important by public school supervising teachers in the development of effective music education teachers, identified differences between band/strings and choral/elementary music supervising teachers, and determined if supervising teachers create preconceptions of preservice teachers (p. 21). Kelly identified social traits including personality and beliefs as the highest ranked among those listed and found the same variables affected teaching when considering both preservice and experienced teachers. Environment, teaching responsibilities, student training, personal skills, values, mastery, and demonstration of subject matter surfaced as key factors. Identification of these skills and behaviors assist preservice and inservice teachers as they continue to become more effective teachers.

Previous findings have indicated that several factors, not always a part of instruction or classroom skills, denote effective teachers (i.e., interactions with administrators). For example, drawing from former music educators and current administrators, Hart (2003) proposed that one must “walk in stride” with an administrator, recommended that teachers put oneself in the
mindset of a non-music background administrator, and identified qualities not related to teaching that were needed to be successful. Hart suggested that music teachers must be politically astute and portray "soft skills"—character traits having nothing to do with musical talent and ability—including integrity, respect, and community skills. Hart further identified five successful traits as: (a) maintaining a positive attitude, (b) contributing to a climate that promotes an open sharing of ideas, (c) being willing to take on challenges outside of your comfort zone, (d) pursuing professional interests and (e) staying current in your field (p. 41). Additionally, Hart discussed the difficulty in learning how to build relationships and communicate, but stressed the importance of these skills for preservice and novice teachers to be effective.

Skills. Preservice and inservice music educators’ opinions of effective teaching have been gathered to examine the skills required to be an effective teacher. Miksza, Roeder, and Biggs (2010) examined middle and high school band directors' opinions of teaching skills, personal characteristics, and music skills important to teaching. These researchers identified the highest ranked music skills (e.g., display a high level of musicianship), the lowest ranked music skills (e.g., possess proficient piano skills), highest ranked teacher skills (e.g., ability to motivate students), the lowest teacher skills (frequent eye contact), the highest ranked personal skills (e.g., energetic), and the lowest ranked personal skills (e.g., manages stress well). When ranking the three broad categories, personal skills and teaching skills received a higher rank than musical skills. The researchers identified advice (e.g., mentor use), teacher struggles (e.g., classroom management), and rewards (e.g., student success) as effective teaching skills (Miksza et al., 2010, p. 377). Identification of these skills by music educators helps define skills useful to music educators considering effectiveness.
Recognizing preservice teachers’ expectations can provide valuable information about their development and define areas that need attention. Fredrickson and Pembrook (2002) examined preservice teachers’ journals of daily expectations, activity descriptions, and comments regarding their worst and best daily aspects to gain perception of their experiences while completing fieldwork in assigned junior high/middle schools. The researchers found that preservice teachers indicated the best aspects of fieldwork as job responsibilities, music experiences, and social interactions and the worse aspects as job responsibilities, poor music making, and improper social reactions; however, an increase occurred from expectation to evaluation. Fredrickson and Pembrook indicated that preservice teachers showed a concern with knowing what to do when initial pedagogy does not work. Recognition of these challenges can aid preservice teachers as they plan to student teach and help them to become more effective in-service teachers.

*Teaching behaviors.* Determining skills and behaviors used in everyday classroom situations can provide insight into the components required of effective teachers. Whitaker (2011) documented students’ and directors’ perceptions high school band directors’ teaching behaviors in authentic settings. Researchers showed that directors spent more time in academic presentation and giving reinforcement than direction, social, and off-task components (p. 290). When observing director nonverbal behaviors, speech varied, phrases were not repetitive, and patterns were steady for all directors when they spoke to the ensemble, yet directors looked down the majority of the time when speaking. Similarities appeared considering directors use of analogies (e.g., easy to understand), demonstrations, and facial expressions. Students indicated more disapproval than approval, but noted that it was necessary to be critiqued. During the interview portion, students’ and directors’ responses were similar, but directors tended to be
more critical. Differences were found when observing non-teaching behaviors; students gave higher ratings than directors. Whitaker concluded that based on the results of this study, student and director perceptions are situational and the director, students, and observer all play an important role.

Similarly, Worthy and Thompson (2009) explored beginning band rehearsals to identify effective strategies, procedures, and exercises (i.e., focus) used by expert teachers and found effective teachers successfully managed every aspect of the lesson, from the introduction of content to classroom management to rule enforcement. Teachers corrected specific playing techniques, focused on embouchure formation, controlled pacing to accommodate student fatigue, and addressed tone and pitch production throughout the lesson. They also provided varied examples and moved throughout the room during instruction. Recognition of effective classroom strategies can aid the development of these skills in more music educators.

Time use. How teachers use their time in the classroom can provide information about their teaching effectiveness. Goolsby (1996) examined sixty videotaped music rehearsals of pre-service, novice, and experienced teachers to evaluate time use in rehearsals. He found that preservice teachers typically spend more time talking than performing, novice teachers rehearse each piece throughout feeling the need to approach every teachable moment, and experienced teachers divided the rehearsal more evenly, allowed break time, and played straight through the final piece creating “fun time” and boosting confidence. Goolsby expressed differences in approaches between levels of teachers are not surprising, but suggested that young teachers could benefit from the rehearsal nature provided by experienced teachers.

Time use combined with students’ attention level is related to teachers’ effectiveness during classroom instruction. Witt (1986) evaluated instrumental music teachers’ time use and
student attentiveness in secondary band and orchestra rehearsals. Differences were shown regarding teaching episodes, playing episodes, and preparation time. Generally, Witt found that students were less attentive during orchestra rehearsals than band rehearsals and band directors provided more structure than orchestra directors.

**Modeling.** Effective teachers provide information and skills for their students that result in noticeable improvements. Sang (1987) examined if teachers of beginning band students' modeling (i.e., the teachers’ ability to demonstrate musical or music related behaviors in the classroom) had a direct effect on the students’ abilities. This author confirmed that teachers spent more time talking about music behaviors than modeling, and that implementation of more modeling increased student abilities. Sang recommended that even though modeling is not the only factor determining success, music educators should take great effort to model and encourage young teachers entering music education to spend time developing modeling skills.

Dickey (1991) compared the use of verbal instruction and modeling instruction during middle school band rehearsals to determine which teaching method was more effective considering ear–to–hand skills, kinesthetic response skills, and music discrimination skills. Four middle school band classes were instructed for ten weeks; two of the teachers primarily used modeling techniques and two of the teachers used verbal instruction only. Researchers administered a pretest and posttest and found that students receiving modeling instruction scored significantly higher than those students who received verbal instruction for ear–to–hand skills and kinesthetic response skills. There was not a difference between groups when comparing music discrimination skills. These findings suggest that distinct areas of learning can be enhanced by modeling instruction.
**Nonverbal Communication.** Communication is an important component of teaching and has been explored by researchers to determine the amount of communication that is the most effective in the classroom. Napoles (2016) found that when teacher talk was limited during instruction, students enjoyed the opportunity to sing more, observers enjoyed the faster pacing, and preservice teachers felt they organized their thoughts better. In another study, Napoles (2014) examined differences between verbal instructions and conducting gestures in eliciting desired articulations and syllabic/word stress from a chorus and to determine how experienced choral teachers perceived performances when cues were consistent and inconsistent. A choral graduate conducting student was recorded conducting four variations: (a) strict pattern, (b) strong downbeat and weaker second and third beat, (c) staccato three beat pattern, and (d) a legato three beat pattern of recorded music camp students (p. 11). Conducting evaluations were completed by experienced secondary choral teachers. Significant differences were identified for all four categories and indicated that students responded better to verbal instruction than gestures only, even when verbal instructions were inconsistent and gestures were not. Additionally, Napoles noted that students indicated they paid more attention when reading instruction than when hearing it.

Kurkul (2007) explored nonverbal communication in one-to-one music performance instruction investigating relationships among nonverbal sensitivity, nonverbal behaviors, and lesson effectiveness of students' college level private lessons (p. 327). Evaluators used The Music Lesson Evaluation Form (MLEF) adapted from the Applied Faculty Student Evaluation for Non-Music Majors (AFSESNM), which focuses on rapport, communication, pedagogical skill, instructional organization, flexibility, and general instruction competence (p. 334), adjusting it from its original form to fit a single lesson scenario instead of an overall experience.
Each teacher and student also completed the Profile of Nonverbal Sensitivity (PONS) to determine individual's ability to recognize and respond to nonverbal cues. The researcher found correlations between teachers, students, external judges, and the observer, and variations between non-verbal behaviors. When factoring in the PONS scores of teachers and students, the higher the teacher scored on the PONS the higher their lesson was rated by students for rapport, communication, pedagogical skill, general instructional competence and total scores (p. 327). Kurkul suggested that teachers’ and students’ evaluation of teacher effectiveness may vary, but that external judges may be a reliable source for evaluation.

Specific components of nonverbal communication have been explored to determine how they are related to teacher effectiveness. For example, Silvey (2013) examined the effect of conductors' facial expression (i.e., approving, disapproving, and neutral) on the ratings of ensemble expressivity of high school band students while observing videos of three conductors (p. 419). The researcher found facial expression influenced ensemble expressivity ratings, showing that expressivity ratings for approving facial expressions were significantly higher than those of non-approving and neutral (Silvey, 2013, p. 427). Furthermore, Silvey discovered that neutral facial expressions were rated lower than non-approving expressions indicating that any facial expression is better than none. He recognized facial expression as a teaching tool to contribute to teachers’ level of effectiveness.

In a review of literature, Fredrickson (1992) explored eye contact between the teacher and student arguing that eye contact is a component of good teaching. The author suggested that eye contact between the conductors and students could lead to better ensemble communication and portrayal of musical ideas, while increasing on-task student behavior and improving student achievement. Fredrickson also proposed that eye contact affects students’ perceptions about the
teacher and recommended that more research is needed to fully understand the impact of eye contact on teacher effectiveness.

To investigate ways of increasing teacher effectiveness considering eye contact and focus of attention, Orman (2016) examined the effect of virtual reality conducting practice with audio on eye contact, directional focus, and focus of attention of novice band conductors. Participants video recorded themselves conducting a live ensemble before and after completing the virtual reality portion of the study to access improvement. Virtual reality portion included audio recordings and still images of the ensemble that changed as the participant look around the ensemble, simulating the typical rehearsal setting. The researcher found that virtual reality techniques can be used to create more life-like situations and determined that using audio while completing score study may increase conductors’ eye contact; however, the use of virtual reality did not result in eye contact improvements for novice teachers.

**Teaching practices.** Teachers’ skills are essential components of expertise; however, the process of transferring learned knowledge from teacher to student is vital and could provide more information about teacher expertise, the process, and timeline. Evaluation of research in this area provides additional knowledge related to the qualities of effective teachers and lends more evidence to the path required to reach expertise.

Comparisons of teachers’ career levels provide information about the similarities and differences at various stages of teaching. In a case study, Pike (2014) identified traits of novice and experienced group piano teachers to identify similarities and differences using teacher questionnaires, weekly lesson plans, and interviews. The researcher found similarities and differences between instruction given by the expert and novice teacher related to classroom teaching skills, student/teacher focus, and activities affecting student retention and performance.
success. Pike concluded that for success, group piano teachers should set and articulate expectations for students, advise parents and students for outside practice, and assess students during class time.

Teacher delivery plays a large role as students are perceptive to differences and quality of instruction. Madsen (2003) examined the effect of teacher instruction (accuracy and delivery) and student attentiveness on evaluative perceptions of middle school, high school, undergraduate music majors, and experienced classroom teachers when evaluating videotaped lessons for teacher effectiveness. The researcher found a significant difference due to experience level, teaching segments, and written categories. Additional results showed all age levels were highly critical of lesson delivery, but indicated teachers' instruction delivery (i.e., high or low intensity) and student off-task behaviors influenced the responses of high middle and high school students. Madsen also found lesson content, accuracy, and on-task behaviors were not significant factors.

Napoles and MacLeod (2013) examined teacher delivery (i.e., teacher intensity) and student progress to determine influence on preservice teachers' perceptions of teaching effectiveness when observing digitally recorded private-lessons. Researchers found high delivery was preferred even when student progress was low, more student progress was rated higher than lower progress, and delivery and progress seem to be connected.

Specific teaching techniques contribute to teacher effectiveness and expertise. Price (1989) explored the teaching unit process and discussed substantial research that indicated a need and importance for teaching cycles to assist with structure and time use in music education. Price recognized and explored the mastery, effectiveness, and implementation of the concept giving suggestions and guidance. Price expressed the use of teaching cycles creates a better classroom environment with more effective use of time, better results, and proper participation.
Furthermore, Price (1992) addressed this three-step pattern of teaching, evaluated music education students’ implementation of the technique, and determined the effects of exposure to instruction, teaching practica, instructor feedback, and videotaped self-observations. The researcher found that all results increased after review, yet evidence did not indicate students learned to independently use sequential patterns to teach. Price indicated that students could apply sequential patterns to new works when asked to do so, but the study did not access if they could apply the technique to all areas of teaching.

*Observation techniques.* Evaluation in new areas can be difficult as possible techniques are explored and utilized. One of the most developed and implemented evaluation techniques in music education is observation and includes written, verbal, and recorded responses. In fact, preservice teachers are trained in observation techniques to recognize, correct, and develop skills for observing and learning from inservice teachers (Madsen & Madsen, 2015).

These techniques provide information to assist teachers in the classroom with student involvement, lesson development, and teacher effectiveness and are implemented using various methods. For example, Forsythe (1977) used observation forms and an interval viewing technique to determine if student participation (i.e., on-task, off-task) was related to the class activity presented by the teacher. Eleven elementary music teachers conducted observations over the course of one academic year to determine student on-task and off-task behavior during various activities. A factor analysis showed that students were less off-task during activities that required full participation (e.g., singing, playing and instrument) and more off-task when verbal interaction was occurring between the teacher and student. Forsythe suggested that this information could help teachers as they prepare for lessons and indicates that they need to
provide additional teacher approval to facilitate student engagement in low engaging activities (p. 239)

Similarly, Madsen and Geringer (1983) used observation forms to determine on-task and off-task student behavior of university students during music classes. The researchers observed students during music history, music theory, music education, music therapy, and choral and instrumental ensembles, while participating in lectures, discussions, performances, listening activities, music dictation, and preparation activities. The researchers found significant differences for the type of class and the type of activity performed; students were more off-task when participating in activities requiring verbal interaction and were more on-task when participating in activities that required active performance.

Beyond the classroom setting, observation has been used as a tool to explore behaviors during more individualized teaching events, such as, applied instruction. Duke (1987) compared observations of trained musicians and non-musicians when asked to observe academic and social behaviors of one-on-one applied music instruction through observation of video recorded teaching sessions. Duke discovered variations in responses from both groups when observing teacher and student talk, but no differences when observing performances; both groups overestimated disapproval amounts. General results indicated a need for more training and techniques for providing feedback.

As technology advanced, observation techniques expanded to include the use of video recording technology to explore and provide more answers related to instruction and teacher effectiveness. This method was used in the form of video self-assessment (Arnold, 1991; Price, 1992), recorded video observation of teachers (Colprit, 2000; Duke, 1999), and as an observation training tool in the classroom for training teachers (Sherin & van Es, 2005). Responses during
these observation tasks included written, verbal, and recorded responses and was used to provide feedback for teachers to increase skills and effectiveness (Fukkink, Trienekens, & Kramer, 2011). These techniques have helped music educators better understand their own concerns and characteristics, focus on specific aspects of instruction, and enhance their effectiveness. For example, Powell (2016) had instrumental methods students observe videos of teaching episodes and complete written free response reflections before and after watching their teaching videos. As participants completed the task their reflections after watching the video were much more detailed, specific, and critical than those reflections completed before observing the video. Participants increased their awareness and self-examination, which could lead to more effective teaching.

Yarbrough et al. (1979) compared the effect of two videotape feedback techniques, reviewing video recordings with an instructor and reviewing video recordings alone using timed intervals, to record observations and improve beginning conductors’ skills (p. 103). The researchers indicated that verbal content was the only area of significant difference. Body movement and facial expression were mentioned more by the observation group than by the instructor group, and the group receiving teacher interaction made more statements related to eye contact, mannerisms, technique, and the instructor. The researchers suggested that students in advanced and lower level conducting classes would benefit from more modeling.

Researchers have used video observation techniques combined with written evaluations when observing undergraduate instrumental music teachers. Montemayor and Moss (2009) investigated the effects of aural model supported rehearsal preparation on behavioral and evaluative elements of novice teachers' rehearsals. Video observations and completed self- and ensemble-evaluations showed listening to a recorded model had no effect on verbalizations, but
conductors did focus on the ensemble more than themselves. Positive feedback occurred more frequently than negative feedback, and dynamics were mentioned often. The researchers suggested that listening to models may affect teachers’ rehearsals, but cannot serve as the sole means of preparation.

Some researchers have combined several techniques to collect observation data. For instance, Worthy and Thompson (2009) included onsite observation, conversations with participants and researchers, and recordings of classroom management, instructional material, and activities to examine common characteristics of expert beginning band teachers and their classrooms. Researchers showed that expert teachers were proactive in classroom management, prioritized fundamental concepts to be taught, and provided a model when giving instruction, which occurred more often in the beginning band setting than in previous studies in the middle and high school band setting.

Instead of collecting data, some researchers have employed observation as a learning tool for teachers. For example, Napoles and Vazquez-Ramos (2013) used recorded videos to reduce teacher talk time by having teachers document and compare their talk time during rehearsal. Participants estimated their talk time immediately after they taught a lesson, then observed a video of themselves teaching the lesson using stopwatches to calculate actual talk time. Participants then conducted a second rehearsal to evaluate if talk time was altered through the process. The researchers found that significant differences occurred between the first and second teaching sessions, and that the process made participants more aware of the time they spent talking while teaching.

Observation techniques have been used to study various characteristics, skills, and components of teacher effectiveness and have shown to have a positive impact considering the
preparation of teachers. Snoeyink (2010) investigated the use of video observation to determine if preservice teachers’ perceptions while teaching were the same as when viewing a video of the lesson. Recordings of the lesson were captured from the front of the classroom focused on the students and from the back of the classroom focused on the teacher. The author found disagreement between how the preservice teachers thought the lesson went prior to and after reviewing the video recording. Participants indicated that when watching the video, they observed discipline and instruction concerns not previously observed and noted an increased sense of skill after completing the task. Snoeyink documented that the process resulted in teachers moving around the room more than before and developed a system of noticing in their reflection that involved recognizing an issue, reflecting, and responding; techniques he defines as teacher with-it-ness. Snoeyink suggested that all preservice teachers could benefit and improve perception from time spent evaluating videos of themselves in classroom situations. Perspective as it pertains to teaching is important as preservice teachers work to develop the skills needed to perform more expert-like during classroom situations, therefore, attention to training in this area can be beneficial and contribute to expertise.

