Choral Directors' Knowledge Of Biological And Sociological Sex Differences In The Secondary Choral Classroom

by

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ABSTRACT

Secondary choral directors who enter the work force are expected to teach all types of choirs, including mixed-sex choirs, male choirs, and female choirs. Most undergraduate programs address voice change differences and literature selection for same-sex choirs. The literature would indicate that little to anything else pertaining to biological and sociological sex differences are discussed. Additionally, there is no definitive research that addresses whether or not other biological and sociological sex differences would aid in the success of secondary choral directors. The purpose of this study was to assess choral directors' knowledge of biological and sociological sex differences in the secondary choral classroom. There were three null hypotheses: (1) there will be no differences in directors' knowledge of sex differences based a variety of different variables; (2) there will be no differences in directors' expressed need for more knowledge and training of sex differences based on several variables; and (3) there will be no difference in regards to which sex choral directors prefer to work with based on several variables. Data suggest a variance in choral educators' knowledge about sex differences. The data also indicates that the majority of survey participants knew little to nothing about biological and sociological sex differences that could potentially impact the secondary choral classroom. Based on these findings, the researcher has concluded that many of the participants have not been exposed to the literature and research stating that understanding these differences could positively affect the success of both the teacher and the student in the classroom. Findings also suggest that there is a need and a

desire for more knowledge and training regarding biological and sociological sex differences as they pertain to the secondary choral classroom.

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CHAPTER 1

INTRODUCTION

Statement of the Problem

Secondary choral directors who enter the work force are typically expected to teach all types of choirs, including mixed-sex choirs, male choirs, and female choirs. They may not be prepared to do so. Most undergraduate programs address voice change differences and literature selection for same-sex choirs. However, there is no definitive research that addresses whether or not other biological and sociological sex differences would aid in the success of secondary choral directors. Based on the general education literature, teachers' success could be improved if they had more awareness and understanding of biological and sociological sex differences in the classroom (Cable & Spradlin, 2008; Hannon & Ratliffe, 2007; Rex & Chadwell, 2009; Sax, 2005; Sax, 2010). It stands to reason that secondary choral directors could experience similar benefits of success if they had more knowledge regarding students' biological and sociological sex differences.

Researchers and authors suggest there are numerous issues regarding sex differences that affect learning and instruction in general education classrooms. Most of these sex differences can be categorized into either biological or sociological differences. Differences include, but are not limited to, (a) brain differences (Bland, 2003; Brizendine, 2006; Gurian, 2001; James, 2007; Moir & Jessel, 1991; Obleser, Rockstroh & Eulitz, 2004; Ruytjens, Albers, Van Dijk, Wit, & Willemsen, 2006; Shaywitz et al., 1995;

Snodgrass & Harring, 2004-2005; Van Dyke, Zuverza, Hill, Miller, Rapport, & Whitman, 2009), (b) hearing differences (Brizendine, 2006; Moir & Jessel, 1991; Sax, 2005), and (c) behavioral differences (Cable & Spradlin 2008; Carp, 2004; Downey & Vogt, 2005; Jorgensen & Pfeiler, 2008; Pollard, 1999; Sadker & Sadker, 1994; Sax, 2009; Wilson, 2010). Educators and researchers suggest that knowledge of these sex differences could improve instruction in the regular education classroom (Cable & Spradlin, 2008; Hannon & Ratliffe, 2007; Rex & Chadwell, 2009; Sax, 2005; Sax, 2010). The researcher believes that knowledge of these biological and sociological sex differences could potentially benefit instruction in the secondary choral classroom.

Teacher attrition is a major problem within the field of education. Within the first three years of teaching the attrition rate for all teachers is 20% (Hancock, 2008). Specifically, music teachers have an attrition rate between 11-27% (Hancock, 2009), with secondary music teachers at a 95% higher risk of attrition/migration compared to elementary music teachers (Hancock, 2008). Research suggests that teacher preparation has a great deal to do with teacher attrition (Hancock, 2008). Teacher preparation that includes a more acute awareness of biological and sociological sex differences could potentially decrease teacher attrition in education.

Despite the wealth of general education literature pertaining to awareness of sex issues and success in the classroom (Cable & Spradlin, 2008; Hannon & Ratliffe, 2007; Rex & Chadwell, 2009; Sax, 2005; Sax, 2010), there is a lack of coverage on these topics in choral methods textbooks, choral methods classes, other music education courses, professional organizations, and professional development opportunities. Scholars and researchers have suggested that discussions of these issues in teacher preparation classes

and professional development seminars may lead to greater success in the classroom (Cable & Spradlin, 2008; Hannon & Ratliffe, 2007; Rex & Chadwell, 2009; Sax, 2005; Sax, 2010).