**Professional development.** Advancements in teaching practices and examination of good teaching (Schmidt, 1998) leave teachers looking for alternative methods, new techniques, and advanced skills to enhance their classroom teaching and improve effectiveness needed to increase expertise (Bowles, 2003). These needs are supplemented by the desire to improve as an educator, meet students’ needs, and provide the best experiences. Additionally, teacher shortages and budgetary concerns often place teachers in new positions (i.e., band director teaching choir) for which they have had little training or experience, resulting in a search for new teaching practices that can be found through professional development opportunities.
Teachers are exposed to valuable techniques and resources while completing their degree programs and early teaching experiences, nevertheless, preservice and inservice teachers turn to professional development opportunities to supplement their training, aid in the development of new skills, and maintain licensure (Conway, 2008; Conway, Hibbard, Albert, & Hourigan, 2005). Conference sessions, short courses, workshops, graduate study, networks and institutions, and long-term site based projects have all been recognized as types of effective professional development (Barrett, 2006). Other researchers have explored the use of music discussion forums (Bauer & Moehle, 2008), music performance opportunities (Burkett, 2011; Pellegrino, 2011), week-long technology workshops (Bauer, Reese, & McAllister, 2003) and mentoring (Conway & Holcombe, 2008) and found that they too are beneficial to music educators seeking to learn new skills. These opportunities provide exposure to new techniques, exploration of new areas, and refreshment of learned skills that enhance teachers’ skill sets as they continue a path to expertise.

Inservice teachers have stated a preference for learning from colleagues (Bush, 2007) at professional development events (i.e., conferences). It is not surprising that teachers value learning from experts in their field, some whom are currently in the classroom, but Standley (2011) suggested that an expert teacher can learn just as much from the novice teacher about new ideas as the novice can learn from the expert about traditional and proven ideas. To gain professional development, conferences may be preferred because even well-intended professional development options are not always applicable, and although beneficial, relationships with mentors and colleagues are difficult to maintain, which can hinder learning (Delorenzo, 1992).
National and state music education conferences offer a variety of professional
development topics (Price & Orman, 1999; Todd & Hancock, 2015) for teachers to expand and
renew their skill sets. Teachers have identified topics of interest as; technology, assessment,
literature, standards, and grant writing (Bauer & Moehle, 2008). In addition, conference sessions
have proven to boost teachers’ confidence (Burkett, 2011) and contribute to teacher growth even
when teachers already exhibit confidence in the area (Hammel & Gerrity, 2012), and have been
especially helpful to teachers who are new to the profession (Conway & Christensen, 2006),
fulfilling the professional development need of music educators beyond formal training
(Kimpton, 2005). Similarly, VanWelden and Whipple (2014) recognized that conference
sessions are beneficial for teachers to feel more comfortable in specific areas (i.e., special
education) even if they already possess skills in the area.

Over time, music teachers gain knowledge, learn skills, and feel more confident in their
abilities, yet differences in teaching effectiveness exist. This has been attributed to early career
teacher identity changes (Russell, 2012) and individual teachers’ needs (Eros, 2011; 2013). Eros
(2013) recognized this as a career cycle, where new skills—such as those gained through
professional development—are needed to aid teachers as they progress through various levels of
their teaching careers. However, even when professional development is provided with the intent
to expand or provide additional skills, some areas are addressed more than others (Todd &
Hancock, 2015).

**Teaching Expertise**

Teaching expertise has been the focus of numerous research studies. In general,
researchers have examined the classification of teachers into discrete developmental levels based
on their skill level (Dreyfus & Dreyfus, 1986), identification of expert teachers by teacher-
education researchers (Palmer, Stough, Budenski, & Gonzales, 2005), comparisons of teachers’ classroom instruction and methods (Bergee, 2005; Goolsby, 1996), opinions of desirable teacher characteristics (Teachout, 1997), and improving the conceptual definition of expertise by separating two highly correlated ideas—experience and expertise (Berliner, 2004; Standley & Madsen, 1991).

Berliner (2004) studied the nature of teaching expertise and supported a developmental model traversing three to seven years and passing through five stages: novice, advanced beginner, competent, and proficient. Accrued years of teaching experience was central to the model as teachers needed time to develop an understanding of domain specific content, realize multiple strategies for content delivery, and acquire an intuitive understanding of students. This general understanding of teaching expertise—it requires time to develop—is prevalent throughout the literature on expert teachers.

In another study supporting experience as a key component to expertise, Dreyfus and Dreyfus (1986) describes five stages of teacher expertise ranging from novice, advanced beginner, competent, proficient, and expert, with the extreme stages characterized by basic content knowledge (novice) to unconscious decision making (expert). The journey through the five stages is expected to take 5 to 7 years as teachers move from basic content knowledge (novice) to unconscious decision making (expert). Teachers reach the expert stage when they make connections with prior events and recognize correlations between their instruction and student behavior; experts generally move fluidly through a lesson without thinking about individual aspects of their instruction, unlike novices. This model, like Berliner’s (2004), seems to provide a reasonable gauge to measure teacher progress toward expertise; however, levels of expertise and years of experience, as noted by the time to reach expert status, were not
considered independent constructs, which inadvertently may reinforce the notion that teaching expertise is equated to years of teaching experience and vice versa.

Two studies examined teaching expertise by analyzing the actual behaviors of teachers in their classrooms and constructed clear differences between levels of expertise and experience, but the two concepts remained entangled. Goolsby (1996) observed and recorded music educators’ time use, verbal instruction, and rehearsal techniques to discern how these practices differed between groups with varying degrees of training and experience. Goolsby found that preservice teachers spent more time talking than rehearsing, novice teachers attempted to address a multitude of topics when rehearsing, and experienced teachers prioritized their time by rehearsing, creating breaks, and developing “fun time.” Bergee (2005) observed the rehearsals and conducting behaviors of expert, intermediate, and novice teachers while participants used a concurrent think-aloud process to verbalize their thoughts and priorities when teaching. Results indicated that expert teachers focused on deep musical concepts such as balance and blend, novice teachers focused on surface concepts such as dynamics, and intermediate teachers had difficulty completing the think-aloud process while conducting. Neither Goolsby (1996) nor Bergee (2005) considered expertise and experience as separate constructs when grouping participants, which makes it difficult to know whether simply having the opportunity to practice skills over time leads to teaching expertise or whether there are other phenomena at work.

The differences between less and more experienced teachers has also been examined through teachers’ opinions about expertise. For example, Teachout (1997) collected opinions of preservice and inservice teachers considering the importance of 40 teacher skills and behaviors. Results showed that both groups held similar views of effective teaching with personal skills being perceived as more important than teaching and music skills. However, ranking of skills
between preservice and inservice teachers were significantly different: “(a) Be enthusiastic, energetic; (b) Maximize time on task; (c) Maintain student behavior; (d) Be patient; (e) Be creative, imaginative, and spontaneous; and (f) Display a high level of musicianship” (Teachout, 1997, p. 49). Teachout attributed these differences to the years of classroom experience held by inservice teachers, which preservice teachers did not possess, and emphasized that the daily opportunity to apply techniques, test their efficacy, and sharpen teaching skills.

The importance of acquired experience to the development and attainment of expertise has been the subject of public discourse since Gladwell (2008) popularized the notion that 10,000 hours or 10 years of steadfast practice was needed to develop expertise. Gladwell argued that experts were generally recognized for the skills they develop later in their careers and not for their earlier works as it was difficult to acquire the prerequisite practice time at a young age. As such, most experts were “late bloomers.” Based on this line of thinking, one could intuitively surmise that as teachers spend more time in the classroom they should demonstrate increased instructional expertise.

In contrast, Standley and Madsen (1991) treated expertise and experience as separate constructs. Music educators and music therapists with varying levels of expertise and experience (i.e., freshmen, juniors, novices, experienced teachers, and experts) observed 20 1-minute video excerpts from a variety of musical situations and simultaneously observed, analyzed, and wrote about their observations. Written responses were analyzed to determine whether the content was factual, stating exactly what they observed (e.g., high school choir), or inferential, using what they observed to infer about an unknown aspect of the musical situation (e.g., statement that students were watching the conductor based on them staying together, yet the director was not seen). Accurate inferential observations were considered desirable because they portrayed an
advanced level of thinking and understanding by demonstrating a connection between their observations and prior knowledge, while accurate factual comments were less desirable because they involved simply stating what was seen. University faculty rated the responses, points were awarded for each type of response, and statistical comparisons were made between groups. Results indicated that observation expertise was present despite a participant’s years of experience and a clear relationship between years of teaching experience and expertise was not present—at least when participants observed the selected musical situations.

Palmer et al. (2005) examined the criteria used by researchers to identify participants for research studies about expert teachers and discovered inconsistent selection practices across studies, even when considering the same field, topic, and theoretical construct. Generally, expert teachers were identified using varying combinations of years of experience, professional membership status, peer recognition, and teaching performance. Palmer et al. concluded that expert teachers possessed:

1. Three to 5 years of teaching experience;
2. Teacher certification in a relevant area;
3. Degrees in primary or related area;
4. Recognition from peers as an exemplary teacher;
5. Recognition from administrators as an exemplary teacher;
6. Recognition from teacher educators as an exemplary teacher;
7. Documented evidence of student learning and advancement.

The paper recommended researchers use these attributes as a standard for identifying expert teachers in their studies.
Situational awareness. The differences between preservice and expert teacher effectiveness could be less related to instruction or skills and more related to interpretation of classroom events. This could account for areas of need, such as, classroom management, which requires a teacher to possess the ability to respond to and make immediate decisions about classroom events (e.g., student behavior, student performance). Saus et al. (2006) described this as situational awareness—a cognitive process that involves perceiving and comprehending critical elements of information during a specific task, then formulating immediate decisions. As such, situational awareness could be a significant component of effective teaching that does not receive appropriate attention.

When considering situational awareness as a major factor of teaching effectiveness, determining the difference between experts’ and non-experts’ situational awareness is needed. Situational awareness was found to be more evident when observing experts and it has been stated that they seem to see and remember more because of their superior knowledge and the ability to chunk information, which “leverages natural constraints within the ecology [i.e., the classroom] to reduce uncertainty” (Bennett & Flach, 2011, p. 453). In other words, experts connect the information they know with their observations, allowing them to think more productively than novices. More information about why this is the case could prove valuable.

Considering individual teachers and skills related to situational awareness, focus of attention could contribute to differences portrayed between experts and non-experts. Duke, Cash, and Allen (2011) explored the effect of performers’ focus while performing short passages of a keyboard excerpt and found that performance was affected by area of focus; the more distal the focus, the better quality and more accurate the performance. If this is the case, determining
where expert teachers look and their focus could be used to help guide novice teachers to focus in a more effective manner, increasing teacher effectiveness.

Technological advancements provide additional avenues for exploring differences in teacher effectiveness considering situational awareness. Stürmer, Seidel, Müller, Häusler, and Cortina (2017) recorded videos of classroom instruction and used a mobile eye tracking device to collect fixation frequency and fixation duration eye data for preservice teachers to make comparisons with experts based on previous research. The researchers found that focus of attention for preservice and expert teachers differed during instruction. Preservice teachers focused on only a few students during the length of the lesson, while experts looked around the room focusing on the entire classroom. Determining teacher focus during instruction could lead to valuable information concerning teacher effectiveness.

**History of Eye Tracking**

The earliest known eye tracking study was published by Delabarre (1898), a psychology professor at Brown University, to investigate methods of recording eye movements. This investigation led to the development of a primitive recording device using a plaster mold of a participant’s eye. The mold was physically placed on the cornea of the eye and attached to a lever and stylus by a thread. As eye movement occurred, the lever guided the stylus to draw a graph representation of eye data. This method had mechanical limitations, recording inaccuracies, and uncomfortable side effects requiring at least one week of recovery time. Furthermore, Dalabarre could not assure participants’ eye safety.

Modern day eye-tracking involves the use of a device that omits infrared light from a source that reflects on the cornea of the eye to collect eye movements. The device is typically affixed to the participants’ head, attached to a computer screen, or embedded into a pair of eye
glasses. Eye movement data is collected, transmitted to a computer equipped with eye tracking software, and analyzed to disclose information about eye gaze location, eye movement speed, and eye gaze duration (Holmqvist et al., 2011).

Cooke (2005) classified the systems used to collect eye tracking data as head-mounted systems, those worn by the participant, and remote systems, those with a light source below a computer screen requiring the participants’ heads to remain stationary. Cooke suggested that equipment preferred was dependent on the type of study conducted and the task participants were asked to complete. Head-mounted systems allowed for more movement than stationary options, but were not required for most on screen video tasks. Stationary options were used for situations involving visual search tasks such as examining a participants’ reading patterns or website viewing tendencies, and head mounted systems were used for movement related tasks such as driving a car or flying a plane.

**Eye Tracking Research**

Eye tracking research includes literature surveys that provided information about the widespread uses of eye tracking in a multitude of fields (Duchowski, 2002; Lai et al., 2013; Tien et al., 2014), descriptive studies that explored eye tracking research (Afonso, Garganta, McRobert, Williams, & Mesquita, 2012; Manske & Schier, 2015; Marquard et al., 2011; Sarter, Mumaw, & Wickens, 2007; Tien et al., 2015) and student performance (Rayner, Smith, Malcolm, & Henderson, 2009; Slykhuis et al., 2005; Susac et al., 2014), studies that differentiate expertise in education (Wolff et al., 2016), and studies that exhibit the uses of eye tracking for advancement (Jarodzka et al., 2013; O’Meara et al., 2015, Vine et al., 2012). These researchers discovered a great deal about the decisions researchers make when designing and implementing research studies that use eye tracking techniques.
Uses for eye tracking. Content analysis of recent research explored the use of eye tracking techniques in social science (Lai et al., 2013); neuroscience, psychology, and computer science (Duschowski, 2002); and medicine (Tien et al., 2014) to understand the use of eye tracking across fields of study. Lai et al. (2013) examined studies listed in the Social Sciences Citation Index database from 2001-2012 to determine uses of eye tracking techniques used in current research. Seven themes emerged: (a) patterns of information processing, (b) effects of instructional design, (c) reexamination of existing theories, (d) individual differences, (e) effects of learning strategies, (f) patterns of decision making, and (g) conceptual development (p. 95). Lai et al. determined that measurement choice was based on the type of study and recognized that options for implementing eye tracking technology were continuously increasing.

Duchowski (2002) surveyed eye tracking studies in neuroscience, psychology, and computer science and found that eye trackers have been used mostly for diagnostic purposes and for information processing tasks such as reading and scene perception (Henderson & Hollingsworth, 1998). Eye trackers were generally applied as an input device, using eye gaze in the same way that one uses a mouse for a computer (i.e., selective contingent) or to present information in real-time perception as would be seen in an authentic situation (i.e., gaze contingent). Selective contingent tasks required participants to look at a specific area before they could move on to the next step of a process, serving as a type of check box. Gaze contingent tasks collected eye gaze data to determine specific areas that were observed by a participant with no specific target area. Duchowski found that psychology based studies involving reading experiments were the most prominent among published studies.

Tien et al. (2014) surveyed medical studies that used eye tracking technology to determine possibilities for training medical personnel. The authors identified 24 studies. Sixteen
of the studies used eye tracking as an assessment tool while eight of the studies used eye tracking as a training tool. Based on their analysis, the authors concluded that eye tracking is a reliable quantitative data assessment tool that could be used to provide valuable insights into the training and assessment of surgeons’ skills.

**Implementation of eye tracking.** The use of eye tracking provides important information about where people look during specific tasks and can help establish a deeper understanding about the process used when making decisions. Recent researchers have explored visual attention when using simulations of situations (Manske & Schier, 2015), differentiated levels of expertise based on eye patterns during administrative medical procedures (Marquard et al., 2011), and identified and compared eye gaze behavior during fine motor tasks (Tien et al., 2015). In order to understand the interpretations made by participants, however, additional information is needed.

Manske and Schier (2015) examined airport tower traffic controllers’ visual patterns under simulations of typical working conditions to determine their visual attention during landing and take-off procedures; they identified differences related to task complexity (e.g., radars, runway, weather display). Eye gaze data showed that participants’ eye gaze focus was similar when observing complex and simple situations during arrivals and departures, and confirmed that air traffic controllers were attending to the appropriate areas during takeoff and landing procedures. The researchers suggested that this information could serve as a model of air traffic controllers’ eye gaze patterns and assist air them to increase effectiveness.

Marquard et al. (2011) compared eye patterns of nurses when giving medication and performing other administrative tasks to differentiate levels of expertise and experience. The researcher observed nurses’ behaviors and scan patterns to determine how they verified patients’
identity and completed routine tasks. They found that nurses who identified errors completed more steps, scanned more areas, and remained on task more so than nurses who made patient identification errors. Eye fixations showed that nurses identifying errors spent more time fixating on the patients’ chart and maintained a consistent sequence of events throughout the process. Identification of these differences can help training programs recognize and design tools to improve nurses’ administrative processes.

Tien et al. (2015) used eye tracking glasses to record junior and expert surgeons’ eye gaze behavior during open inguinal hernia repair operations. The researchers calculated fixation frequency, dwell time, pupil size, pupil rate of change, and pupil entropy, and measured workload using the Nasa Aeronautics and Space Administration Task Load Index (NASA TLX). The researchers found that expert surgeons had more fixations, longer dwell times, and lower cognitive demands when compared with junior surgeons. In general, they concluded that the eye gaze differences between expert and junior surgeons could be used to assess surgical skill.

Eye tracking gathers important information about where people look and provides a way to connect visual and verbal content. As such, eye tracking techniques are often combined with other data collection techniques to provide a deeper understanding. Afonso et al. (2012) combined eye tracking data with verbal think-aloud reports to examine situational awareness between skilled and highly skilled athletes while playing volleyball. Twenty-seven volleyball players wore eye tracking glasses while participating in a volleyball practice, leaving the court between sessions to provide retrospective think aloud comments. Results indicated that “players with a higher skill level spent more time fixating on [the] functional spaces between two areas” (Afonso et al., 2012, p. 343) and observed a larger number of locations, while lower skill level players focused on the ball and specific players. A secondary result suggested a link between
participants’ visual search behaviors and the sophistication of their knowledge base as portrayed in their verbal reports, suggesting that eye tracking data can be used as a measure of procedural knowledge.

Sarter et al. (2007) examined the monitoring strategies of 20 airline pilots when observing highly automated commercial flight decks during a flight simulation task, while collecting pilots’ cognitive and eye gaze behaviors. Pilots responded to questions after the simulation task to demonstrate an understanding of the task itself. Eye tracking data showed that when in automatic mode, pilots focused on basic flight parameters, ignored aspects of the flight deck, and did not make connections between flight deck changes and aircraft behavior. The researchers suggested this task was a good source of information for identifying pilots’ shortcomings and can be used when developing effective training systems.

**Eye tracking in education.** In education, researchers have used eye tracking primarily to evaluate, understand, and improve student performance. Researchers have experimented with eye tracking technologies to understand how students’ focus their attention when viewing teacher presentations (Slykhuis et al., 2005), to understand how students prioritize their time when problem solving in math (Susac et al., 2014), and to investigate cognitive processes when completing visual search tasks when reading.

Slykhuis et al. (2005) examined students’ engagement during a PowerPoint presentation in traditional and video based classes to determine students’ areas of attention during instruction. After tracking the students’ eye movements over time, the researchers compared the amount of time students spent examining each PowerPoint slide and the time students focused on specific areas of the slides. Results indicated that complementary pictures directly related to the information presented received more attention from students than decorative pictures that did not
pertain to the topic; narration had little effect on the time spent viewing both types of pictures. These researchers concluded that students discriminate between relevant and less relevant information during instruction, and recognized that time spent attending to areas of the PowerPoint slides served as a viable method to determine students’ abilities to discern information required for learning.

Susac et al. (2014) examined students’ problem solving skills when rearranging simple algebraic equations to explore how students prioritized different components of the equations. The researchers recorded students’ eye gaze fixations and verbal reports to understand student improvement over the course of the task. Eye fixations indicated exactly where students were looking, which Susac et al. used to evaluate if their strategies were effective. The researchers concluded that students who knew where to look had more effective problem solving strategies and determined that when studying cognitive processes, eye gaze data were more reliable than verbal reports. This information could be used to explore problem difficulty, student expertise, and metacognitive processes (Susac et al., 2014, p. 576).

Rayner et al. (2009) compared reading studies and studies investigating cognitive processes focusing on perceptual span, preview benefit, eye movement control, and eye movement models. Rayner et al. found that studies in reading used more advanced techniques, had task dependent fixations, and included smaller perpetual spans. When viewing larger areas like those in scene perception, saccades were higher because more information was processed during each fixation, and complexity of the task influenced the number and length of saccades and fixations. Rayner et al. pointed out that visual search studies have advanced rapidly, developing more cognitive studies, and suggested that techniques used in reading could successfully be used in other areas of study.
**Eye tracking in music education.** In music, eye tracking research is more limited, but has focused on sight-reading skills of piano players of differing levels (Goolsby, 1994; Penttinen & Huovinen, 2011) and when completing basic music reading tasks (Waters & Underwood, 1998).

Waters and Underwood (1998) compared the eye movements of expert and novice musicians while completing simple music reading tasks, determining if they were the same or different. Results showed that expert musicians completed the task more accurately, had more fixations, and spent less time viewing the first stimulus than novices. Similarly, Goolsby (1994) examined the eye movements of skilled and less-skilled piano players to explore eye movements over three practice periods using four different melodies. Eye movements were similar across all three practice periods, but differences occurred when complex notation appeared in the music selections. Goolsby also found that over the three practice periods, eye fixations decreased but were longer in duration. Findings suggested that skilled performers look ahead when sight reading and glance back when performing (Goolsby, 1994, p. 77).

Penttinen and Huovinen (2011) evaluated eye movements of beginning piano players while sight-reading at different levels of skill development. A group of amateur piano players served as a comparison group. Beginning adult pianists, all elementary music education majors, participated in 9 months of piano class instruction and completed three evaluations at the beginning, middle, and end of instruction period to illustrate progress. The researchers found that over time, fixation counts of beginning pianists became more similar to those of the comparison group, and participation highlighted visual processing information that could assist with understanding issues novice sight-readers encounter, leading to developments in pedagogy.
Eye tracking in teacher education. The success of eye tracking studies in education has provided teachers with insight into student learning, however, research in teacher education is just beginning as researchers explore teachers’ behaviors and interactions during classroom situations. For example, Wolff et al. (2016) explored differences and similarities between expert and novice teachers’ focus of attention by comparing where, when, and how long teachers looked at different activities and objects when viewing classroom environments. Results indicated that expert teachers spent more time monitoring various areas of the classroom and novice teachers focused on areas with little or no activity. Differences in scanning patterns were also evident. Expert teachers scanned the classroom focusing on areas with student activity, while novice teachers scanned the room and focused on areas with image attractors (i.e., neon shoe laces). When considering disruptive student behaviors, novice teachers focused on the student who instigated the disruption while expert teachers examined the area around the student.

Wolff et al. (2016) proposed that differences found in classroom awareness and eye gaze focus between novice and expert teachers explain why expert teachers interpret classroom situations differently than novice teachers. These researchers speculated that variances in viewing patterns were attributed to the way expert teachers recognize causal relationships between student behavior and classroom events and use prior knowledge and experience to interpret their observations. In essence, findings of this study indicated that novice teachers overlook important aspects of the classroom that expert teachers observe; conversely, expert teachers spent less time viewing certain areas, indicating presence of a visual information hierarchy that novice teachers could benefit from developing.

In music education, one study used eye tracking to examine teachers’ eye gaze focus during individualized instruction of string students and similar to other areas found differences
related to level of expertise (Duke and Marcum, 2016) The researchers investigated the eye gaze of a master violin teacher and skilled graduate student during one–on–one instruction of a familiar and novel violin student. Duke and Marcum found that the eye fixations of the master teacher were related to the goals defined for the lesson when teaching both students, however, the eye fixations of the skilled graduate student were aligned to the lesson when viewing the familiar student, but were not always aligned when viewing the novel student. The researchers recognized relationships between eye gaze and expertise of music teachers that further suggest that exploration of eye gaze could provide valuable information about music teacher expertise.

Differences between the eye gaze of expert and novice teachers when observing the classroom (Wolff et al., 2016) and during individualize instruction (Duke & Marcum, 2016) lend evidence to suggest that training programs designed to develop teachers’ eye gaze are needed. This has been accomplished in other areas using eye tracking technology and could also provide a way to help music teachers respond to complex rehearsal situations in a more expert-like manner.

**Eye tracking as a training tool.** Eye tracking has provided a way to evaluate student growth and expertise by offering a method for determining eye gaze in a way that reduces subjectivity. This process relies less on the participant to determine where they are looking and more on collected eye gaze data. As such, eye tracking technology has been used to train novices in various fields by using expert eye gaze replay to create training videos. These videos have relied heavily on eye gaze replay (Mason et al., 2016; Vine et al., 2012) and have been paired with expert commentary (Jarodzka et al., 2013) and post-video expert consultations (O’Meara et al., 2015).
O’Meara et al. (2015) used eye tracking technology and video debriefing to improve the situational awareness of nursing and paramedic students. Students observed a series of simulated medical situations while the researchers tracked their eye gaze. Afterwards, the students viewed the video replay with their eye gaze superimposed over the video and discussed the process with an expert. Participants shared that reviewing the eye gaze video replay facilitated corrections required for their future decisions and results showed that participants’ situational awareness when working with patients increased.

Vine et al. (2012) used eye gaze to improve the performance of novice laparoscopic surgeons, providing little instruction or verbal guidance. Surgeons completed gaze-training where eye movements were guided by highlighted areas during a laparoscopic procedure. The researchers found that this guiding technique was successful and more expert-like gaze strategies were evident from novices after participation. In addition, the method was cost effective and provided performance advantages for participants.

Improving eye gaze has been explored, but has focused on improving student’s eye gaze and not teacher’s eye gaze. Jarodzka et al. (2013) coupled verbal explanations of an expert marine biologist with eye gaze replay to enhance inexperienced student’s visual search skills when observing the locomotion patterns of fish. Eye movement modeling example (EMME) videos were created that included expert eye movements superimposed over eye gaze replay recordings, and expert verbal descriptions of the fish locomotion patterns. Participants individually viewed the EMME videos and then attempted to match the correct fish locomotion pattern with what they saw in the video. Results indicated students’ visual search strategies and interpretation of the fish locomotion patterns improved significantly after observing the
modeling examples. This method was recognized as a potential training tool for visual search and interpretation.

In education, Mason et al. (2016) used eye movement modeling examples (EMME) to determine if middle school students would develop better processing skills in their own reading after following the eye gaze of an expert. To develop the EMME video, an expert model read sentences and viewed illustrations provided on a computer monitor while eye movements were recorded. Recorded eye movements were represented by a red dot, representing eye fixations, that appeared over the text and illustrations on a computer monitor; verbal content was not provided.

Prior to the study, students reading comprehension levels were collected from a standardized school reading test given to all seventh graders and students were randomly assigned to EMME and no-EMME groups. During the study, all participants completed a pretest and posttest where they read text examples, viewed illustrations, and provided answers to questions afterwards; content was different for the pretest and posttest. Between the pretest and posttest, students in the EMME group viewed EMME videos depicting a model experts’ eye gaze. Findings showed that students in the EMME group viewed illustrations for longer periods of time than those in the no-EMME group and exhibited a deeper level of reading comprehension when answering questions afterwards. Lower level learners were more affected than higher level learners from viewing the EMME videos. Due to the success of this method in the education setting with classroom students, it is possible that EMME video training could the tool needed to advance learning for preservice teachers and provide a way to improve teachers’ situational awareness.
**Conclusion**

Countless components contribute to teacher expertise, and many areas have been explored in music education and other fields that contribute to the advancement of teachers and their overall effectiveness. However, visual attention in music education is not as advanced as in other fields, and researchers have not explored eye gaze as a major contributing factor of effectiveness for music teachers.

Whereas eye gaze tracking techniques have broadened to new areas of study (i.e., medicine, education), a disparity remains considering how it is used. It is clear from past research that eye tracking techniques in the medical field have improved understanding and offered training options, providing advancement that narrowed the gap in expertise. In education, researchers have accrued visual knowledge using eye gaze tracking techniques, but have little implementation of the technology as a training tool. In fact, in areas such as, music education, these techniques have yet to be explored.

Developments in other areas concerning skill level and expertise with the use of eye gaze tracking combined with the lack of research related to eye movements and their impact on expertise in music education lends evidence to suggest that eye gaze tracking could provide missing links concerning the development of expertise for music educators. In the current study, the researcher focused on similarities and differences in eye movements of novice and expert music educators while observing middle school band rehearsals and explored the use of eye gaze replay as a training tool for novice teachers’ situational awareness to help narrow the gap between those who are considered experts and those who are not.
CHAPTER 3

METHOD

Purpose

The purpose of this study was to compare the eye gaze focus of novice and expert instrumental music teachers when observing middle school band rehearsals and to determine whether guided observation training, using the eye gaze replay of a model expert music teacher, would alter the eye gaze focus of novice teachers so their eye movements became more like those of the experts.

Institutional Review Board

The researcher obtained permission to conduct the study on July 14, 2015 from the University of Alabama Institutional Review Board (see Appendix A). As outlined in the IRB protocol, the researcher secured participant consent forms in a music education office, room 262, located in Moody Music Building at The University of Alabama.

Research Design

The researcher used a variation on the three-group randomized pre-post control design. The third group was a referential comparison group of expert music teachers, who were tested only one time. The results of the referential group were compared with results from the pre- and posttests for the control and experimental groups. In addition, the researcher compared the results from the pretest between upperclassmen and underclassmen novice music teachers and the experts to determine critical areas of interest in the video segments.
Participant Recruiting

**Novice instrumental music teachers.** The researcher recruited first-year music education majors for the study at an after-rehearsal meeting of all freshmen music education majors enrolled in the university marching band. The researcher recruited second-, third-, fourth-, and fifth-year music education majors for the study during a regularly scheduled lab class shared by two music education methods courses: (a) MUS 448: Teaching Instrumental Music in Public Schools and (b) MUE 351: Teaching Flute and Single Reeds. The researcher secured permission to invite students to participate in the study from the class instructors.

During the recruitment presentations, the researcher described the study, emphasized participation was voluntary, distributed a handout detailing the process (see Appendix B), and collected information (e.g., name, email, classification) for those interested in participating. The researcher remained after the presentation to answer questions. As a token of appreciation, the researcher provided candy to those who volunteered.

To expand the number of participants in the study, the researcher obtained a list of students’ email addresses and names for all music education majors enrolled in courses offered by the Music Education Department at the University of Alabama. The researcher removed students who volunteered to participate in the study from the list and emailed the remaining students an invitation to participate. The contents of the email included a request for participation and details about the study. The researcher responded to emailed questions from individual students to clarify requirements for participating in the study.

**Expert instrumental music teachers.** The researcher selected four expert instrumental music teachers from Alabama using the recommendations for creating samples of expert teachers
for research purposes as described by Palmer et al. (2005) and the criteria that were also used by
Goolsby (1996) and Berliner (2004). In summary, experts were:

1. Experienced teachers with 10 or more years of service;
2. Experienced middle school teachers with 3 or more years of service;
3. Teachers with high-performing students as measured by superior ratings at state-level
   music performance assessments;
4. Identified as experts by a professional peer group—a panel of officers of the Alabama
   Bandmasters Association;
5. Current members of a professional association—the Alabama Music Educators
   Association.

Using these criteria, the researcher assembled a list of 15 expert instrumental music
teachers and consulted an experienced professor of music education to further confirm the
expertise of the persons on the list. Fifteen (100.0%) experts were retained for the final list and
emailed an invitation to participate in the study. The contents of the email included a request for
participation, details about the study, requirements for participation, a timeline for completion,
and a request to respond one week after receiving the invitation. Eight (53.3%) expert teachers
responded to the email and four (26.7%) agreed to participate in the study.

The researcher purposefully recruited an additional expert teacher \( n=1 \) from outside
Alabama to participate in the study as the model expert based on his extensive pedagogical
experience, expertise with middle school bands, and unfamiliarity with the novice instrumental
music educators. The model expert met or exceeded the requirements set for selecting expert
instrumental music educators (e.g., band performance at The Midwest Band Clinic, all-state
clinician, years of superior bands). In addition, the model expert was willing to commit the time required to complete the observations needed to develop the treatment videos.

**Participants**

Novice instrumental music teachers \((n=29)\) included upperclassmen \((n=14)\) and underclassmen \((n=15)\) music education majors enrolled in the teacher preparation program at the University of Alabama during the 2015-2016 academic year. Seven (24.1%) were in the first year of the program, seven (24.1%) were in the second year, seven (24.1%) were in the third year, and eight (27.7%) were in the fourth or fifth year. Sixteen (55.2%) were male and 13 (44.8%) were female. Participants were familiar with the researcher before participating in the study.

Expert instrumental music teachers \((n=5)\) were inservice educators with an average of 23.2 years \((SD = 8.04\) years\) of teaching experience. Three (60.0%) were male and two (40.0%) were female. Four (80.0%) were teaching at the middle school level at the time the study was conducted and one (20%) was teaching at the college level. The researcher was familiar with all of the expert participants.

**Stimuli Creation**

The researcher used 20 video segments selected from recordings of middle school band rehearsals as stimuli. The first 10 video segments were recorded during daily band rehearsals of five middle school bands located in four Alabama schools. See Appendix C for a description of the band programs at the four schools. The last 10 video segments were recorded during daily rehearsals of a week-long summer music camp held at the University of Alabama. A description of the summer music camp band is in Appendix D.
The researcher used a Sony 4k video camera (model # FDRAX53/B) to record the rehearsals of the summer music camp band and a Cannon 1080p video camera (model #1238C001) to record the rehearsals of the middle school bands. Video cameras were positioned to capture the perspective of the director on the podium looking out at the ensemble, aimed at the center of the ensemble, and zoomed out to “maximum” to capture the widest field of view. To include as many students as possible and minimize the presence of the director in the videos, the researcher mounted the cameras to a tripod attached to a ladder and raised 7.0 ft to 12.0 ft above floor level as shown in Figure 1 and positioned 11.0 ft to 12.0 ft in front of the first row of band students. The researcher instructed the director to position himself outside the view of the camera when the ensemble was playing and otherwise asked the students and directors to rehearse as usual, so the content of the videos was authentic. The musical content of the rehearsals included a variety of warm-up exercises (e.g., major scales, articulation exercises) and music with a range of performance styles (e.g., pop, classical, jazz, marching band).

Figure 1. Example of recording set up when capturing video footage for the stimulus.
Video recordings resulted in a total of 25.4 hours of recorded rehearsal time and were imported into the computer program *iMovie* (version 10.1) for evaluation. The researcher then segmented the videos, edited them to minimize distracting aural and visual content, and examined them using an instrumental performance rubric for ideal opportunities to teach or comment on aspects of the ensembles’ tone, balance, blend, intonation, articulation, rhythm, technique, and dynamics (Latimer, Bergee, & Cohen, 2010). This process resulted in 47 useable video segments from the recordings of local school bands and 103 useable video segments from recordings of the summer band camp rehearsals. The researcher compared video segments containing similar content and selected those with more inferential comments and durations closest to 60s for the stimulus. This process resulted in a total of 20 video segments; 10 from each set of video recordings.

The researcher exported the 20 video segments from *iMovie* and imported them into the computer program *Experiment Center* (version 3.5). The researcher appended on-screen instructional text and aural directions to the beginning, middle, and end of the 20 video segments. The researcher inserted 2 seconds of blank video between each video segment to provide transitions between videos. See Appendix E for a detailed description of the video editing process and instructional text.

**Dependent Measure**

As participants watched the videos, their eye gaze was tracked and the amount of time they focused on the different areas of the video segments was logged in milliseconds using a SensoMotoric Instruments (SMI) RED 250 eye-tracking system. The SMI system calculated the average dwell times for each participant for 48 Areas of Interest (AOI).
As shown in Figure 2, the researcher created 48 AOIs by superimposing a six-row by eight-column grid that covered the entire viewing area captured in the video segments. The dimension of the AOIs was set so to accommodate the size of one student per AOI. Every AOI had a unique two-digit code (e.g., A1, B2, C3) to identify the column (A, B, C, D, E, F, G) and row (1, 2, 3, 4, 5, 6).

*Figure 2. Example of the 48, 6 X 8, gridded map AOIs for each video segment. Student’s faces are blurred to protect students’ identity, but were visible when participants watched the videos.*

**Equipment, Materials, and Arrangements**

**Eye-tracking instruments.** The researcher captured eye gaze data with a SensoMotoric Instruments (SMI) RED 250 eye-tracking system. The eye tracking system used an infrared light source to record eye movements at a sampling rate of 250 Hz. The infrared device was mounted beneath a 22 in. Dell computer monitor, and connected to a Dell Latitude laptop computer.
(model E6530) running *iView* (version 4.2.64) and *Be Gaze* (version 3.5) software to record and analyze eye-movement data. The external computer monitor and laptop were connected using a VGA connection cable.

The SMI (n.d.) website proclaimed that the design of the *RED 250 eye-tracking device* minimizes physical contact between the device and participants by recording binocular gaze and pupil data through image-based pupil eye tracking using corneal reflection. Additional features include automatic eye tracking and head movement compensation, resulting in eye gaze position accuracy of less than four degrees, system latency of less than 6 ms, and a processing latency of less than .5 ms. The manufacturer claimed that the eye tracking device avoids concerns with participants’ eye color, age, glasses, and contact lenses, and ensures accurate data collection when the eye tracking device operates at a distance of 23.6 to 31.5 in. from the participant.