While there is a great deal of literature about sex differences in general education, little has been written pertaining to sex differences in the choral classroom. Further, most of this literature is not research-based. The available literature relates primarily to literature selection (Barham, 2001; Buchanan & Mehaffey, 2005, Buchanan & Mehaffey, 2007; Brunner, 1992) and voice change (Cooksey 1977(a); Cooksey, 1977(b); Cooksey, 1977(c); Cooksey, 1978; Gackle, 1987; Gackle, 1991).

Teacher Training

Researchers have indicated that training relating to biological and sociological sex differences tends to aid instructors in making better pedagogical choices (Hannon & Ratliffe, 2007; Martino, Mills, & Lingard, 2005; Rex & Chadwell, 2009; Sax, 2005; Sax, 2010). Awareness of these issues could be beneficial to teachers' success in the classroom, which may include better classroom discipline, better understanding of how each of the sexes processes and comprehends information, and better pedagogical choices (Hannon & Ratliffe, 2007; Rex & Chadwell, 2009; Sax, 2005; Sax, 2010).

Biological Sex Differences

Biological sex differences can greatly impact the delivery of instruction in the classroom. These differences have been shown to affect language processing, language and speech development, learning style preferences, student focus, instructional preferences, pedagogical preferences (Barton & Cohen, 2004; Gurian, 2001; James,

2007; Moir & Jessel, 1991; Sax, 2005; Shaywitz et al., 1995; Vasich, 2005), and hearing differences (James, 2007; Moir & Jessel, 1991; Sax, 2005).

Biological sex differences in the brain's structure and function are important to understanding the optimal way in which each of the sexes learns. Educators who have knowledge of the brain's structure and function could possibly be more effective in the classroom because of their increased knowledge of how each of the sexes learns. Structural brain differences include, but are not limited to, differences in hemispheric size and amount of connectors between the hemispheres. Functional biological sex differences include; how each sex processes information and communicates (Barton & Cohen, 2004; Gurian, 2001; James, 2007; Moir & Jessel, 1991; Sax, 2005; Shaywitz et al., 1995; Vasich, 2005).

Behavior Sex Differences

There are many behavioral differences between the sexes. Scholars have suggested that gender differences in student behavior may relate to how the brain functions. Behavior may also be impacted by sociological constructs that have been established and reinforced by society's expectations of the different sexes. Based on this information, teachers may be advised to consider the ways in which they instruct and interact with their students (Pollard, 1999; Sadker, 2002; Vogt, 2005).

Teacher Attention Differences Regarding Behavior

The literature states that teacher attention directed at the students differs between the sexes (Sadker, 2002). Overall, during instruction females tend to receive less teacher attention than males. Sadker (2002) observed that this lack of teacher attention towards female students might be due to attention being redirected toward male students who are

disruptive to the classroom environment. Some scholars have suggested that same-sex classes may be the answer to try and equalize teacher attention. Same-sex classes enable the teacher to focus on pedagogical practices and materials that will be most effective for the sex being instructed (Cable & Spradlin, 2008; Pollard, 1999; Sax, 2005).

Emotional Sex Differences

Emotional sex differences are tied to how the brain processes language and emotion. According to the literature, females process language and emotion in the same area of the brain while males process language and emotion in two separate areas of the brain (Cable & Spradlin, 2008). These structural differences in the brain impact how the sexes express emotion both between and among the sexes. The knowledge of structural brain differences and its relationship to emotional expression might be of great benefit to teachers as they prepare to instruct students.

Learning Style Differences

Males and females tend to have different learning style preferences. Males tend to be more peer-oriented, kinesthetic, and prefer peer groups rather than teacher-directed instruction (Honigsfeld & Dunn, 2003). In contrast, another scholar wrote that males prefer the structure of teacher-centered learning as long as the classroom is active (Sax, 2005). Females, on the other hand, tend to have greater levels of self-motivation and persistence when it comes to learning (Honigsfeld & Dunn, 2003). In general, females tend to want to please the teacher and avoid risk taking (Sax, 2010). This trait of fear of risk taking is traditionally not associated with males. Males tend to like to take risks. Teachers that understand these learning style differences could be more effective in the classroom.

Temperament

Researchers have identified temperament as another sociological sex difference that affects instruction in the classroom (Else-Quest, Hyde, Goldsmith, & Van Hulle, 2006). Overall, females tend to have a more agreeable temperament and are able to deal with aggression in less confrontational ways than males. Females tend to internalize feelings while males tend to externalize feelings. Researchers have reported that male's externalization of feelings can often lead to behavioral issues in the classroom (Else-Quest, Hyde, Goldsmith, & Van Hulle, 2006).

Summary

Researchers have identified numerous biological and sociological sex differences that could potentially affect student success in the classroom. As reported in the literature, biological sex differences include, but are not limited to, the following: (a) the structure of the brain, (b) processing differences, (c) language and speech development, (d) attention differences (Barton & Cohen, 2004; Gurian, 2001; James, 2007; Moir & Jessel, 1991; Sax, 2005; Shaywitz et al., 1995; Vasich, 2005), and (e) hearing differences (James, 2007; Moir & Jessel, 1991; Sax, 2005). Sociological sex differences include behavior differences (Pollard, 1999; Sadker, 2002; Vogt, 2005); emotional differences (Cable & Spradlin, 2008); learning style differences (Honigsfeld & Dunn, 2003); and temperament differences (Else-Quest et al., 2006). Authors have stated that knowing about and understanding these biological and sociological sex differences could aid student and teacher success in the classroom (Hannon & Ratliffe, 2007; Rex & Chadwell, 2009; Sax, 2005; Sax, 2010).

Need for the Study

At this time, little has been written pertaining to sex differences in the secondary choral classroom. Research has been conducted regarding biological and sociological sex differences within the general education classroom as well as sex related issues in the instrumental music classroom. The literature pertaining to sex related issues in the instrumental classroom includes topics such as: (a) instrument selection (Abeles, 2009; Eros, 2011; Johnson & Stewart, 2004), (b) jazz improvisation (Wehr-Flowers, 2006), (c) participation in high school and collegiate instrumental jazz ensembles (McKeage, 2004), and (d) solo participation in jazz festivals (Steinberg, 2001). Even though there is research relating to limited issues dealing with sex differences in the instrumental classroom, there is a lack of research regarding sex differences directly related to choral music. An awareness of biological and sociological sex differences could greatly benefit the pedagogical practices of secondary choral directors, because they could direct their instruction and preparation based on the sex differences in their classrooms. In addition to working with both sexes in their classrooms, many choral directors instruct same-sex choirs throughout their school day (e.g., men's choirs or women's choirs). Therefore, research is needed to help secondary choral directors understand sex differences and their implications in the same-sex classroom.

This study investigated choral directors' attitudes about and knowledge of selected student biological and sociological sex differences in the secondary choral classroom. An inquiry was conducted regarding choral directors' teaching preference of all-male or all-female choirs related to the variables of: sex of the choral director, years of experience, level currently teaching, highest degree earned, and whether they taught a

same-sex choir. The survey also asked participants to respond to statements based on research-based sex differences to check their knowledge base. Additionally, choral directors were asked to reflect on the extent to which they believed that greater awareness of sex differences would improve their classroom. Authors have demonstrated that knowledge of these sex differences can greatly benefit the regular education classroom (Hannon & Ratliffe, 2007; Rex & Chadwell, 2009; Sax, 2005; Sax, 2010). Further, researchers have acknowledged that the lack of information regarding sex differences in the classroom highlights a need for teacher training for optimal success in the classroom (Hannon & Ratliffe, 2007; Martino et al., 2005; Rex & Chadwell, 2009; Sax, 2005; Sax, 2010).

Purpose of the Study

The purpose of this study was to assess choral directors' knowledge of biological and sociological sex differences in the secondary choral classroom. This descriptive study was based on the following null hypotheses: (a) There will be no difference in directors' knowledge of sex differences based on sex of the choral director, years of experience, level currently teaching, highest degree earned, and directors who teach single-sex choirs and those who do not; (b) There will be no differences in directors' expressed need for more knowledge and training of sex differences based on sex of the choral director, years of experience, level currently teaching, highest degree earned, and directors who teach single-sex choirs and those who do not; (c) There will be no difference in regards to which same-sex choir directors prefer to work with based on sex of the choral director, years of experience, level currently teaching, highest degree earned, and directors who teach single-sex choirs and those who do not.

The results of this survey could be beneficial for future researchers interested in pursuing this line of inquiry; professional music organizations in planning for future professional development opportunities; secondary methods teachers in planning their courses; and planning future teacher training. Most importantly, this research may provide valuable insights to choral directors regarding more effective and appropriate instruction for their students in the secondary choral classroom.