**Eye-tracking participant station.** As seen in Figure 3, the researcher placed an external computer monitor on a standard teacher's desk measuring 31 in. from the floor to the top of the desk. The researcher attached an adjustable headrest to the desk across from the monitor at a distance of 27.6 in. The researcher constructed a headrest from a 24 in. small suspension curtain rod and placed between two 36 in. heavy-duty bar clamps. For participants’ comfort, the suspension rod was covered in felt using tape at both ends to hold it in place. The participants sat in a chair which measured 24 in. from floor to seat. The researcher specifically chose a chair without wheels to avoid additional movement during participation that could affect head and body placement.

**Eye-tracking researcher’s station.** The researcher’s Dell Latitude laptop computer was positioned directly across from the participant at a table parallel to the teacher’s desk. A blackout curtain was taped to a 6 ft tall garment rack and placed between the researcher and the
participant so the participant could not see the researcher during the study. The stimulus video played for the participants on the computer monitor and real time images of the participants’ eyes were displayed on the researcher’s laptop monitor indicating where the participant was looking during the study. Execution of the study was conducted entirely from a list of stimuli displayed on the researcher’s computer. The arrangement allowed the researcher to conduct the study “out of sight” while still monitoring participants’ progress. In addition, the arrangement eliminated possible distractions that could advert participants’ eyes during the study (e.g., researcher movement) and fostered a private recording environment that was comfortable and inviting for participants as they provided think aloud commentary about the stimulus.

**Laboratory room.** The researcher conducted the study in a computer lab located in the Moody Music Building on the campus of the University of Alabama. As suggested by Holmqvist et al. (2011), the researcher covered windows in the room with blackout panels to omit sunlight during the recording process; fluorescent lights served as the only lighting source in the room to provide the best conditions for eye tracking. To avoid distracting the participant, outside noise and other visual stimuli were avoided. The researcher placed signs on the computer lab door to remind students of procedures and discourage interruptions. Throughout the study, distractions were minimized and sounds heard by participants during a typical day in the music building were present.

**Audio recording.** The researcher used a Zoom H2n Handy Recorder to record participants’ think aloud comments when viewing the stimuli. The recording level was set to a volume of ten to ensure a high-fidelity recording.

**Audio playback.** Audio for the pretest and posttest was played through a Harmon JBL Micro-wireless portable speaker. The speaker was set to a level of six to ensure that the sounds
produced by the ensemble were heard, but not a dominating factor. The speaker was located near the researcher during data collection and was not played through the participant’s computer.

**Treatment playback.** Observation training occurred on eight independent computer stations located in a computer lab in the University of Alabama, Moody Music Building. Each computer station included an adjustable-height computer desk chair, a 22 in. Apple iMac computer (model A1311), and a Logitech on Ear USB headset with noise canceling microphone (model H540). The researcher used the computer programs *QuickTime* (version 10.3) to play the video training stimuli and *Audacity* (version 20.5) to record participants’ oral responses to the videos. The researcher archived and transferred all data using Scan Disk (32GB) USB flash drives.

*Figure 3.* These pictures are examples of the equipment setup used in the study. The picture on the left shows the researcher’s station and the picture on the right shows the participant’s station. The two areas were set up facing each other, separated by a black curtain.
Treatment: Eye Movement Modeling Examples (EMME)

The researcher selected unused video recordings of the previously described summer music camp rehearsals ($n=93$) to develop Eye Movement Modeling Examples (EMME) for the treatment. Following a similar process used to conduct the pre- and posttest, the model expert guide viewed the 93 video segments while his eye movements and think-aloud comments were recorded using SMI Vision eye tracking equipment. Videos were loaded into *iMovie* and reevaluated for content and length. Video segments ($n=30, 32.2\%$) containing desired content, as detailed in Appendix F, inferential comments, and longer than 30 s were selected for the eye gaze training videos.

Using the identified 30 video segments, the researcher created two sets of videos for the treatment sessions. The first set served as eye movement modeling examples (EMME) and included the model expert’s think-aloud comments and eye gaze replay. Eye gaze replay appeared as a semi-transparent yellow circle, 150 pixels in diameter, superimposed over the contents of the video, as shown in Figure 4. The purpose of these examples was to provide a model for novice teachers to emulate and serve as a tool for novice participants to compare their comments with those provided by the model expert.

A second set of 30 videos did not include the model expert’s aural comments but was otherwise identical to the first set. The researcher designed these examples to facilitate participant practice by only including the eye gaze replay of the model expert, video contents, and unaltered rehearsal audio, while the novice teachers provided think-aloud commentary similar to the model expert’s.
Think aloud commentary. Think aloud comments were used for the EMME videos so that novice teachers could hear what the expert teacher was thinking as they followed his eye gaze. It has been suggested that "verbal reports of experts can be used to design instruction" and a description or verbal response from the provider of eye gaze display assists with instruction, even if through video recording (Van Gog, Kester, Niervelstein, Giesbers, & Paas, 2009). Concurrent think aloud comments were chosen to provide the best representation of in–the–moment observations and thought processes. Other methods, such as written comments used by Standley and Madsen (1991), were not used to avoid interference with eye gaze data collection that may have occurred as participants looked down to write.
Treatment sessions. The researcher arranged the 60 videos across six treatment sessions, as shown in Tables 1 and 2. Each treatment session included 10 videos that alternated in purpose, student task, and expert think-aloud commentary. In Treatment Session 1, the researcher presented the EMME version of a video before the Student Practice version. The purpose of this order was to provide students with a model to emulate before they practiced providing think aloud commentary themselves. As the sessions progressed, the order of EMME and student practice gradually inverted so that student practice occurred before the novice teachers heard the model expert’s think aloud commentary. The purpose of this order was to have the novice teachers provide think-aloud commentary without the model and then to compare the accuracy of their statements with the model experts to evaluate their progress.
### Table 1

**Content, Ordering, and Purpose of the Training Videos in Treatment Sessions 1 to 3**

<table>
<thead>
<tr>
<th>Session</th>
<th>Time (minutes)</th>
<th>Video</th>
<th>Expert Content</th>
<th>Student Task</th>
<th>Purpose</th>
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</table>
Procedures

Novice instrumental music teachers received an invitation to sign up for an individual appointment to participate in the pretest. The invitation included a link to a webpage listing the days and times when the pretest would be administered and an option to select their preference. The website provided an option to receive an automated reminder on the day prior to their meeting. The website also provided participants with the option to reschedule their appointment as needed. Only one participant could sign up per available date and time. One day before participating in the study, participants received an email directing them to arrive at least 5 minutes early.

When participants arrived at the laboratory room, the researcher recorded their name, date, and arrival time on a pre-numbered sign-in sheet. The researcher then explained information about the use of infrared light to track eye movements. The researcher invited the participants to ask questions about the study and when the participants were comfortable with the procedures, they signed and dated a consent form.

Participants were then directed to sit at the eye tracking participant station and the researcher repositioned the headrest, chair, computer screen, and infrared light to a comfortable position. The researcher calibrated the SMI eye tracker, a process that allows the eye tracking system to determine the algorithm needed to translate pupil position to eye gaze position, by following the procedures outlined in the iView online manual. A value of less than or equal to .5 degrees was desired and indicated that eye gaze accuracy under ideal conditions was reached. The following script was used by researcher during calibration.

*We will begin by calibrating your eyes. This could take a few tries and I may have to make a few adjustments during the process.*

63
On the screen you should see a white dot with a red center. Do you see the dot?

<Wait for response>

You will follow the dot with your eyes. Please keep your head on the headrest. During this process, it is important to focus on the red center of the dot, especially when the dot stops. Do not try to anticipate where the dot will go next, wait until the dot moves, then follow it with your eyes. What questions do you have?

<Answer questions>

Okay. Here we go.

When the researcher received positive confirmation of calibration, the researcher read the following:

Okay. Calibration is complete and we are ready to begin. The instructions will be next.

When the researcher received negative confirmation of calibration, the researcher read the following:

We will complete the calibration process again. It will take a minute to reset. I will let you know when we will begin.

<Refer to checklist for instructions>

Okay. We are ready to calibrate your eyes. Please be sure your head is on the headrest. Again, you will follow the white dot, while focusing on the red center as closely as possible. Try not to anticipate where the dot will go. Keep your eye on the dot the entire time; do not look away from the dot.

Do you see the dot on the screen?

<Wait for response>

Okay. Here we go.
Thirty-four novice participants (97.1%) and five experts (100.0%) received positive confirmation before preceding to the next step. One novice (2.9%) did not receive positive confirmation after three calibration attempts and continued to participate; the researcher did not use this data for the study.

After calibration, the researcher initiated the Begaze program to display instructions and the stimuli video on the participant’s computer monitor. The initial instructions were: Please keep your head on the headrest throughout the study. You will observe 10 one-minute videos of middle school band rehearsals. As you watch the video, please verbally describe what you observe. The videos will play continuously. When ready to begin, please say aloud, "I am ready to begin."

Participants read the directions, watched the videos, and provided think-aloud comments. The SMI eye tracker recorded participants’ eye gaze and the Zoom H2n Handy Recorder captured their think-aloud comments. When the videos were complete, the researcher provided a 2-minute break to reduce fatigue. The instructions on the participant’s monitor were:

You have completed the first part of the process. You will now have a short break. At this time, you may remove your head from the headrest, drink water, or stand to stretch. You may talk to the researcher, but please do not discuss the content of the study.

If participants asked questions or began discussing the study with the researcher, they were reminded that discussion about the study was not allowed. At the conclusion of the break, the participants returned to the participant station and the calibration sequence was performed again before the study resumed. The study concluded with the following directions:

Thank you for your participation in this study. Please do not discuss the contents of this study with your friends or enemies. You may remove your head from the headrest at this
time. The researcher will email you with further instructions. Don’t forget to take a snack and drink!

At the end of each session, the researcher offered the participants snacks and drinks in appreciation for their participation. The researcher also reminded them to not discuss the study with other students and encouraged them to report incidents to the researcher.

**Posttest.** Procedures and equipment for the posttests were identical to those used for the pretest. At the conclusion of the posttest, the researcher provided a $5.00 gift card to the novice teachers in appreciation for their participation.

**Treatment: Eye Gaze Replay Training Sessions**

The researcher randomly assigned the novice instrumental music teachers to treatment ($n=15$) and non-treatment groups ($n=14$). Members of the treatment group participated in six individually scheduled eye gaze training sessions over 2 weeks, instead of 6 weeks as described when participants were recruited for the study. The purpose of this revision was to improve participant retention and avoid participant attrition. When a participant arrived at the Eye Gaze Treatment Lab, they were escorted to an assigned computer station where the researcher readied the computer to play the video stimuli for the particular training session and simultaneously record participant’s think aloud comments. Participants listened to the video using headphones with an attached microphone. The researcher adjusted the position and level of the microphone before proceeding with the training session.

When a participant was ready to begin, the video began playing and directions for the training were shown on the screen. This process was repeated for the six training treatment sessions with variations in the instructions reflecting the objectives for the session, as previously described in Tables 1 and 2. The directions for the first session included definitions of key terms
such as eye gaze and think aloud commentary and a short orientation before beginning the sessions.

When participating in an EMME portion of the treatment, participants viewed the videos and were instructed to follow the model experts’ eye gaze while listening carefully to the model expert’s commentary. Participants were permitted to review, rewind, and pause the video. In contrast, when participating in a student practice session, participants viewed the videos and were instructed to replicate the comments of the model expert by providing their own think aloud comments. Participants were not permitted to pause, rewind, or stop the video. After each session, participants were instructed to raise their hand to indicate they were finished and their think aloud-commentary was archived. Participants were offered snacks, signed out, and received a reminder about their next session. Individual treatment sessions lasted 14 to 20 mins.

**Expert Instrumental Music Teacher Testing**

Procedures used to collect data from the four expert instrumental music teachers were similar to those used for the novice instrumental music teachers. The researcher contacted the expert instrumental music teachers via email and asked them for a date and time when they were available to participate in the study. The researcher conducted data collection at the expert’s home or school using a transportable version of the eye tracking participant station to hold the external computer monitor, adjustable headrest, and infrared light source at the same height and distance used for the pre- and posttest with the novice instrumental music teachers. All materials were affixed to a folding card table and a portable stool was provided for the participants to sit on. As before, the researcher erected a black curtain to serve as a visual partition between the researcher and participant during data collection. The researcher invited participants to ask
questions about the study and when the participants were comfortable with the procedures, they
signed and dated a consent form.

The researcher then calibrated the SMI eye tracker by following the procedures outlined
in the *Begaze* online manual. Accurate calibration was determined when a value of less than .5
degrees was reached. All four experts (100.0%) received positive confirmation before preceding
to the next step. Participants read the directions, watched the videos, and provided think aloud
comments. The SMI eye tracker recorded participants’ eye gaze and the Zoom H2n Handy
Recorder captured their think-aloud comments. When the videos were complete, the researcher
provided a 2-minute break to reduce fatigue. At the conclusion of the break, the participants
returned to the participant station and the researcher performed the calibration sequence again
before the study resumed. At the end of the session, participants were thanked for their
participation.

**Model Expert Instrumental Music Teacher Testing**

Procedures, equipment, and testing conditions used to collect data from the model expert
instrumental music teacher were identical to those used for the novice instrumental music
teachers.

**Data Analysis**

The researcher examined data from a stratified random sample of six video segments
(middle school band rehearsals, n = 3; summer music camp band, n = 3).

**Dwell time analysis.** The researcher analyzed the average dwell time for each AOI in
five phases. The first three phases are illustrated as a flow chart in Figure 5 and the remaining
phases are illustrated in Figure 6.
During the first three phases, participants’ median average dwell times for individual AOIs were compared by groups using the non-parametric Kruskall-Wallis H test with uncorrected ranks. The researcher used post-hoc Mann Whitney U pairwise comparisons to identify the groups with nonequivalent medians. Alpha levels for the post-hoc tests were adjusted using the Bonferroni approach to $p<.025$ to minimize Type 1 error. In Phase 1, the researcher identified AOIs that were significantly different between the upperclassmen and experts and the underclassmen and the experts. In Phase 2, the researcher confirmed that the treatment and non-treatment groups’ median average dwell times were equivalent and, at the same time, nonequivalent to the experts. Potential CAOIs identified during Phase 1 and Phase 2 were then confirmed or discarded using the flow chart for Phase 3, shown in Figure 5.

The purpose of Phases 4 and 5 were to address the research questions, “Can expert eye gaze replay be used as an effective training method for improving novice teachers’ eye gaze?” and “Does novice teachers’ eye gaze begin to look more similar to experts’ through repetition?” In Phase 4, the researcher compared pretest and posttest median average dwell times for the identified CAOIs for the treatment and non-treatment groups using the non-parametric Wilcoxon Ranked-Sign Test. The test was selected to control for repeated measurement with non-parametric data. The treatment was considered effective when a significant result occurred for the treatment group, with average dwell times increasing or decreasing toward the times recorded for the experts, and a non-significant result occurred for the corresponding non-treatment group.

In Phase 5, the researcher compared the experts’ median average dwell times with the posttest times for upperclassmen and underclassmen using the Kruskall-Wallis H test. The purpose of this phase was to determine whether the posttest median average dwell times for the novices were more like the experts. A non-significant result indicated that the upperclassmen and
underclassmen dwell times were more expert-like after a repeated viewing of the stimulus and participation in the task.

**Visual comparison of heat maps.** To supplement the statistical analysis, the researcher divided the participants’ average dwell times into groups—experts, upperclassmen, and underclassmen—and used these to create AOI heat maps to conduct visual comparisons of the most viewed AOIs for each group. The researcher generated heat map images \( (n = 18) \) for each video segment based on average dwell time using *Begaze* (version 3.5) computer software. The amount of time spent in each gridded AOI was automatically color coded by the computer program with color ranging from blue to red. Blue boxes indicated the observer spent the least amount of time observing within the AOI, while red boxes indicated the observer spent the most amount of time observing within the AOI. Heatmap colors increased from blue to red based on amount of time spent in the area in this order: blue, green, yellow, orange, and red.
Figure 5. Flow chart representing decisions made to identify Critical Areas of Interest (CAOIs) during Phases 1, 2, and 3 analysis.
Figure 6. Flow chart representing CAOI comparisons made during Phases 4 and 5 of analysis.
CHAPTER 4
RESULTS

Overview

The researcher conducted a five-stage comparison of experts and novice (upperclassmen, underclassmen) instrumental music educators’ data for each video segment. Identification of CAOIs was completed during the first three stages. In Stage 1, the researcher compared novices’ median average dwell times from the pretest, for the 48 AOIs, for experts, upperclassmen, and underclassmen to determine an initial set of CAOIs. In Stage 2, the researcher assigned novice teachers to treatment and non-treatment conditions, and compared experts’ median average dwell times to determine a second initial set of CAOIs. In Phase 3, the researcher created a final set of CAOIs by comparing results from Phase 2 with those from Phase 1. The researcher retained initial CAOIs identified in both phases in the final set.

The primary purpose of the study was addressed in Phases 4 and 5. Novice teachers’ pretest and posttest CAOI median average dwell times, identified in Phase 3, were compared between treatment and non-treatment groups to determine if participation in the treatment influenced teachers’ dwell times. Finally, in Phase 5, the researcher compared the posttest CAOI median average dwell times for experts, upperclassmen, and underclassmen for those CAOIs, showing an increase or decrease in dwell time in Phase 4. The purpose of this phase was to evaluate whether participants’ observations became more like the experts’ through repetition. Also, during Phases 4 and 5, gridded heat map comparisons of participants’ average dwell times
were conducted to evaluate similarities and differences between the eye gaze of experts, upperclassmen, and underclassmen.

After all five phases where complete, a visual analysis was completed by the researcher as a supplemental analysis to the statistical outcomes. Visual comparisons were made between upperclassmen, underclassmen, and experts using AOI gridded heat maps based on pretest average dwell times. The purpose of this was to determine in which areas each group spent the most time looking and to determine the events occurring in those AOIs.

**Phase 1 Results**

During Phase 1, the researcher compared the median average dwell times for participants’ pretests for the 48 AOIs using a Kruskal-Wallis H Test. When a significant result was obtained, pairwise comparisons, using a post hoc Mann Whitney U test, the researcher confirmed whether the median average dwell times for upperclassmen and underclassmen were significantly different from experts. Results generally indicated that 27 (9.4%) of the 288 examined AOIs, 48 per video segment, were significantly different between groups. Significant AOIs for both comparisons were labeled as initial CAOIs; five (1.7%) AOIs were labeled initial CAOIs.

**Video Segment 1 results.** In Video Segment 1, results from the Kruskal-Wallis H Tests were significant for five (10.4%) of the 48 AOIs, as shown in Table 3. Post-hoc pairwise comparisons between experts and underclassmen were significant for the five AOIs, B3 ($U=7.0$, $p=.010$), F2 ($U=5.0$, $p=.005$), G2 ($U=9.0$, $p=.016$), G3 ($U=7.0$, $p=.010$), and G4 ($U=8.0$, $p=.012$), as indicated with a superscript a in Table 3; post-hoc pairwise comparisons between experts and upperclassmen resulted in one significant AOI, B3 ($U=9.0$, $p=.013$). Since B3 was the only
significant AOI for both sets of post-hoc comparisons, it was labeled as the only initial CAOI for Video Segment 1.