Assumptions

This research was conducted under the following assumptions:

1. Choral directors in Alabama, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia and West Virginia share similar training in regards to instructing in the choral classroom.
2. Responses to the survey accurately reflect participant views and opinions.

Definition of Terms

The following terms were identified for the purpose of this study:

1. Same-sex choir: Same-sex choirs describe any choir with all-males or all-females. This does not include treble choirs with boys in them.
2. Secondary choral director: A choir director with choir students in any grades six through 12.

Limitations

This study had the following limitations:

1. The administration of the survey instrument was limited to the timeframe of February 29, 2012 through March 3, 2012.

2. Participants in this study included only choral directors attending the ACDA 2012 Southern Division Conference.
3. The researcher chose sex differences to be examined for this study based on the literature available related to education. The sex differences being examined are by no means a comprehensive list of male and female sex differences.

CHAPTER 2

REVIEW OF LITERATURE

There is little doubt that there are differences between the sexes (Bland, 2003; Brizendine, 2006; Gurian, 2001; James, 2007; Moir & Jessel, 1991; Obleser, Rockstroh & Eulitz, 2004; Ruytjens, Albers, Van Dijk, Wit & Willemsen, 2006; Shaywitz, et al., 1995; Snodgrass & Harring, 2004-2005; Van Dyke, Zuverza, Hill, Miller, Rapport, Whitman, 2009). Schooling once included single-sex classes to prepare each of the sexes for traditional life roles such as home economics for females and woodshop for males. Contemporary education, however, has evolved beyond this dated justification for segregating the sexes. Today, same-sex classes are used to provide individualized instruction that caters to the biological and sociological sex differences of males and females.

Based on the literature, there are many biological and sociological sex differences that impact education. However, little research has been conducted pertaining to sex differences in the secondary choral classroom. A more comprehensive understanding of these differences could potentially benefit instruction and student achievement in the choral classroom. Currently, most of the scholarly works regarding sex differences in the choral classroom is limited to octavo selection (Barham, 2001; Brunner, 1992; Buchanan & Mehaffey, 2005; Buchanan & Mehaffey, 2007), and voice change (Cooksey 1977a; Cooksey, 1977b; Cooksey, 1978; Cooksey, 1992; Gackle, 1987; Gackle, 1991; White & White, 2001). Since these topics have been covered extensively in existing literature

reviews, they will not be addressed in the current study. Instead, the literature review will focus on the topic of sex differences in the same-sex classroom.

The media uses the terms "gender" and "sex" interchangeably. Since this can be confusing for the reader, the researcher has made the following distinction within this literature review. "Sex" will refer to the biological differences of males and females, and "gender" will relate to the behavioral and social tendencies (Jordan-Young, 2010).

History of Same-Sex Classrooms

Same-sex classrooms have a longstanding tradition in the public and private educational system in the United States and abroad. The same-sex classroom began in the United States in the middle of the 1800s when there was tremendous growth in the public educational system. It was not until the 1970s, when Title IX was introduced that same-sex classes became limited by the government. This law prohibited same-sex classrooms in most learning environments (Cable & Spradlin, 2008; U.S. Department of Labor, 2011). Title IX (2005) stated, "No person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving federal financial assistance" (Title IX, Education Amendments of 1972, Section 1681, Sex, para. 1) Under Title IX, a few of the classroom subjects were allowed to remain segregated by sex, including choir and sex education (Cable & Spradlin, 2008; U.S. Department of Labor, 2011).

Resurgence of Same-Sex Public Schooling

Same-sex public schools and classes experienced resurgence after the creation of *No Child Left Behind*, mandated by the federal government in 2001. This government

initiative included funds that were available to public school districts to implement new programs. One of these programs included same-sex classes and schools (No Child Left Behind, n.d.). Renewed interest in same-sex classrooms and schools seems to have fueled an increase in literature regarding this topic. This inflation can be seen in the increased amount of research and scholarly articles written pertaining to biological and sociological sex differences.

Justification for Same-Sex Classes

Advocates for same-sex education have contended that separating the sexes better fits the educational and social needs of female and male students. Pedagogues have claimed that a major benefit of separation of the sexes is higher achievement in the classroom (Jackson, 2010; Jackson & Smith, 2000). Authors have also justified same-sex classrooms based on the documented learning style differences among the sexes (Honigsfeld & Dunn, 2003; Sadker, 2002).