Table 3

*Kruskall-Wallis H Test Comparisons between Experts, Upperclassmen, and Underclassmen Pretest Median Dwell Times(ms) for Video Segment 1*

<table>
<thead>
<tr>
<th>Area of Interest</th>
<th>$\chi^2$</th>
<th>$p$</th>
<th>Experts Dwell Time</th>
<th>Mdn</th>
<th>Upperclassmen Dwell Time</th>
<th>Mdn</th>
<th>Underclassmen Dwell Time</th>
<th>Mdn</th>
</tr>
</thead>
<tbody>
<tr>
<td>B3 $^b$</td>
<td>7.55</td>
<td>.023</td>
<td>897.8</td>
<td>368.0</td>
<td>3925.4</td>
<td>3211.4 $^a$</td>
<td>3615.1</td>
<td>3604.3 $^a$</td>
</tr>
<tr>
<td>F2</td>
<td>7.19</td>
<td>.028</td>
<td>692.4</td>
<td>88.1</td>
<td>317.5</td>
<td>2532.3</td>
<td>3298.9</td>
<td>3036.7 $^a$</td>
</tr>
<tr>
<td>G2</td>
<td>5.97</td>
<td>.050</td>
<td>1406.0</td>
<td>0.0</td>
<td>4871.4</td>
<td>3930.8</td>
<td>5514.7</td>
<td>4890.5 $^a$</td>
</tr>
<tr>
<td>G3</td>
<td>7.22</td>
<td>.027</td>
<td>1046.3</td>
<td>871.8</td>
<td>3554.1</td>
<td>3079.9</td>
<td>4128.8</td>
<td>3571.7 $^a$</td>
</tr>
<tr>
<td>G4</td>
<td>6.59</td>
<td>.037</td>
<td>2717.1</td>
<td>2344.3</td>
<td>971.4</td>
<td>651.8</td>
<td>930.4</td>
<td>711.8 $^a$</td>
</tr>
</tbody>
</table>

*Note.* Mdn = Median Average Dwell Time.

$^a$ Significant difference when compared to experts ($p<.05$).

$^b$ Significant difference for both the underclassmen and upperclassmen when compared to experts ($p<.05$).
Video Segment 2 results. As shown in Table 4, the researcher identified a set of eight (16.7%) AOIs for Video Segment 2 using the Kruskal-Wallis H Test. Post-hoc pairwise comparisons confirmed significant differences in the median average dwell times between experts and underclassmen for D2 ($U=21.0, p=.015$), D6 ($U=20.0, p=0.014$), and E1 ($U=21.0, p=.015$); Dwell times were significantly different between experts and upperclassmen for B2 ($U=16.0, p=0.007$), D2 ($U=16.0, p=.007$), E1 ($U=22.5, p=.012$), and E6 ($U=15.0, p=0.002$).

Initial CAOIs for Video Segment 2 were D2 and E1.

Table 4

Kruskall-Wallis H Test Comparisons between Experts, Upperclassmen, and Underclassmen Pretest Median Dwell Times(ms) for Video Segment 2

<table>
<thead>
<tr>
<th>Area of Interest</th>
<th>$\chi^2$</th>
<th>$p$</th>
<th>Dwell Time</th>
<th>Mdn</th>
<th>Dwell Time</th>
<th>Mdn</th>
<th>Dwell Time</th>
<th>Mdn</th>
</tr>
</thead>
<tbody>
<tr>
<td>A3</td>
<td>8.01</td>
<td>.018</td>
<td>577.5</td>
<td>0.0</td>
<td>8.5</td>
<td>808.2</td>
<td>819.7</td>
<td>601.4</td>
</tr>
<tr>
<td>B2</td>
<td>6.78</td>
<td>.034</td>
<td>64.6</td>
<td>0.0</td>
<td>21.3</td>
<td>0.0</td>
<td>0.0</td>
<td>533.9</td>
</tr>
<tr>
<td>B3</td>
<td>11.10</td>
<td>.004</td>
<td>2040.3</td>
<td>368.0</td>
<td>53.6</td>
<td>3211.4</td>
<td>273.4</td>
<td>3604.4</td>
</tr>
<tr>
<td>C4</td>
<td>7.00</td>
<td>.030</td>
<td>2473.2</td>
<td>2286.8</td>
<td>4223.8</td>
<td>663.9</td>
<td>2959.7</td>
<td>732.1</td>
</tr>
<tr>
<td>D2</td>
<td>8.11</td>
<td>.017</td>
<td>1950.7</td>
<td>0.0</td>
<td>10.4</td>
<td>0.0</td>
<td>62.8</td>
<td>213.9</td>
</tr>
<tr>
<td>D6</td>
<td>7.66</td>
<td>.022</td>
<td>520.7</td>
<td>0.0</td>
<td>68.0</td>
<td>0.0</td>
<td>61.3</td>
<td>0.0</td>
</tr>
<tr>
<td>E1</td>
<td>11.95</td>
<td>.003</td>
<td>39.2</td>
<td>0.0</td>
<td>541.2</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>E6</td>
<td>9.96</td>
<td>.007</td>
<td>211.2</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>54.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Note. Mdn= Median Average Dwell Time.

$^a$ Significant difference when compared to experts ($p<.05$).

$^b$ Significant difference for both the underclassmen and upperclassmen when compared to experts ($p<.05$).
**Video Segment 3 results.** The researcher identified a set of four (8.3%) AOIs, shown in Table 5, for Video 3. Pairwise analysis showed differences in median average dwell times between underclassmen and experts for AOIs F1($U=14.0$, $p=.002$), G1($U=15.0$, $p=.009$), and G4 ($U=4.0$, $p=.002$) and between experts and upperclassmen for AOIs F1($U=15.0$, $p=.002$) and G1($U=16.0$, $p=.007$). The researcher identified initial CAOI’s for Video Segment 3 as F1 and G1.

Table 5

*Kruskall-Wallis H Test Comparisons between Experts, Upperclassmen, and Underclassmen Pretest Median Dwell Times(ms) for Video Segment 3*

<table>
<thead>
<tr>
<th>Area of Interest</th>
<th>$\chi^2$</th>
<th>$p$</th>
<th>Dwell Time</th>
<th>Mdn</th>
<th>Dwell Time</th>
<th>Mdn</th>
<th>Dwell Time</th>
<th>Mdn</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1 $^b$</td>
<td>18.48</td>
<td>&lt;.001</td>
<td>1280.4</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>F5</td>
<td>6.24</td>
<td>.044</td>
<td>179.0</td>
<td>117.9</td>
<td>288.9</td>
<td>0.0</td>
<td>788.0</td>
<td>0.0</td>
</tr>
<tr>
<td>G1 $^b$</td>
<td>10.73</td>
<td>.005</td>
<td>1335.5</td>
<td>0.0</td>
<td>13.6</td>
<td>0.0</td>
<td>19.4</td>
<td>0.0</td>
</tr>
<tr>
<td>G4</td>
<td>10.06</td>
<td>.007</td>
<td>28.8</td>
<td>2344.3</td>
<td>439.5</td>
<td>651.8</td>
<td>841.4</td>
<td>712.0</td>
</tr>
</tbody>
</table>

*Note.* Mdn= Median Average Dwell Time.

$^a$ Significant difference when compared to experts ($p<.05$).

$^b$ Significant difference for both the underclassmen and upperclassmen when compared to experts ($p<.05$).
**Video Segment 4 results.** As shown in Table 6, the researcher identified a set of five (10.4%) CAOIs for Video Segment 4. Pairwise analysis confirmed significant differences in median average dwell time between underclassmen and experts for AOIs D5 ($U=9.0, p=.016$), D6 ($U=9.0, p=.014$), and E6 ($U=10.0, p=.018$), and between upperclassmen and experts for D6 ($U=8.0, p=.009$) and F6 ($U=22.5, p=.012$). Therefore, D6 was the only area considered an initial CAOI for Video Segment 4.

Table 6

*Kruskall-Wallis H Test Comparisons Between Experts, Upperclassmen, and Underclassmen Pretest Median Dwell Times(ms) for Video Segment 4*

<table>
<thead>
<tr>
<th>Area of Interest</th>
<th>$\chi^2$</th>
<th>$p$</th>
<th>Dwell Time</th>
<th>Mdn</th>
<th>Dwell Time</th>
<th>Mdn</th>
<th>Dwell Time</th>
<th>Mdn</th>
</tr>
</thead>
<tbody>
<tr>
<td>D5</td>
<td>10.41</td>
<td>.005</td>
<td>1368.0</td>
<td>188.1</td>
<td>2305.1</td>
<td>180.0</td>
<td>5314.0</td>
<td>0.0 $^a$</td>
</tr>
<tr>
<td>D6 $^b$</td>
<td>9.08</td>
<td>.011</td>
<td>54.4</td>
<td>0.0</td>
<td>611.1</td>
<td>0.0 $^a$</td>
<td>1287.4</td>
<td>0.0 $^a$</td>
</tr>
<tr>
<td>E6</td>
<td>8.83</td>
<td>.012</td>
<td>28.0</td>
<td>0.0</td>
<td>133.3</td>
<td>0.0</td>
<td>388.2</td>
<td>0.0 $^a$</td>
</tr>
<tr>
<td>F5</td>
<td>6.26</td>
<td>.044</td>
<td>257.6</td>
<td>117.9</td>
<td>72.2</td>
<td>0.0</td>
<td>357.8</td>
<td>0.0</td>
</tr>
<tr>
<td>F6</td>
<td>6.71</td>
<td>.035</td>
<td>126.9</td>
<td>0.0</td>
<td>0.0 $^a$</td>
<td>0.0</td>
<td>104.4</td>
<td>0.0</td>
</tr>
</tbody>
</table>

*Note.* Mdn= Median Average Dwell Time.

$^a$ Significant difference when compared to experts ($p<.05$).

$^b$ Significant difference for both the underclassmen and upperclassmen when compared to experts ($p<.05$).
**Video Segment 5 results.** The researcher identified a set of three (6.3%) AOIs for Video Segment 5, as shown in Table 7. Pairwise analysis confirmed a significant difference in median average dwell time between experts and underclassmen for AOI D4 ($U=5.0$, $p=.005$), and between experts and upperclassmen for AOI D1 ($U=8.0$, $p=.008$). Initial CAOIs were not labeled for Video Segment 5 because differences between underclassmen and experts and upperclassmen and experts were not identified for the same areas.

Table 7

*Kruskall-Wallis H Test Comparisons between Experts, Upperclassmen, and Underclassmen Pretest Median Dwell Times(ms) for Video Segment 5*

<table>
<thead>
<tr>
<th>Area of Interest</th>
<th>$x^2$</th>
<th>$p$</th>
<th>Dwell Time</th>
<th>Mdn</th>
<th>Dwell Time</th>
<th>Mdn</th>
<th>Dwell Time</th>
<th>Mdn</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>8.13</td>
<td>.017</td>
<td>593.5</td>
<td>0.0</td>
<td>136.2</td>
<td>0.0</td>
<td>603.1</td>
<td>0.0</td>
</tr>
<tr>
<td>D4</td>
<td>7.55</td>
<td>.023</td>
<td>417.0</td>
<td>393.9</td>
<td>1215.3</td>
<td>2262.1</td>
<td>1557.6</td>
<td>3073.3</td>
</tr>
<tr>
<td>F2</td>
<td>7.35</td>
<td>.025</td>
<td>1582.2</td>
<td>88.1</td>
<td>818.3</td>
<td>2532.3</td>
<td>1812.2</td>
<td>3036.7</td>
</tr>
</tbody>
</table>

*Note.* Mdn= Median Average Dwell Time.

$^a$ Significant difference when compared to experts ($p<.05$).

$^b$ Significant difference for both the underclassmen and upperclassmen when compared to experts ($p<.05$).
**Video Segment 6 results.** As shown in Table 8, the researcher identified two (4.2%) AOIs for Video Segment 6. Pairwise comparisons confirmed a significant difference between *experts and underclassmen* median average dwell times for AOI G6 ($U=12.5$, $p=.024$); however, the researcher found no differences when comparing the median dwell times of underclassmen and experts for either AOI. Therefore, initial CAOI’s were not labeled for Video Segment 6.

Table 8

*Kruskall-Wallis H Test Comparisons between Experts, Upperclassmen, and Underclassmen Pretest Median Dwell Times (ms) for Video Segment 6*

<table>
<thead>
<tr>
<th>Area of Interest</th>
<th>$x^2$</th>
<th>$p$</th>
<th>Experts</th>
<th></th>
<th>Upperclassmen</th>
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<th>Underclassmen</th>
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<tr>
<td></td>
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<td>Mdn</td>
<td>Dwell</td>
<td>Mdn</td>
<td>Dwell</td>
<td>Mdn</td>
</tr>
<tr>
<td>G6</td>
<td>14.50</td>
<td>.001</td>
<td>0.0</td>
<td>0.0</td>
<td>36.8</td>
<td>0.0</td>
<td>277.1</td>
<td>0.0 $^a$</td>
</tr>
<tr>
<td>H4</td>
<td>6.90</td>
<td>.031</td>
<td>137.6</td>
<td>556.6</td>
<td>144.1</td>
<td>511.8</td>
<td>980.1</td>
<td>484.4</td>
</tr>
</tbody>
</table>

*Note.* Mdn = Median Average Dwell Time.

$^a$ Significant difference when compared to experts ($p<.05$).

$^b$ Significant difference for both the underclassmen and upperclassmen when compared to *experts* ($p<.05$).

**Phase 2 Results**

In Phase 2, the researcher randomly assigned upperclassmen and underclassmen novice teachers to treatment or non-treatment groups. Similar to Phase 1, the researcher compared the pretest median average dwell times for the 48 AOIs using a Kruskall-Wallis H test. When a significant difference was found, the researcher used a post-hoc Mann Whitney U test to confirm similarities between the treatment and nontreatment groups. If significant differences were not found between groups, the researcher labeled them as an initial CAOI. The researcher conducted a separate analysis for each video segment.
**Video Segment 1 results.** The researcher identified an initial set of eight CAOIs for Video Segment 1, shown in Table 9. Pairwise median average dwell time comparisons showed significant differences between B5 ($U=52.0$, $p=.020$), B6 ($U=53.5$, $p=.006$), and E2 ($U=44.5$, $p=.008$) and were eliminated. Pairwise comparisons showed similarities between groups for B3, F2, G2, G3, and G4 and were labeled as CAOIs.

Table 9

*Kruskall-Wallis H test Comparisons between Expert, Non-treatment, and Treatment groups for Pretest Median Dwell Times(ms) for Video Segment 1*

<table>
<thead>
<tr>
<th>Area of Interest</th>
<th>$\chi^2$</th>
<th>$p$</th>
<th>Dwell Time</th>
<th>Mdn</th>
<th>Dwell Time</th>
<th>Mdn</th>
<th>Dwell Time</th>
<th>Mdn</th>
</tr>
</thead>
<tbody>
<tr>
<td>B3$^a$</td>
<td>8.21</td>
<td>.017</td>
<td>897.8</td>
<td>368.0</td>
<td>4029.2</td>
<td>4197.0</td>
<td>3538.9</td>
<td>3211.4</td>
</tr>
<tr>
<td>B5</td>
<td>6.19</td>
<td>.045</td>
<td>569.8</td>
<td>633.3</td>
<td>629.8</td>
<td>297.9</td>
<td>1284.7</td>
<td>1139.6</td>
</tr>
<tr>
<td>B6</td>
<td>7.31</td>
<td>.026</td>
<td>297.3</td>
<td>0.0</td>
<td>12.8</td>
<td>0.0</td>
<td>266.8</td>
<td>115.8</td>
</tr>
<tr>
<td>E2</td>
<td>7.37</td>
<td>.025</td>
<td>1097.9</td>
<td>635.0</td>
<td>2380.9</td>
<td>1949.7</td>
<td>729.0</td>
<td>296.0</td>
</tr>
<tr>
<td>F2$^a$</td>
<td>9.57</td>
<td>.008</td>
<td>692.4</td>
<td>88.1</td>
<td>4123.5</td>
<td>3552.1</td>
<td>2408.9</td>
<td>1855.3</td>
</tr>
<tr>
<td>G2$^a$</td>
<td>6.51</td>
<td>.039</td>
<td>1406.0</td>
<td>0.0</td>
<td>5799.5</td>
<td>5810.2</td>
<td>4605.6</td>
<td>3688.7</td>
</tr>
<tr>
<td>G3$^a$</td>
<td>6.64</td>
<td>.036</td>
<td>1046.3</td>
<td>871.8</td>
<td>4346.3</td>
<td>3393.9</td>
<td>3451.1</td>
<td>3307.2</td>
</tr>
<tr>
<td>G4$^a$</td>
<td>6.78</td>
<td>.034</td>
<td>2717.1</td>
<td>757.9</td>
<td>861.7</td>
<td>579.9</td>
<td>1035.5</td>
<td>680.1</td>
</tr>
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</table>

*Note.* Mdn= Median Average Dwell Time.

$^a$ Median dwell times of *treatment* and *non-treatment* group confirmed as similar ($p<.05$).
**Video Segment 2 results.** The researcher identified a set of 11 AOIs in Video Segment 2, as shown in Table 10. Pairwise comparisons confirmed significant differences between the median average dwell times of the treatment and non-treatment groups for H5 ($U=54.0$, $p=.024$). All other AOIs were confirmed as similar between the two groups and labeled as initial CAOIs for Video Segment 2.

**Table 10**

*Kruskall-Wallis H test Comparisons between Expert, Non-treatment, and Treatment groups for Pretest Median Dwell Times (ms) for Video Segment 2*

<table>
<thead>
<tr>
<th>Area of Interest</th>
<th>$\chi^2$</th>
<th>$p$</th>
<th>Dwell Time</th>
<th>Mdn</th>
<th>Dwell Time</th>
<th>Mdn</th>
<th>Dwell Time</th>
<th>Mdn</th>
</tr>
</thead>
<tbody>
<tr>
<td>B2$^a$</td>
<td>6.78</td>
<td>.034</td>
<td>64.6</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>21.3</td>
<td>0.0</td>
</tr>
<tr>
<td>B3$^a$</td>
<td>9.08</td>
<td>.011</td>
<td>2040.3</td>
<td>1543.8</td>
<td>250.0</td>
<td>0.0</td>
<td>75.5</td>
<td>0.0</td>
</tr>
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<td>C2$^a$</td>
<td>6.16</td>
<td>.046</td>
<td>548.1</td>
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<td>0.0</td>
<td>0.0</td>
<td>37.3</td>
<td>0.0</td>
</tr>
<tr>
<td>D2$^a$</td>
<td>7.39</td>
<td>.025</td>
<td>1950.7</td>
<td>2883.9</td>
<td>18.3</td>
<td>0.0</td>
<td>52.0</td>
<td>0.0</td>
</tr>
<tr>
<td>D6$^a$</td>
<td>9.60</td>
<td>.008</td>
<td>520.7</td>
<td>283.3</td>
<td>134.1</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>E1$^a$</td>
<td>11.96</td>
<td>.003</td>
<td>39.2</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>E3$^a$</td>
<td>6.87</td>
<td>.032</td>
<td>2191.6</td>
<td>943.7</td>
<td>6550.9</td>
<td>6145.4</td>
<td>5157.0</td>
<td>5194.2</td>
</tr>
<tr>
<td>E6$^a$</td>
<td>9.96</td>
<td>.007</td>
<td>211.2</td>
<td>92.0</td>
<td>54.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>F4$^a$</td>
<td>7.16</td>
<td>.028</td>
<td>2276.1</td>
<td>1816.3</td>
<td>3501.6</td>
<td>3758.0</td>
<td>4776.5</td>
<td>5106.0</td>
</tr>
<tr>
<td>G5$^a$</td>
<td>6.90</td>
<td>.032</td>
<td>942.8</td>
<td>599.8</td>
<td>1379.9</td>
<td>1466.2</td>
<td>2284.6</td>
<td>2487.6</td>
</tr>
<tr>
<td>H5</td>
<td>6.32</td>
<td>.042</td>
<td>279.0</td>
<td>192.0</td>
<td>387.8</td>
<td>90.0</td>
<td>799.7</td>
<td>653.5</td>
</tr>
</tbody>
</table>

*Note.* Mdn= Median Average Dwell Time.

$^a$ Median dwell times of treatment and non-treatment group confirmed as similar ($p<.05$).
**Video Segment 3 results.** As shown in Table 11, the researcher identified a set of four AOIs for Video Segment 3. Pairwise comparison of the treatment and nontreatment groups confirmed that there was no significant differences in median average dwell times for the four AOIs and were labeled as initial CAOIs.

Table 11

*Kruskall-Wallis H test Comparisons between Expert, Non-treatment, and Treatment groups for Pretest Median Dwell Times (ms) for Video Segment 3*

<table>
<thead>
<tr>
<th>Area of Interest</th>
<th>$x^2$</th>
<th>$p$</th>
<th>Experts Dwell Time</th>
<th>Mdn</th>
<th>Non-treatment Dwell Time</th>
<th>Mdn</th>
<th>Treatment Dwell Time</th>
<th>Mdn</th>
</tr>
</thead>
<tbody>
<tr>
<td>C2(^a)</td>
<td>6.04</td>
<td>.049</td>
<td>3189.7</td>
<td>2990.5</td>
<td>1029.2</td>
<td>1052.7</td>
<td>927.7</td>
<td>375.9</td>
</tr>
<tr>
<td>F1(^a)</td>
<td>18.48</td>
<td>.000</td>
<td>1280.4</td>
<td>260.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>G1(^a)</td>
<td>10.73</td>
<td>.005</td>
<td>1335.5</td>
<td>831.6</td>
<td>14.6</td>
<td>0.0</td>
<td>18.1</td>
<td>0.0</td>
</tr>
<tr>
<td>G4(^a)</td>
<td>7.67</td>
<td>.022</td>
<td>28.8</td>
<td>0.0</td>
<td>717.9</td>
<td>610.2</td>
<td>554.7</td>
<td>247.5</td>
</tr>
</tbody>
</table>

*Note. Mdn= Median Average Dwell Time.*

\(^a\) Median dwell times of treatment and non-treatment group confirmed as similar ($p<.05$).
**Video Segment 4 results.** As shown in Table 12, the researcher identified two AOIs for Video Segment 4. Pairwise comparison of the treatment and nontreatment groups showed a significant difference in median average dwell times for B2 ($U=67.5, p=.013$) and no difference for D6. Therefore, AOI B2 was eliminated and AOI D6 was labeled as an initial CAOI.

Table 12

*Kruskall-Wallis H test Comparisons between Expert, Non-treatment, and Treatment groups for Pretest Median Dwell Times (ms) for Video Segment 4*

<table>
<thead>
<tr>
<th>Area of Interest</th>
<th>$x^2$</th>
<th>$p$</th>
<th>Experts</th>
<th></th>
<th>Non-treatment</th>
<th></th>
<th>Treatment</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Dwell Time</td>
<td>Mdn</td>
<td>Dwell Time</td>
<td>Mdn</td>
<td>Dwell Time</td>
<td>Mdn</td>
</tr>
<tr>
<td>B2</td>
<td>6.46</td>
<td>.040</td>
<td>3189.7</td>
<td>2990.5</td>
<td>1029.2</td>
<td>1052.7</td>
<td>927.7</td>
<td>375.9</td>
</tr>
<tr>
<td>D6*</td>
<td>7.57</td>
<td>.023</td>
<td>1280.4</td>
<td>260.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

*Note. Mdn= Median Average Dwell Time.*

*a Median dwell times of treatment and non-treatment group confirmed as similar ($p<.05$).*

**Video Segment 5 results.** Analysis of median average dwell time medians for Video Segment 5 did not indicate a significant difference among gridded areas of interest for the expert, treatment, and non-treatment groups, therefore, initial CAOIs were not labeled for Video Segment 5.

**Video Segment 6 results.** The researcher did not identify significant differences when comparing the median average dwell times of the expert, treatment, and non-treatment groups for AOIs in Video Segment 6. Therefore, initial CAOIs were not identified for Video Segment 6.
Phase 3 Results

During Phase 3, the researcher retained the initial CAOIs identified in both Phase 1 and Phase 2 and discarded all others, as illustrated in Figure 5. Initial CAOIs identified in Phase 1 and Phase 2, and CAOI comparison results appear in Table 13. The researcher used final CAOIs for analysis in Phase 4 and Phase 5 of the study.

Table 13

*Initial CAOIs from Phase 1 and Phase 2, and Final CAOIs Identified for Each Video Segment*

<table>
<thead>
<tr>
<th>Video</th>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Final CAOI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>B3</td>
<td>B3, F2, G2, G3, G4</td>
<td>B3</td>
</tr>
<tr>
<td>2</td>
<td>E1</td>
<td>B2, B3, C2, D2, D6, E1, E3, E6, F4, G5</td>
<td>E1</td>
</tr>
<tr>
<td>3</td>
<td>F1, G1</td>
<td>C2, F1, G1, G4</td>
<td>F1, G1</td>
</tr>
<tr>
<td>4</td>
<td>D6</td>
<td>D6</td>
<td>D6</td>
</tr>
<tr>
<td>5a</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6a</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

*Note.* Final CAOIs are those CAOIs present in both Phase 1 and Phase 2. aCAOIs were not identified for this video.

Phase 4 Results

Phase 4 followed the logic outlined in Figure 6. The researcher used a Wilcoxon Signed-Rank Test to compare pretest and posttest median average dwell times for the five CAOIs identified in Phase 3 for the treatment and nontreatment groups to determine if the treatment significantly improved novice teachers’ dwell times. The treatment consisted of six training sessions that involved following expert eye gaze, hearing expert think aloud comments, and replicating expert comments as detailed in Chapter 3.
**Video Segment 1 results.** Comparisons of pretest and posttest median average dwell times for the treatment and nontreatment groups showed a significant difference and decrease in the median dwell time for the outlined box, CAOI B3, as shown in Table 14 by the larger number of negative verses positive ranks. In addition, as shown in the heatmaps in Figure 7 for the treatment group and Figure 8 for the non-treatment group, the outlined boxes showed large decreases in the dwell time average from pretest to posttest; posttest dwell time averages for both groups in the outlined boxes were similar to those outlined for the experts.

Table 14

*Wilcoxon Signed-Rank Test for CAOI in Video Segment 1*

<table>
<thead>
<tr>
<th>CAOI</th>
<th>Z</th>
<th>p</th>
<th>N</th>
<th>Mean Ranks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Negative</td>
<td>Positive</td>
</tr>
<tr>
<td>Treatment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B3</td>
<td>-3.01</td>
<td>.003</td>
<td>13.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Non-treatment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B3</td>
<td>-2.54</td>
<td>.011</td>
<td>11.0</td>
<td>3.0</td>
</tr>
</tbody>
</table>
Figure 7. Gridded heat maps based on average dwell time for the treatment group (pretest/posttest) and experts for Video Segment 1. CAOI B3, outlined in silver, showed a change in average dwell time from pretest to posttest for the treatment group, decreasing as required to be considered more like experts.
Figure 8. Gridded heat maps based on average dwell time for the non-treatment group (pretest/posttest) and experts for Video Segment 1. CAOI B3, outlined in silver, decreased in dwell time from pretest to posttest, resulting in dwell time averages more like the experts for CAOI B3.
**Video Segment 2 results.** As shown in Table 15, median average dwell times for the treatment group significantly increased from pretest to posttest for CAOI D2, but did not change for E1. Median average dwell times for the non-treatment group significantly increased from pretest to posttest for both CAOIs.

As shown in the heatmaps in Figure 9, the treatment groups’ dwell time averages for the box outlined, CAOI D2, a large increase was shown from pretest to posttest and resulted in dwell time averages similar to experts. No change occurred for the treatment group from pretest and posttest for the box outlined, CAOI E1. Pretest dwell time averages were already similar to the experts and remained so after exposure to treatment. The nontreatment groups’ dwell time averages for CAOI D2 and CAOI E1 increased (see Figure 10) and surpassed the time spent by experts in both areas.

Table 15

*Wilcoxon Signed-Rank Test for CAOI in Video Segment 2*

<table>
<thead>
<tr>
<th>CAOI</th>
<th>Z</th>
<th>p</th>
<th>N</th>
<th>Mean Ranks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Negative</td>
<td>Positive Ties</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Negative</td>
<td>Positive</td>
</tr>
<tr>
<td>Treatment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D2</td>
<td>-2.93</td>
<td>.003</td>
<td>0.0</td>
<td>11.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.0</td>
<td>15.0</td>
</tr>
<tr>
<td>E1</td>
<td>0.00</td>
<td>1.00</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Non-treatment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D2</td>
<td>-3.30</td>
<td>.001</td>
<td>0.0</td>
<td>14.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>E1</td>
<td>-2.02</td>
<td>.043</td>
<td>0.0</td>
<td>5.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

*Note. E1 did not change from pretest to posttest for the treatment group. The dwell time was zero.*

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Figure 9. Gridded heat maps for the treatment group pretest/posttest and experts based on average dwell time for Video Segment 2. CAOI D2, outlined in silver, increased in dwell time to become more like experts; no change occurred from pretest to posttest for CAOI E1.
Figure 10. Gridded heat maps based on average dwell time for the non-treatment group (pretest/posttest) and experts for Video Segment 2. Both CAOIs D2 and E1, outlined in silver, indicated a change in the desired direction for the Non-treatment groups’ dwell time to become more like the experts.
**Video Segment 3 results.** As shown in Table 16, median average dwell times between the pretest and posttest for CAOIs F1 and G1, outlined in silver, showed a significant difference for the treatment and non-treatment groups. Dwell times averages for the treatment group, shown in Figure 11, and those for the non-treatment group, shown in Figure 12, indicated large increases from pretest to posttest. When compared to expert dwell times averages; both the treatment and non-treatment groups average dwell times increased and surpassed the time spent by experts in both CAOIs.

Table 16

*Wilcoxon Signed-Rank Test for CAOI in Video Segment 3*

<table>
<thead>
<tr>
<th>CAOI</th>
<th>z</th>
<th>p</th>
<th>N</th>
<th>Mean Ranks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Negative</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Negative</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F1</td>
<td>-2.80</td>
<td>.005</td>
<td>0.0</td>
<td>10.0</td>
</tr>
<tr>
<td>G1</td>
<td>-3.10</td>
<td>.002</td>
<td>0.0</td>
<td>12.0</td>
</tr>
<tr>
<td>Non-treatment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F1</td>
<td>-3.18</td>
<td>.001</td>
<td>0.0</td>
<td>13.0</td>
</tr>
<tr>
<td>G1</td>
<td>-3.06</td>
<td>.002</td>
<td>0.0</td>
<td>12.0</td>
</tr>
</tbody>
</table>
Figure 11. Treatment group (pretest/posttest) and expert gridded heat maps based on average dwell times for Video Segment 3. CAOIs F1 and G1, outlined in silver, both increased and surpassed the dwell time averages required to look more like the experts.
Figure 12. Comparison of non-treatment group (pretest/posttest) and expert gridded heat maps based on average dwell times for Video Segment 3 indicated that CAOIs F1 and G1, outlined in silver, not only increased in the direction required to become more expert-like, but surpassed average dwell time of the experts in CAOIs F1 and G1.
Video Segment 4 results. The researcher found no differences between the pretest and posttest median average dwell times for the treatment ($z=-1.10, p=.27$) and non-treatment ($z=-0.66, p=.51$) groups. As shown in Figure 13, the treatment groups’ dwell time averages decreased from pretest to posttest, therefore becoming more like expert dwell times. The dwell time averages of the non-treatment group increased from pretest to posttest for outlined box, CAOI D6, as shown in Figure 14, the opposite direction required to become more like the experts.
Figure 13. Gridded heat maps illustrating the average dwell times for Video Segment 4. Average dwell time for the treatment group decreased in the direction required to resemble the experts’ average dwell time from pretest to posttest for CAOI D6, outlined in silver.
Figure 14. Comparison of non-treatment group (pretest/posttest) gridded heat maps based on average dwell times for Video Segment 4 showed an increase in average dwell time from pretest to posttest for CAOI D6, outlined in silver. This change occurred in the opposite direction desired from pretest to posttest; the desired outcome was for the average dwell time to decrease from pretest to posttest.
**Video Segment 5 results.** The researcher did not complete pretest and posttest dwell time comparisons for Video Segment 5, because the researcher eliminated all CAOIs during Phase 3.

**Video Segment 6 results.** The researcher did not complete pretest and posttest dwell time comparisons for Video Segment 6, because the researcher eliminated all CAOIs during Phase 3.

**Phase 5 Results**

In Phase 5, the researcher compared expert, upperclassmen and underclassmen posttest median average dwell times using a Kruskall-Wallis H Test. Non-significant results indicated that the upperclassmen and underclassmen were more expert-like after repeating the task, while significant results indicated that repetition had no effect.

**Video Segment 1 results.** As shown in Table 17, there was no significant difference between the posttest median average dwell times for the three groups for the outlined box, B3. Upperclassmen (see Figure 15) and underclassmen (see Figure 16) dwell times averages decreased, resulting in times more similar to experts.

Table 17

*Kruskall-Wallis H Test for CAOIs identified for Video Segment 1*

<table>
<thead>
<tr>
<th>Area of Interest</th>
<th>$x^2$</th>
<th>p</th>
<th>Experts</th>
<th></th>
<th>Upperclassmen</th>
<th></th>
<th>Underclassmen</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Dwell Time</td>
<td>Mdn</td>
<td>Dwell Time</td>
<td>Mdn</td>
<td>Dwell Time</td>
</tr>
<tr>
<td>B3</td>
<td>0.60</td>
<td>.741</td>
<td>897.8</td>
<td>368.0</td>
<td>132.5</td>
<td>0.0</td>
<td>839.9</td>
</tr>
</tbody>
</table>
Figure 15. Upperclassmen (pretest/posttest) and Expert gridded heat maps based on average dwell times for Video Segment 1 indicated that dwell time averages for CAOI B3, outlined in silver, decreased in the direction required for Upperclassmen to become more expert-like.
Figure 16. Comparison of underclassmen (pretest/posttest) and expert grided heat maps based on average dwell times for Video Segment 1 indicated that dwell time for CAOI B3, outlined in silver, decreased as needed to become more like the experts’ dwell time.
Video Segment 2 results. The analysis shown in Table 17 indicated that no significant difference was found between the median average dwell times for experts, upperclassmen, and underclassmen for the outlined boxes, CAOIs D2 and E1. Dwell time averages for upperclassmen and underclassmen increased for both CAOIs when compared with average pretest dwell times (see Figure 17 and 18).

Table 18
Kruskall-Wallis H Test for CAOIs identified for Video Segment 2

<table>
<thead>
<tr>
<th>Area of Interest</th>
<th>$x^2$</th>
<th>$p$</th>
<th>Experts Dwell Time</th>
<th>Mdn</th>
<th>Upperclassmen Dwell Time</th>
<th>Mdn</th>
<th>Underclassmen Dwell Time</th>
<th>Mdn</th>
</tr>
</thead>
<tbody>
<tr>
<td>D2</td>
<td>0.62</td>
<td>.732</td>
<td>1950.7</td>
<td>0.0</td>
<td>2021.9</td>
<td>0.0</td>
<td>2312.2</td>
<td>213.9</td>
</tr>
<tr>
<td>E1</td>
<td>0.94</td>
<td>.626</td>
<td>39.2</td>
<td>0.0</td>
<td>203.9</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>
Figure 17. Comparison of upperclassmen (pretest/posttest) and expert gridded heat maps based on average dwell time for Video Segment 2 showed that dwell time for CAOIs D4 and E1, outlined in silver, both increased as required to become like the experts.
Figure 18. Comparison of underclassmen (pretest/posttest) and expert gridded heat maps based on average dwell times for Video Segment 2 showed that dwell time for CAOIs D6 and E1, outlined in silver, increased as required to become like the experts.
**Video Segment 3 results.** The analysis shown in Table 19 indicated no significant difference between the median average dwell times for experts, upperclassmen, and underclassmen for the outlined boxes, CAOIs F1 and G1. Analysis showed dwell time averages for upperclassmen (see Figure 19) and underclassmen (see Figure 20) increased for both CAOIs when compared with pretest dwell time averages.

Table 19

*Kruskall-Wallis H Test for CAOIs identified for Video Segment 3*

<table>
<thead>
<tr>
<th>Area of Interest</th>
<th>$\chi^2$</th>
<th>$p$</th>
<th>Experts</th>
<th>Upperclassmen</th>
<th>Underclassmen</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Dwell Time</td>
<td>Mdn</td>
<td>Dwell Time</td>
</tr>
<tr>
<td>F1</td>
<td>0.49</td>
<td>.784</td>
<td>1280.4</td>
<td>0.0</td>
<td>2213.8</td>
</tr>
<tr>
<td>G1</td>
<td>1.76</td>
<td>.414</td>
<td>1335.5</td>
<td>0.0</td>
<td>2528.6</td>
</tr>
</tbody>
</table>
Figure 19. Comparison of upperclassmen (pretest/posttest) and expert gridded heat maps with average dwell times for Video Segment 3 indicated large increases in dwell time for CAOIs F1 and G1, outlined in silver. These increases moved in the direction required to become more like the experts.
Figure 20. Comparison of underclassmen (pretest/posttest) and expert gridded heat maps based on average dwell times for Video Segment 3 showed that dwell time for CAOs F1 and G1, outlined in silver, increased in the direction needed to become more like the experts.
**Video Segment 4 results.** Posttest results, shown in Table 20, indicated a significant difference between groups for the outlined box, CAOI D6, suggesting the groups viewed the area differently.