Males and females exhibit different strengths and weaknesses, which need to be addressed in the classroom. Learning style differences and preferences are some of the issues that need to be discussed prior to instruction. Authors have reported that separating the genders into same-sex classes allows the teacher to instruct to the strengths of each of the sexes (Cable & Spradlin, 2008; Martino et al., 2005; Sadker, 2002).

Gender bias can influence the perception teachers have concerning each of the students. As related to gender bias, Sadker (2002) wrote, "*both* boys and girls exhibited different strengths and had different needs" (p. 283). This statement pertaining to gender bias is consistent with the reporting's of Honigsfeld and Dunn (2003) concerning the different needs of males and females.

Social issues can often impede the learning environment in a mixed-sex classroom setting (Sax, 2001). Through their research, Cable and Spradlin (2008) questioned some of the data for same-sex schooling. As indicated by these authors, students' social tendencies could affect student achievement and success in the classroom. Female and male students are often distracted, or preoccupied, with non-academic issues in a mixed-sex classroom setting because they like to socialize with the opposite sex. Further, students tend to be more interested in their reputation and appearance in a mixed-sex classroom compared to a same-sex classroom. Separating the sexes often reduces or eliminates the socialization issues that can impact student learning.

Educational Experiences for Males and Females

The educational experience could be very different for a male student and a female student in the same classroom (Pollard, 1999). Students' educational experiences are affected by many different variables within and outside of the learning environment. These factors and socialization issues could potentially have an impact on academic achievement and success.

Gender stereotyping and bias could adversely affect the learning environment in any classroom setting. Gender stereotyping is the exaggeration, and often one-sided portrayal of males and females (Marshall, 1998). Scholars have stated that students may receive different educational experiences because of gender stereotyping and gender bias (Pollard, 1999; Sadker, 2002). Gender stereotyping originates with students, teachers, parents, and the media (Walker, n.d.).

Gender stereotypes could possibly have a negative impact on the education of students (Sadker, 2002). Gender bias continues to be perpetuated by educational

materials, teachers, and students, while behaviors by females and males reinforce gender stereotypes. Sadker (2002) stated, "The truth is that *both* boys and girls exhibit different strengths and have different needs, and gender stereotypes shortchange all of us" (p. 238).

Some examples of gender stereotyping are that males are tough and never cry; females should cook and clean; and males should be the primary breadwinners in the family. Teachers who are not aware of gender issues can perpetuate these stereotypes (Marshall, 1998). Mainstream media tends to perpetuate these gender stereotypes through advertising and other messaging because the stereotypes are socially acceptable (Marshall, 1998).

Gender bias is defined as "A term in sociology and women's studies for bias associated with sexual roles in society and gender terms in language" (McArthur, 1998, Gender Bias section, para. 1). An example of gender bias is "Well, she's supposed to be back by now but she's probably stopped off somewhere to gossip" (McArthur, 1998, Gender Bias section, para. 1). The learning environment in a classroom may be impacted if the teacher is not aware of gender stereotypes and gender bias (Pollard, 1999; Sadker, 2002). Females have less opportunity for problem solving and receive less teacher attention than males (Pollard, 1999). They may also feel repressed in a mixed-sex classroom setting, which could lead to less classroom participation and subsequently adversely affect females' academic performance. Regarding gender stereotyping, Sadker (2002) wrote, "Certainly boys (like girls) confront gender stereotypes and challenges, and teachers and parents must work hard every day to make schools work for all children" (p. 236). Therefore, males as well as females can be impacted negatively by gender stereotyping.

Same-Sex Classrooms and Schools

England and Australia have a large number of same-sex schools resulting in a vast body of research relating to the topic. Jackson and Smith's (2000) research compared single-sex and mixed-sex schooling. The authors performed two studies; one investigated the perceptions of female students in England over a 10-year period, while the other was a longitudinal study conducted over a two-year period that followed students in a same-sex math class. The first study included two Australian secondary schools which had transitioned from a single-sex to mixed-sex environment. Results of this study indicated no decline in student achievement for 15-year-olds. The first year of the transition demonstrated a slight decline in self-concept, but the years following showed no decline in self-concept. The second study was conducted over two years in a co-educational school in England. Single-sex math classes were created for one section of students. Eighty percent of the females in the study indicated a desire to remain in single-sex classes for the following year, while 72% of the males expressed a preference to return to mixed-sex math classes. Jackson and Smith (2000) reported that the high percentage of males wanting to return to a mixed-sex environment could be related to social issues that only occur when they are around the opposite sex.