Pretest results indicated a decrease in dwell time average was required for both upperclassmen and underclassmen to view CAOI D6 more like experts. As shown in Figure 21, the dwell time average of upperclassmen increased from pretest to posttest, the opposite of the desired result. Figure 22 shows a decrease in dwell time average from pretest to posttest for underclassmen, however, when compared to experts’ differences in dwell time average for CAOI D6 were still large.

Table 20

*Kruskall-Wallis H Test for CAOIs identified for Video Segment 4*

<table>
<thead>
<tr>
<th>Area of Interest</th>
<th>$x^2$</th>
<th>$p$</th>
<th>Dwell Time</th>
<th>Mdn</th>
<th>Dwell Time</th>
<th>Mdn</th>
<th>Dwell Time</th>
<th>Mdn</th>
</tr>
</thead>
<tbody>
<tr>
<td>D6</td>
<td>6.26</td>
<td>0.044</td>
<td>54.4</td>
<td>0.0</td>
<td>777.5</td>
<td>216.1</td>
<td>914.9</td>
<td>0.0</td>
</tr>
</tbody>
</table>
Figure 21. Comparison of upperclassmen (pretest/posttest) and expert gridded heat maps based on average dwell times for Video Segment 4 indicated that dwell time for CAOI D6, outlined in silver, changed in the opposite direction required to be more expert-like; upperclassmen dwell time needed to decrease, yet an increase in average dwell time occurred.
Figure 22. Comparison of Underclassmen (pretest/posttest) and Expert gridded heat maps based on average dwell times for Video Segment 4 showed that dwell time for CAOI D6, outlined in silver, decreased as needed to be more like the experts, yet a large difference remained between the two.
**Video 5 results.** The researcher did not conduct posttest analysis for Video Segment 5 because CAOIs were not identified during Phase 3.

**Video 6 results.** The researcher did not conduct posttest analysis for Video Segment 6 because CAOIs were not identified during Phase 3.

**Visual Content Analysis using Pretest AOI Heatmaps**

The researcher conducted a visual analysis of novice and expert teachers’ pretests for each video segment showing a significant difference in average median dwell time between groups to compare the areas of the classroom viewed and to identify the most observed AOI for each group. Visual comparisons were completed for video segments one through four to compare upperclassmen, underclassmen, and experts. Video segments five and six were not compared because significant differences in average median dwell time were not found.

Visual analysis was completed using color-coded gridded heat maps. The amount of time spent observing AOIs was represented with highlighted boxes in the following colors: blue, green, yellow, orange, and red. The blue boxes represented AOIs observed the least and progressed through the listed colors to the red box that represented the AOI observed the most. Colors indicated total average dwell time and were not based on continuous viewing; participants may have looked away from the area and revisited it after looking elsewhere.

**Video Segment 1 results.** Video Segment 1 was selected from videos recorded at school one of the symphonic band described in Appendix C. As shown in figure 23, visual analysis of pretest heat maps showed that overall upperclassmen, underclassmen, and experts mostly viewed the same areas, as indicated by the green, yellow, and orange highlighted boxes for each group heatmap, but time in those areas varied. Both groups of novice teachers spent most of their time observing AOI G2, as indicated by the red square outlined with a silver box; this AOI was
observed much less by experts. The experts observed AOI F4 more than any other AOI, as indicated by the red box outlined in silver.

AOI G2 was positioned over the bass drummer, located at the back of the room, who was using incorrect playing technique with distracting gestures and large bass drum strokes; the bass drum was a dominant sound in the video recording. Throughout the video, the bass drum player turned and talked to other percussionists and rarely looked at the conductor.

AOI F4, observed by the experts, was positioned over a flute player, at the front of the room. The flute player had issues with hand position, posture, and playing technique that affected her overall sound quality and intonation.
Figure 23. Pretest gridded heatmaps for Video Segment 1 that were used to make visual comparisons between the average dwell time of Underclassmen, Upperclassmen, and Experts.
**Video Segment 2 results.** Video Segment 2 was selected from videos recorded at school two described in Appendix C. As shown in figure 24, more differences were observed between experts and novices when comparing heatmaps for Video Segment 2. Experts scanned the entire classroom more, as indicated by the large amount of green AOIs, but were clearly focused in AOI D4, indicated by the red box outlined in silver. Both the upperclassmen and underclassmen spent the most time observing AOI E3, indicated by the red box outlined in silver.

AOI D4 included an alto saxophone player and flute player throughout the video segment. The alto saxophone player was distracted and talked with another alto saxophone player in the section, often had improper embouchure, and showed issues with posture. The flute player had incorrect playing technique, instrument carriage, and posture that affected intonation. The AOI observed most by the experts, AOI D4, was the second highest area of focus for upperclassmen, but not as high of a priority for underclassmen.

Both the upperclassmen and underclassmen spent the most time observing AOI E3, an area that included the bass drummer and occasionally a trombone player. The bass drummer was using large strokes on the bass drum and did not have a music stand or music. He rarely looked at the conductor. The trombone player was bent over in his chair with collapsed shoulders and incorrect hand position.
Figure 24. Pretest gridded heatmaps for Video Segment 2 that were used to make visual comparisons between the average dwell time of Underclassmen, Upperclassmen, and Experts.
**Video Segment 3 results.** Video Segment 3 was selected from videos recorded at school three described in Appendix C. As shown in figure 25, underclassmen, upperclassmen, and experts had the largest average dwell time in the same AOI, D2, outlined in silver. AOI D2 included two students in the percussion section who were switching between the triangle, snare drum, and bass drum. Both students exhibited playing technique issues with all three instruments. Due to the switching of instruments for the percussionists, the second highest observed area by the experts was AOI C2, the yellow box outlined in black. Experts scanned other areas as indicated by the green AOIs, but spent most of their time observing in AOIs D2 and C2.

Both underclassmen and upperclassmen spent the second highest amount of time observing AOI E3, outlined in black. This AOI included a clarinet player who played with her head down and cheeks puffed. When compared to experts, the upperclassmen and underclassmen observed AOI C2 for less than half the length of time. Experts observed AOI E3, but did not spend a large amount of time observing the area.
Figure 25. Pretest gridded heatmaps for Video Segment 3 that were used to make visual comparisons between the average dwell time of Underclassmen, Upperclassmen, and Experts.
**Video Segment 4 results.** Video Segment 4 was selected from videos recorded at the summer music camp described in Appendix D. As shown in figure 26, the average dwell times of underclassmen were more similar to that of the experts than the dwell time of upperclassmen as demonstrated by the number of green and blue boxes present on the gridded AOI heatmaps. Upperclassmen scanned the room more and stopped in various AOIs, demonstrated by the number of yellow boxes on the gridded AOI heatmap, focusing on posture and horn position issues. Underclassmen and experts scanned these areas but did not chose to focus on them for an extended amount of time.

All three groups identified one distinct area of interest; however, the area was not the same between experts and novices. Upperclassmen and underclassmen identified AOI D5 as indicated by the red box outlined in silver, and experts identified AOI E3, indicated by the red box outlined in silver.

AOI D5 included a flute player without an instrument seated in the center of the front row of the ensemble. Throughout the segment the flute player leaned on her stand, wrote on her music, and looked around the room. Underclassmen remained more focused in the identified area than upperclassmen, who also spent considerable time scanning other areas of the room and focusing on posture and instrument position issues of various students as indicated by the green and yellow boxes in figure 26.

AOI E3 included a French horn player with embouchure, hand position, and horn carriage and playing technique issues that could be heard in the recording. The student stopped playing for a few moments, but did not put her instrument down.
Figure 26. Pretest gridded heatmaps for Video Segment 4 that were used to make visual comparisons between the average dwell time of Underclassmen, Upperclassmen, and Experts.
CHAPTER 5
DISCUSSION

Research Questions

The research questions guiding this study were:

1. How does the eye gaze focus of novice and expert instrumental music teachers compare when observing videos of middle school band rehearsals?

2. Can expert eye gaze replay be used as an effective training method for novice teachers in the area of situational awareness?

3. Does novice teachers’ eye gaze begin to look more similar to experts’ through repetition?

Eye Gaze Comparison of Novice and Expert Teachers

Results of this study showed that 90.6% of the total AOIs had median average dwell times that were similar between experts and novices and only 1.7% were consistently different enough to become CAOIs. Generally, these results suggest that both novice and expert teachers view middle school band rehearsals similarly, contradicting previous research that showed experts spend time dwelling on specific areas more than novices (Wolff et al., 2016). Though the number of CAOIs were few for each video, when the average dwell time data of the four video segments were visually examined and compared with contents of the videos, descriptive differences between groups appeared that align with previous research and need to be taken into consideration.

When comparing the qualitative observations in the four video segments to Wolff et al. (2016), comparisons can be made concerning the type of information observed. Wolff
recognized that novice teachers focus on distracting information more than experts who spend time focusing on relationships of distractors and the surrounding areas. In general, when considering all four video segments evaluated, it appears that novice teachers recognize surface information such as posture, instrument playing position, and technique that is easily visible (e.g., hand position), all of which could be considered distractors in the music classroom. Evidence showed that experts focused on those areas, but move on to areas that required more in-depth analysis (e.g., specific playing technique, fingerings, embouchure).

Determining the exact reason for these differences is difficult, yet could indicate that novice teachers struggle with identifying exact problems and spend more time searching for where to look than experts who identify a problem area and spend time observing, diagnosing, and correcting the issue. Likewise, large differences between novice teachers’ and experts’ dwell time in specific areas supports the idea that a hierarchy of time occurs and has been recognized by other researchers regarding eye gaze and individual music instruction (Duke & Marcum, 2016). The reason for this phenomenon is not evident, but perhaps could be attributed to individual teachers’ variations in skill level, knowledge, and application. Recognizing an issue is one step, but subject knowledge and pedagogical solutions are required to efficiently address issues that are observed. If a difference occurred between novice and expert teachers, it is feasible that the area included information that needed attention, but the processes for addressing the issues were varied between expert and novice teachers. The small amount of time spent in some AOIs by experts could mean that they diagnosed the issue quickly and moved on to more pressing issues, while novice teachers required more time in the area to discover the solution. This small amount of time may also indicate that expert teachers make decisions concerning the importance of their observations and those they focus on the most. Expert teachers may have
determined some areas were not that important and dismissed them, whereas novice teachers chose to spend more time in the area to understand and address the concern. It is also possible that expert teachers observed specific areas and began diagnosing the problem, but continued to scan the video for a concern of higher priority. A teacher may identify an issue, diagnose it quickly, and simultaneously address the issue while also searching for the next area to be addressed. These possibilities align with previous research, suggesting that expert teachers scan the room more than novice teachers (Wolff et al., 2016), which would result in a lower dwell time for experts because their time was spent in a larger number of areas when observing.

Differences between novice and expert teachers may be related to the ability to set and maintain learning objectives and goals during instruction. When examining the most observed AOIs for the four videos, novice teachers observed the percussion section for the largest amount of time in two of the four videos, while experts observed the area, but did not spend the majority of their time focusing in the area. Anecdotal evidence suggests that the percussion section of an ensemble is often given less attention than other sections of the ensemble and novice teachers are advised to be aware of this. Given this information and recognizing that situational awareness is a goal oriented process (Ensley, 1995), it is reasonable to consider that novice teachers focused on the percussion section for such a large portion of time because it was their goal to avoid ignoring them, a goal that they were able to meet. Pre-determining goals and ways to achieve them could solve a lot of concerns regarding situational awareness in the classroom. On the other hand, it may be argued that lesson plans are written in advance to serve this purpose. However, large ensemble instruction is complex and the environment while teaching varies from moment–to–moment, even when having a detailed plan. Teachers determine goals and objectives to meet during instruction, but cannot accurately predict what may occur each moment of instruction;
teachers may observe other problem areas that need attention. This requires the teacher to determine which area is the most important to attend to, which may be more difficult for novice teachers than experts and have an affect their focus during instruction.

**Expert Eye Gaze Replay Training**

Findings of this study did not support that eye gaze replay can be used to effectively advance novice teachers’ eye gaze. Evidence showed that while participants in the treatment group improved from pretest to posttest, those assigned to the nontreatment group also improved. The lack of differences between the treatment and nontreatment group and the improvement of both groups from the pretest to posttest for the five identified CAOIs indicates that repetition had an effect; however, the effectiveness of eye gaze replay as a training tool remains undetermined.

It is not clear why the treatment did not effectively influence novice teachers’ eye gaze. The treatment used in this study included expert think-aloud verbalizations combined with expert guided eye gaze, a technique that Jarodzka et al. (2013) successfully implemented when studying fish locomotion patterns. The ineffectiveness of this technique when observing middle school band rehearsals suggests that the nature of the task itself may have been an issue. Perhaps hearing verbalizations and following expert eye gaze, while also observing classroom content created a cognitive load that was too high for novice teachers and was more than novice teachers could comprehend or pay attention to at one time. It is also a possibility that the differences between the observation patterns of experts and those of the novice teachers were different enough that hearing the model experts’ think-aloud process created cognitive dissonance for novice teachers who may have preferred looking at something else in the video.

Or, perhaps the way experts observe is an issue when considering training methods for novice teachers. In the examples used for the treatment group, the model expert scanned the
room until an area of interest was identified, he stopped momentarily to observe the area, and then simultaneously spoke about his observations and began scanning the room for the next area of interest. Because novice teachers’ eye gaze indicates that they tend to linger in areas longer than experts, it is feasible that expert teachers identify an area, talk about it, and then move on. These differences between the two may have been too overwhelming for novice teachers. An approach incorporating eye gaze replay and retrospective comments that allow novice teachers to focus on one task at a time may be more effective.

The improvement of all participants indicates that the treatment may not have been distinctive enough to separate those novice teachers who received treatment and those who did not. For example, the researcher purposefully used unscripted middle school band rehearsals to represent authentic classroom situations to prepare teachers for the realities of observing and responding in a school environment over participation in a simulation. If the video segments were scripted and contained a few purposefully constructed opportunities for instruction (e.g., improper embouchure, incorrect fingerings, poor instrument position) that gradually increased in difficulty and progressively required greater discrimination by the observer, the breakdown of instruction may have provided a more effective method of learning to observe like expert teachers and applying the technique to authentic classroom situations. On the other hand, if the treatment incorporated a method that began with authentic situations and slowly reduced the number of prescribed areas until the observer was successful, then added them back gradually, taking into consideration the skill level and knowledge of each individual student, the outcome may have been different. A more prescribed rehearsal for the treatment like those used by Wolff et al. (2016) may provide more advancement for individual novice teachers, larger differences in
dwell times between those who participated in the treatment and those who did not, and expedite eye gaze abilities of novice teachers that can then be applied in classroom situations.

It is possible that more differences did not occur between the treatment and nontreatment group due to experimental bias, in this case known as the John Henry Effect (Heinich, 1970). The John Henry Effect occurs when the experimental group or even the control group perceives themselves at a deficit, resulting in greater efforts. This increased effort could eliminate differences that may have occurred between the two groups. In this study, when forming the treatment and nontreatment groups, the researcher told the participants they would receive an email to set their next participation date and that it would not be the same for everyone. The participants were therefore aware that some students would participate in the treatment portion of the study and some would not. It is feasible that the John Henry Effect did indeed occur.

**Eye Gaze Improvement through Repetition**

Posttest results showed that for three out of the four video segments, no significant differences were found between novice and expert teachers. Novices’ average dwell time increased or decreased in the desired direction when compared to their pretests, indicating that novices viewed the video segments more like experts after watching the video segments a second time. Overall, these findings suggest that repetition and practice serves as an appropriate training tool and encourages novice teachers to observe rehearsals of middle school bands similar to experts. Video Segment 4 was the only video segment that showed a significant difference among groups; a difference occurred for both underclassmen and upperclassmen.

Even though novice teachers’ eye gaze became more like the experts’ through repetition, there are still concerns considering the observations of novice teachers when viewing middle school band rehearsals. Overall median average dwell times increased or decreased in the desired
direction after participating in the study for the examined videos, but in several cases, not only did the increase or decrease occur in the appropriate direction, novice teachers’ dwell time averages were often longer than that of the experts. Whereas this change in eye gaze focus is desired, this extended time may indicate that novice teachers need more time to interpret what they are observing, causing them to spend less time on other aspects required to properly manage the classroom. Worthy and Thompson (2009) identified this trait as an important aspect of effective teaching.

**Possible confounding variable.** Video Segment 4 was the only video segment analyzed in Phase 5 that was taken from the recordings of the summer music camp. The examined CAOI, D6, included an area at the front of the room that included the ensemble conductor; in video segments one through three, the conductor was not in view of the camera. The conductor was seen in all three of the camp videos, but it was determined during the video segment selection process that inclusion of the conductor was not distracting (see Appendix E); however, that may not be the case for novice teachers.

When examining the amount of time spent in CAOI D6, the experts looked in the area briefly with an average dwell time of 54.4 ms, but moved on to other areas. The upperclassmen spent time in the area for the pretest with an average dwell time of 611.1 ms, and for the posttest spent even more time in the area with an average dwell time of 777.5 ms. The underclassmen spent time in the area during the pretest (1287.4 ms) and decreased their time spent there during the posttest to look more like the experts, but the decrease in average dwell time (914.9 ms) was not large enough to consider them to be more like the experts. These findings suggest that experts looked at the conductor some of the time, but moved on to other more important areas of the video segment; however, upperclassmen and underclassmen spent more time observing the
conductor than the experts did. When evaluating other areas of the video segment, the upperclassmen and underclassmen spent most of their time viewing AOI D5, right above CAOI D6, so even when they looked away from the conductor, the majority of their time was spent directly in front of the conductor observing a flute player in the same general direction. The flute player being observed did not have her flute out to play and was distracting to surrounding students. Meanwhile, the experts spend most their time observing AOI E3 (3121 ms), an AOI including a French horn player who had posture, embouchure, and hand position issues.

The reason the novice teachers spent more time observing the conductor is not clear. Perhaps novice teachers spent time observing the conductor as a habit of watching the conductor while participating in ensembles. It is also feasible that novice teachers look to the conductor as a model for their future selves and spent time in the area observing conducting techniques or ensemble communication. As future teachers in training, another possibility is that novice teachers spent time in the area observing and critiquing the teacher’s conducting techniques as they work to perfect their own. While it is difficult to determine the exact reason they spent time looking in the area, it is clear that novice teachers did not spend time gathering the same information as the expert teachers. Future studies should eliminate the conductor from the stimulus video.

Limitations and Recommendations for Future Research

The use of eye tracking in this study provided information about the observations of novice and expert teachers and where they spend their time looking when observing middle school band rehearsals; however, more in-depth analysis is needed to understand how eye gaze impacts overall teaching effectiveness. The current researcher examined eye data, and although verbalizations of the participants were recorded, they were only used as a tool to keep students
on task and were not examined. A combination of eye tracking data (i.e., eye gaze) and an analysis of the think-aloud comments could provide more information about the connections novice and expert teachers make between their observations and responses.

The tools used in the treatment portion of this study serve as a starting point and need refining to explore situational awareness. A more prescribed method with planted errors would provide the opportunity to address teacher’s various ability levels concerning situational awareness. As technology continues to move forward, more options may develop that provide more effective methods for in–the–moment observations.

**Conclusion**

Situational awareness is a vital component of expertise in a multitude of fields, and is dependent on individual eye gaze (O’Meara et al., 2015). Researchers have used eye gaze recording and training techniques to understand differences between novices and experts (Marquard et al., 2011) and in education, researchers have used eye gaze recording to explore where teachers look in the classroom and the relationship between eye gaze and teachers’ situational awareness (Wolff et al., 2016). In this study, the researcher sought to understand music teachers’ situational awareness by comparing the eye gaze of expert and novice instrumental music educators when observing middle school band rehearsals and testing the effectiveness of an instructional program utilizing expert-guided eye gaze to improve situational awareness. Pretest results indicated that 90.6% of the AOIs were similar when comparing novice and expert teachers’ eye gaze for the six video segments. Additional results showed that the expert guided eye gaze did not have an impact on novice teachers’ eye gaze; however, an improvement did occur due to repetition for four (80%) of the five final CAOIs from pretest to posttest. Novices’ eye gaze generally became more like the experts (Wolff et al., 2016).
Gladwell (2007) suggested that experts make quick unconscious decisions without identifiable reasoning and based on knowledge and skills acquired. Based on findings in this study, it is reasonable to think that experts make quick decisions, but whether teachers observe every aspect of the classroom and attend to chosen aspects is up for debate. Eye gaze evidence has shown that while expert teachers identify specific areas of interest, they cover a larger area of the classroom, allowing them to make more decisions and observations during one rehearsal, while novice teachers remained focused in smaller areas for longer periods of time, resulting in less scanning of the classroom. In addition, eventually novices find important areas, first identified by experts through repeated attempts, but novice teachers need to decrease the length of time in the evaluation process. Researchers have spent considerable time exploring teachers’ effectiveness through the examination of skills and techniques used in the classroom (Goolsby, 1996; Standley & Madsen, 1991; Wolff et al., 2016) and eye gaze may provide valuable data.

The results of this study did not indicate a substantial difference between those who participated in the expert guided eye gaze training and those who did not, which could be related to a multitude of factors. Eye gaze tracking of novice teachers provided valuable information that could assist them in increasing teacher effectiveness in the area of music education. Possibilities will continue to grow as technology advances, equipment becomes more accessible, and more research is conducted.
REFERENCES


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doi:10.1177/0270467604265535


doi:10.1177/87551233020210020701


doi:10.1177/1057083710393152


APPENDIX A

Institutional Review Board Approval

July 14, 2015

Danielle Todd
School of Music
The University of Alabama
Box 870366

Re: IRB # 15-OR-221, “The effect of guided eye gazing on speed and accuracy of rehearsal decisions made by preservice band directors”

Dear Ms. Todd:

The University of Alabama Institutional Review Board has granted approval for your proposed research.

Your application has been given expedited approval according to 45 CFR part 46. You have also been granted the requested waiver of informed consent. Approval has been given under expedited review category 7 as outlined below:

(7) Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

Your application will expire on July 12, 2016. If your research will continue beyond this date, please complete the relevant portions of the IRB Renewal Application. If you wish to modify the application, please complete the Modification of an Approved Protocol Form. Changes in this study cannot be initiated without IRB approval, except when necessary to eliminate apparent immediate hazards to participants. When the study closes, please complete the Request for Study Closure Form.

Please use reproductions of the IRB approved stamped consent forms to obtain consent from your participants.

Should you need to submit any further correspondence regarding this proposal, please include the above application number.

Good luck with your research.

Sincerely,

Carpanuto T. Myles, MSM, CIM, CIP
Director & Research Compliance Officer
Office for Research Compliance
The University of Alabama
APPENDIX B

Participant Recruitment Handout

Study Title

The effect of expert guided eye gaze on novice Instrumental music educators’ observations of middle school band rehearsals.

Principal Investigator

E. Danielle Todd

Who: Freshmen, Sophomore, Junior, and Senior Instrumental Music Education Majors.

What: A research study investigating the differences between novice and expert instrumental music educators in areas of situational awareness (i.e., the ability to perceive the classroom environment, comprehend the meaning, and make immediate and future adjustments). After identifying if and what differences exist the researcher will investigate a way to train novice instrumental music educators to think more like an expert before leaving the classroom and beginning their first teaching job using guided expert eye gaze replay.

When: August 24, 2015 – October 6, 2015

Time Requirements:
- Week 1: 30-minute individual appointment with the researcher
- Week 2-5: Six individual appointments with researcher (30 mins each)
- Week 6: 30-minute individual appointment with the researcher
- All appointments will be schedule at participants’ convenience.

Where: Computer lab located in Moody Music Building, Room 238 (behind vending machines)

Why: This study is important because identifying differences between novice and expert teachers and finding ways to teach novice teachers to think more like experts will help teachers be more successful benefiting them and their students.

How: To participate in this study please fill out the participant information sheet and turn it in after class. I will be available to answer any questions you have and take your completed forms. If your willingness to participate changes please email Danielle Todd at todd00@crimson.ua.edu.
Description of Middle School Bands

School One

The band program served 97 students in grades six through eight, with a school enrollment of 625. Two bands were recorded at this location, the concert band and symphonic band. The concert band consisted of 25 members, 24 of which were in their second year of experience and one completing her first year. Six of the students were in grade seven and 19 were in grade eight. The band was comprised of 56% females and 44% males. The symphonic band had 29 members, 27 of which were in their third year of experience, one in her second year, and one completing her first year. Twenty-eight of the students were in eighth grade and one was in seventh grade. The band was comprised of 58% females and 42% males.

The band director earned a Bachelor's Degree in 2005 and a Master's Degree in 2011, both from The University of Alabama. He has taught middle school band for 10 years; 9 years at his current school. He was a member of the National Association for Music Education (NAfME), the Alabama Music Educators Association (AMEA), and the Alabama Bandmasters Association (ABA).

School Two

The band program served 90 students in grades six through eight, with a school enrollment of 500. The band recorded for this study was the top performing band and had a total of 45 members. Twenty-eight of the students were in eighth grade, completing year 3 of
instruction and 19 were in seventh grade, completing year two of instruction. The band was comprised of 45% females and 55% males.

The band director was a first-year middle school band director and earned his Bachelor's Degree in 2013 from the University of Alabama. His band attended music performance assessment and received superior ratings. The director was a member of the National Association for Music Education (NAfME), the Alabama Music Educators Association (AMEA), the Alabama Bandmasters Association (ABA), and the National Band Association (NBA).

School Three

The band program served 66 students in grades 6 through 8, with a school enrollment of 325. The band recorded for this study had 19 members, all of which were in grade 8, completing year two of instruction. The band was comprised of 58% females and 42% males.

The band director was a first-year middle school band director. She earned a Bachelor's Degree in 2010 and a Master's Degree in 2014, both from The University of Alabama. She was a member of the National Association for Music Education (NAfME), the Alabama Music Educators Association (AMEA), and the Alabama Bandmasters Association (ABA).

School four

The band program served 375 students in grades six through eight, with a school enrollment of 1050. The band recorded for this study was the top band at this school and consisted of 80 members. Sixty-five of the students were in eighth grade, completing year three of instruction and 15 were in seventh grade, completing year two of instruction. The band was comprised of 50% females and 50% males. The band program served 375 students in grades six through eight, with a school enrollment of 1050.
The band director has taught middle school band for nine years; eight years at his current school. He earned a Bachelor's Degree in 2006 and a Master's Degree in 2008, both from The University of Alabama. He was a member of the National Association for Music Education (NAfME), the Alabama Music Educators Association (AMEA), and the Alabama Bandmasters Association (ABA). He serves as a guest conductor and adjudicator across the state. His bands have received superior ratings at Music Performance Assessment for the past seven years and he was recognized by his local school system as Teacher of the Year in 2012.
APPENDIX D

Stimulus and Treatment Video

Description of Middle School Summer Camp Band

The University of Alabama summer music camp was available to middle school and high school students who completed grades seven through 12 during the prior school year; participants were required to pay a registration fee and auditioned for chair placements. Students were separated into the Crimson Band for high school students (i.e., grades 10-12) and the White Band for middle school students (i.e., grade six through eight). The camp began on Sunday afternoon with registration and concluded on Friday with a final public performance. After registration, students completed an audition for chair placements that included four chromatically adjacent scales and a brief sight-reading piece. The ensemble rehearsed each morning from 8:30 a.m. to 10:00 a.m. and again in the afternoon from 1:00 p.m. to 3:45 p.m.

The band recorded for this study was the middle school band, White Band, and consisted of 36 members. The band was comprised of 49% females and 51% males. Members of the band were 6th, 7th, and 8th grade students from various schools; percentages of each grade level were unknown.

The director of the White Band has taught for 23 years. He received his Bachelor of Music Education degree from Valdosta State University, the Master of Science in Music Education from Troy State University and was pursuing his Doctorate of Musical Arts in Music Education from Boston University during the time of the study. His bands have performed at state music education conferences and university band festivals, and received the National Band
Association’s “Citation of Excellence.” The director was also named Teacher of the Year and received the Phi Beta Mu “Outstanding Instrumental Music Educator Award.”
APPENDIX E

Creation of Pretest/Posttest Video Stimulus

The researcher watched all of the video recordings collected at local schools and the summer music camp and selected excerpts with student performances or demonstrations lasting at least 30 seconds with minimal director talk. The videos were evaluated by a second person with 23 years of experience in research and instrumental teaching for consistency in camera angles, content, and perspective. Videos recorded at three schools were eliminated due to inconsistencies in ensemble and equipment setup when compared to other recorded bands (3 hr, 1 min, and 2 s).

Equipment used for recording rehearsals was set up so that the director of the ensemble was not included, however, the director was visible at times. Recordings collected at the local middle schools included the director less than those recorded at the summer music camp. Examination by the researcher and a senior researcher determined that due to the angle of the camera setup, the inclusion of the director in the camp videos was not distracting except when the director blocked the view of students in the ensemble from the camera.

All video recordings were imported into the computer program, iMovie (10.1) and placed into separate project files; one for each recording location. Video recordings were evaluated individually and usable segments were isolated using the split clip tool. Segments including excessive teacher talk, student talk, or distracting images of the director were omitted.
**Special Editing**

In two of the video segments, the director used brief phrases or words that could be distracting. To isolate this segment of the video, the researcher detached the audio and video tracks, isolated the section including talk with the split clip tool, and muted that portion of the audio track.

In four of the video segments, the field of view was digitally altered to equivocate the size of the ensemble and scale of students across video segments.

All video segments were evaluated for content, choosing segments with variety and demonstrating specific concepts such as; tone, balance, blend, intonation, articulation, rhythm, technique, and dynamics, that are often used in performance rubrics (Latimer, Burgee, & Cohen, 2010). If two segments were similar in content, the segment considered to be the best for the task, which was not necessarily the best-performed or most accurate representation, was used. A total of 103 video segments were created using the camp videos and 27 using the local school videos.

Similar to Standley and Madsen (1991), the researcher reviewed all identified segments \((N=130)\) and narrowed the total number of selections to 20, 10 from local schools and 10 from the summer music camp, through evaluation of variety, content, and duration (as close to 60 seconds as possible); number of recordings per ensemble was not a consideration. All 20 videos were copied and saved individually as *iMovie* files labeled Pretest/posttest Video and numbered sequentially. The transition tool was used to insert a two-second fade affect to the beginning and end of each video selection.

To include a two second blank space between videos for the final stimulus creation, a separate *iMovie* video was created using the tile tool. A black centered title page was inserted
and adjusted to last for two seconds; no words were added, the screen remained black. The file was saved and labeled *Black Video*.

All videos were exported in MP4 format to the computer desktop and stored in a file labeled *Videos for Pretest/Posttest*. For compatibility with the eye tracking software, videos were converted from MP4 to AVI format using an online video converting website (www.onlinevideoconverter.com) and saved on an external hard drive. Settings were adjusted to offer the clearest video for the stimulus. Pixel count was set to 1920 x 1080, frames per second to 24, and bitrate to 13,934 and chosen using the following formula: (2,073,600 x 24) x 4 x 0.07 = 13,934,592 bps / 1000 = 13,934 kbps bitrate (www.ezs3.com). Other settings were not adjusted (e.g., sound). The high action video example was used because it offered the best picture and streaming was not a concern.

The video stimulus was created using a Dell Latitude E6530 laptop provided by SMI with preloaded software, *Experiment Center* (version 3.5). A new experiment was opened and labeled *Pretest/Posttest* and instructions were inserted at the beginning, midway, and end of the stimulus using the text tool. Eye movement recording controls were set to "do not record" when participants were reading instructions or calibrating their eyes. Pretest/posttest videos segments 1 through 20 were inserted with a "black video" inserted between each one (e.g., between Video 1 and Video 2, between Video 2 and Video 3, between Video 3 and Video 4). After video 10, the researcher paused the experiment while participants took a two-minute break. A standard timer was used to keep track of time during the break and participants were notified when it ended. During the break participants were allowed to stand, drink water, and check phone messages, but were not allowed to leave the room. Participants spoke to the researcher during the break, but the study was not discussed. After the break, participants continued with the remaining ten videos.
APPENDIX F

Creation of Treatment Videos

To maintain consistency throughout the training process, one ensemble was used for the development of the training stimulus. As such, the total number of rehearsals recorded during the week of the summer music camp resulted in more usable clips than the videos recorded at various schools. Therefore, treatment videos were developed using videos recorded during summer music camp rehearsals \((n = 93)\) that were 30 to 60 seconds in length. Videos included as part of the pretest and posttests were not used for the treatment portion of the study.

Literature

Music for daily rehearsals included warm-ups provided by the director, (e.g., scales, rhythms, and tuning patterns) and literature chosen by the conductor to be performed at the final camp concert. Selections included: *The City of Lights*, by Andrew Watkin, *Piper's Rhapsody*, James Hosay, *The Water Is Wide*, by James Swearing, *Groovee!*, by Richard Saucedo, and *The Lion King* (selections), arranged by Paul Lavender. All selections were classified as Grade Level 2 by publishers.

Model Expert

To develop the stimulus for the experimental portion of the study, the researcher and an experienced researcher in music education discussed and agreed on one expert music middle school instrumental music educator to serve as the model expert; the model expert was not the
The model expert was contacted requesting participation. Time requirements, travel, hotel stay, and basic information were discussed, however, specific contents and processes surrounding the study were not shared so the expert could also serve as one of the five experts in the study. After agreeing to participate, a date and time was scheduled for the model expert to complete the two-day process. The model expert traveled to the University of Alabama and was provided hotel stay, food compensation, and travel expenses.

**Pretest participation.** The model expert followed a similar protocol as the other experts and participated in the pretest. Since the model expert was on site, the study was administered in the School of Music using equipment and setup that was identical to those used for the novice teachers. Collected data was used in combination with the other four experts as part of the expert comparison group.

**Eye movement modeling examples (EMME).** After completing the pretest, the model expert watched 93 videos from the summer music camp that were considered in the creation of the treatment, while eye movement data were collected and think aloud comments were recorded. Calibration was completed for each video the expert watched. To reduce fatigue, a
break was scheduled every ten minutes. Additional breaks were provided as requested by the model expert.

Collected data were used to develop the training videos used during the study for the preservice teacher treatment group. Videos watched by the model expert using *Experiment Center (version 3.5)* were opened in *Begaze (version 3.5)* to develop expert eye gaze replay videos using the eye gaze replay tool. The expert’s eye gaze was superimposed on the video screen using a large yellow transparent circle to highlight where the expert was looking while watching the video.

To develop the EMME video, the following settings were adjusted by clicking the box next to the appropriate setting: raw data, hide zero data, no connection lines, no trailer, and right eye only. “Right eye only” was chosen based on the calibration numbers collected from the expert prior to watching each video. Calibration numbers for the expert teacher were lower for the right eye than the left, which coincided with his indication that he was right eye dominant. The cursor was set as a translucent yellow circle 150 pixels in size to allow enough coverage to easily highlight the area where the expert was looking while observing the video segments of a middle school band rehearsal as shown in *Figure 4*. To eliminate fixation count during the gaze replay, “no fixation counter” was selected.

Videos were exported and the box indicating “use initial settings” was checked. Replay video output settings were set to: 25 frames per second, a video size of 1680/1050, High Quality Xvid encoder, a playback speed of 100%, and export stimulus audio. Apply watermark was not used. Videos were saved with the title *Clip* followed by the original video number. Videos were exported in AVI format and converted to MP4 format using the website onlinevideoconverter.com. When converting videos, settings were kept to original exported
settings. All videos were previewed to check the quality of the gaze replay and to confirm the export process was successful.

**Selection of eye gaze replay video segments.** Videos for the pre- and posttest stimulus and videos considered for the treatment were edited at the same time. The process is described in Appendix E. Once all videos were edited for duration, separate files and labels (e.g., Video 1, Video 2, etc.) were created for each video segment and they were stored on an external hard drive in mp4 format. A total of 30 files were selected to be used as part of the treatment. Once all videos were edited for duration, separate files and labels (e.g., Video 1, Video 2, etc.) were created for each video segment and they were stored on an external hard drive in mp4 format.

Video segments \((n = 93)\) viewed by the model expert were reevaluated for content and eye gaze clarity. Those video segments 30 seconds or more in duration were isolated and prepared using *iMovie* for possible use with the experimental group based on Goolsby's (1996) recognition that expert teachers tend to allow students to perform for an average of 30 seconds or more during rehearsals before stopping and giving feedback. If the video segment was less than 30 seconds, but content was desired, the researcher evaluated whether two video segments could be combined and did so if the content was sequential and combining was not awkward or distracting. When combined, the *iMovie*-transition tool was used to insert the cross-dissolve transition from one scene to the next; the video did not stop. A total of 30 files were selected to be used as part of the treatment.

**Adding expert commentary to eye gaze replay videos.** The original audio recording of the experts’ think aloud comments were in one continuous sound file for each session recorded. The researcher identified the matching expert commentary by consulting transcripts of the
experts’ think aloud comments and original video recordings and separated them into matching segments for the use with the eye gaze replay videos.

The researcher separated the original audio from each eye gaze replay video and added the expert commentary sound file to each corresponding video segment; expert commentary sound files included the recording of the ensemble in the background and could be clearly heard.

To align the sound with the video, the researcher used the percussion as a visual aid and adjusted the sound file as needed, increasing and decreasing the start position and location. Comparisons were made with the newly edited videos and the original videos to confirm accurate alignment.

All instructions were read aloud, recorded, and added to the training videos by the researcher. To limit the number of volume adjustments needed and ensure consistent sound levels between sound files and spoken segments, the sound for original video clips were reduced to 50% playback and all voice recordings for commentary and instructions were increased to 200%.
BIOGRAPHICAL SKETCH

Name: Eleanor Danielle Todd

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Higher Education:
- The University of Alabama Tuscaloosa, Alabama
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Experience:
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  2006-2012
  Band (7-8)
- Northern Kentucky University
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Honors:
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