Teacher – Student Interaction

Authors have documented differences regarding the amount of teacher–student interactions in the classroom. As compared to their male counterparts, females tend to have less academic contact with the teacher during class (Sadker, 2002). Cable and Spradlin (2008) observed that teachers call on males eight times more often than females in the classroom. Further, the authors reported that males tend to be rewarded rather than

punished for speaking out of turn in class. Jones and Dindia (2004) conducted a meta-analysis of 32 studies that examined teacher effectiveness. The researchers were specifically examining teacher-initiated contact with students and whether these interactions varied based on the sex of the student. Results of the meta-analysis indicated that teachers had more negative interactions with males and more interactions in general with male students compared to their interactions with female students. The gender of the teacher, which will be discussed later in this chapter, was also found to correlate with the behaviors of the students.

Females tend to respond positively to teachers who care about them even if they do not like the subject being taught. A female student who believes that the teacher cares about her will usually work hard in any subject so that she will not disappoint the teacher. This is not the case for males. Males generally do not worry about disappointing a teacher if they do not like a subject or care about their grades (Sax, 2010).

Researchers have noted that teachers treat male and female students differently for the same behavior. Males often receive more negative attention in the classroom than females. Sadker (2002) observed that teachers tend to punish males more publicly, severely, and much more often than girls. This more severe punishment occurs even when males break the same rules as females (Sadker, 2002). However, these statements regarding the punishment of males contradict the work of Cable and Spradlin (2008), who found that males get away with more unacceptable behavior in comparison to females.

The Need for Teacher Training in the Same-Sex Classroom

Various authors have argued that the entire education profession fails to emphasize the role of gender in the classroom (Sadker, 1999; Sanders, 1997; Sanders & Campbell, 2001). One of the main determinants of failure for the same-sex classroom is a lack of teacher training in preparing individuals to teach the separated sexes (Hannon & Ratliffe, 2007; Rex & Chadwell, 2009; Sax, 2005). Scholars have stated that California's unsuccessful attempt at same-sex schools was due, in part, to lack of teacher training (Campbell & Sanders, 2002; Sadker & Zittleman, 2004).

Some of the failures in same-sex classrooms can be related to lack of teacher preparation and knowledge. As reported in the literature, few of the teachers in California felt prepared to instruct in the same-sex classroom (Gray & Wilson, 2006). Twenty-nine percent of the teachers studied believed that they needed no special training in order to teach in the same-sex classroom. Additionally, Gray and Wilson (2006) reported 55% of the teachers did not enjoy instructing all-male classes and 71% indicated that they would rather teach mixed-sex classes. The teachers who taught all-male classes indicated that the classes were more active. Teachers in the study also perceived that competition and bullying increased in the all-male classes (Gray & Wilson, 2006).

As noted in the previous studies, teacher training can impact the effectiveness of educators in a same-sex environment. In a similar study, Gray and Leith (2004) noted that 53% of teachers received no training on gender issues prior to teaching. The authors reported that 92% of the teachers had received no training within the past five years. Teachers in this study said that they felt that more training and awareness of teaching in

the same-sex classroom were needed to help understand some of the issues involved in instructing in the same-sex classroom.

Teachers who have knowledge pertaining to sex differences tend to be more effective in the classroom. Researchers investigating a school in Canada discovered that many curricular-related issues were related to same-gender instruction. One of the main findings was that teacher perception of gender impacted the content being taught (Blair & Sanford, 1999). Martino et al. (2005) reported that teachers' knowledge about gender greatly impacted the way in which they instructed in the same-sex classroom. Teacher assumptions regarding gender tend to be made pertaining to the way boys behave, respond, and learn as a group. Accordingly, assumptions occur when teachers lack training and knowledge regarding gender issues in the classroom (Martino et al., 2005).

Scholars have addressed in the literature some of the reasons that boys tend to struggle in school. Sadker (2009) reported that there are five factors associated with boys failing in school. They were: (a) teaching methods that are not geared towards the ways in which boys learn (b) video games that separate boys from reality and real-life goals; (c) overprescribed prescription drugs for ADHD, which may be causing some damage to the motivational areas of the brain; (d) environmental estrogens from some foods as well as plastic bottles that are reducing the testosterone levels in boys; and (e) the reduction of masculine role models in society (Sax, 2009).

Instructional strategies and materials based on sex differences have been found to impact the success of teachers and students in the same-sex classroom. Martino et al. (2005) "…focused on developing teachers' knowledge about boys and in the ways that the teachers taking the boys' classes ought to utilize pedagogical practices and curriculum

materials that were connected to their perceptions of boys' interests" (p. 250). Researchers reported that male teachers were able to relate better to boys in all-male classes as compared to female teachers (Martino et al., 2005). Conversely, Ashley (2010) noted that little evidence exists that male teachers are better suited for teaching boys with regards to singing.

Multiple authors have argued that teachers need to receive professional development training regarding gender issues in the classroom (Hannon & Ratliffe, 2007; Martino et al., 2005; Rex & Chadwell, 2009; Sax, 2005). Gender training would enable the teacher to be more cognizant of gender-related issues when designing pedagogical methods. It has been suggested that without gender training teachers tend to make assumptions regarding how males learn, respond, and behave. Martino et al. (2005) concluded that more research is needed regarding the programs designed to inform educators about the social and educational needs of females and males in schools. Student success in same-sex classes relies on programs for teacher training that consider pedagogical and curriculum adaptations to better fit the educational needs of the sexes.

Student/teacher interactions seem to be one of the issues adversely affecting the sexes in the mixed-sex classroom (Cable & Spradlin, 2008; Jones & Dindia, 2004; Pollard, 1999; Sadker, 2002). Hannon and Ratliffe (2007) conducted a study of 67 high school physical education students. Validity issues should be noted due to the small population of students, but the results for that population were conclusive with a 91% rate of reliability. Two different instructors taught the two co-educational classes. One class remained co-educational throughout the study while the other one was divided by sex. The trained observers used a modified version of the *Observational Recording Record of*

Physical Educator's Teaching Behavior to indicate the type and rate of verbal interactions with instructors. Researchers discovered that more teacher/student interactions occurred in the single-sex class as compared to the co-educational class.

The correlation between teacher training and student and teacher success in the same-sex classroom has been well documented. Rex and Chadwell (2009) examined the history of same-sex classes and the importance of teacher training for success in the same-sex classrooms in South Carolina. According to the literature, South Carolina has experienced a great deal of success in single-sex classrooms partly due to the teacher training programs that have been implemented. Sadker and Zittleman (2004) criticized the move towards same-sex classrooms because most school systems put no forethought into how they should be implemented or who should be trained. Therefore, many of the same-sex classrooms that are discussed in Sadker and Zittleman's (2004) study failed. Sax (2005) indicated that failure in the same-sex classroom tends to happen when there is a lack of training or professional development. Additionally, Sax (2010) reported that schools tend to teach to the female brain and; therefore do not address the needs of males in the classroom. Class subjects must be taught specifically with the sexes in mind for students to have optimal success.

Teachers do not always receive the training they need in order to be successful in the same-sex classroom. Teachers need to be trained to teach boys and to be aware of potential gender bias and gender issues in classroom materials and textbooks (Weaver-Hightower, 2003). Additionally, the gender of the teacher needs to be carefully considered when instructing in the same-sex environment. Campbell and Sanders (2002) found that teachers in same-sex classrooms were not necessarily familiar with training

related to gender-equitable issues. This lack of training could enable traditional gender stereotypes to prevail in the classroom.

Based on the research literature, instructors who teach in both a same-sex and mixed-sex environment should not use the same pedagogical strategies or materials (Streitmatter, 2002). Streitmatter (2002) conducted a year long qualitative study of one high school teacher who taught both single-sex and mixed-sex math classes. The study consisted of interviews and observations of male and female students who were taught by a male teacher. The researcher wanted to know whether or not students would behave differently in a same-sex environment as compared to the mixed-sex environment and if the instructor's teaching style would differ based on these two class formats. The researcher reached three conclusions. First, all of the students, regardless of sex, agreed that they were better able to focus on classroom work in the single-sex classes. Second, each of the sexes indicated that distractions existed in a mixed-sex setting that did not exist in the single-sex classes. Finally, each of the sexes expressed different perspectives about being in a single-sex classroom. The research concluded that girls were less inhibited in the same-sex class. It also stated that the teacher used different teaching styles with them as compared to the mixed-sex classroom (Streitmatter, 2002).

Sex of the Teacher

Research has been conducted regarding the sex of the teacher and his/her effectiveness in the same-sex classroom. Martino et al. (2005) suggested that it did not matter if the teacher was male or female in a same-sex classroom. The researchers reported that one of the keys to teaching boys was, "…developing teachers' knowledge about boys and in the ways that the teachers taking the boys' classes sought to utilize

pedagogical practices and curriculum materials that connected to their perceptions of boys' interests" (Martino et al., 2005, p. 250). A related study concluded that male and female teachers had teacher traits that were more preferable to each of the sexes (Hutchings et al., 2008). Female students tended to like teachers who were helpful, generous, nice, and kind, while male students tended to like teachers who were authoritative, intelligent, and knowledgeable. Males also liked teachers because of the kind of work the teachers asked them to do. Therefore according to this research, the sex of the teacher was not as important to the students as were the traits teachers possessed (Hutchings et al., 2008).

Sex and Gender Issues in Textbooks and Teaching Pedagogies

There is little information in teacher education textbooks regarding how to teach females and males (Koza, 1992; Zilleman & Sadker, 2006). Zittleman and Sadker (2006) examined 23 textbooks written between 1998-2001 and discovered that only 3% of the textbooks addressed gender distinctions, while most had no mention of gender. Based on these findings, the researchers indicated that future teachers would gain little to no knowledge from their methods textbooks regarding teaching in the same-sex classroom (Zittleman & Sadker, 2006). In a related study, Campbell and Sanders (1997) documented that two-thirds of science and math methods professors spent two hours or less during the entire college semester instructing about gender equity.

Few studies have been written regarding sex bias in music textbooks. Koza (1992) conducted a study regarding female musician equality in music textbooks. The researcher examined 3,500 illustrations in music textbooks and hypothesized that bias existed. Even though the partiality towards males was different from publisher to

publisher, 68.9% of the illustrations depicted male students. Koza (1992) found that either females were omitted in illustrations or the proportions were greatly in favor of males.

Anatomy of the Brain

In the past 20 years, a significant amount of educational, medical, and psychological research has been conducted on brain differences between the sexes (Bland, 2003; Brizendine, 2006; Gurian, 2001; Gurian & Stevens, 2004; Moir & Jessel, 1991; Mostafa, 2006). This abundance of research is due in part to the influx of same-sex classrooms and schools as a result of *No Child Left Behind*. Some sources are written by educators who are trying to enlighten parents and teachers on the scientific facts of brain research (Gurian, 2001; Gurian & Stevens, 2004), while others are written by doctors whose focus is brain research (Bland, 2003; Brizendine, 2006; Moir & Jessel, 1991; Mostafa, 2006).

Brain Basics

The brain has three primary areas: (a) the cerebrum, which comprises the majority of the brain; (b) the cerebellum, which is located in the back of the head at the base of the skull; and (c) the brainstem, which is connected to the spinal cord. Within the cerebrum are four lobes, the frontal lobe, parietal lobe, temporal lobe, and the occipital lobe (Col, 2001).

The frontal lobe is located in the front of the brain and manages emotions, behavior, attention, abstract thought processes, creative thoughts, initiative, intellect, judgment, reflection, inhibition, skilled and muscle movements, coordination of movements, sense of smell, some eye movements, generalized and mass movements,

physical reaction, some motor skills, and libido. The occipital lobe is located in the back of the brain and is responsible for processing reading and vision. The parietal lobe is located just behind the frontal lobe on the top of the head. This lobe processes some visual functions, response to internal and external stimuli, and some language and reading functions. The final of the four lobes, the temporal lobe, is located directly above the cerebellum and brainstem. The temporal lobe controls visual and auditory memories, some language and speech, some vision pathways, some emotions and behavior, music, some hearing, and sense of identity (Col, 2001; Moir & Jessel, 1991).

The brain is divided into the left and right hemispheres. The left hemisphere is predominately used for reading, writing, and speaking. This hemisphere also controls sequential thought processes and orderly and concrete sequences. The information that enters the right eye goes directly to the left hemisphere. The left hemisphere also controls the right side of the body (Gurian, 2007; Moir & Jessel, 1991).

The right hemisphere is responsible for information regarding spatial relations, basic patterns, and shapes. In short, the right hemisphere processes everything non-verbal. Objects seen by the left eye are processed in the right hemisphere of the brain. This hemisphere also controls the left side of the body. The corpus callosum houses the fibers that connect the two halves of the brain. These fibers provide communication between the right and left hemispheres (Col, 2001; Guian, 2007; James, 2007; Moir & Jessel, 1991).

As previously noted, the cerebellum is located in the back of the head and is responsible for coordination and motor movement. This area is also in charge of balance and posture. The brain stem is located at the base of the head and is responsible for

cardiac, vasomotor, and respiratory centers. In addition, the brain stem is the sensory and motor pathway to the face and body (Col, 2001; Guian, 2007; James, 2007; Moir & Jessel, 1991).

Within the cerebral hemispheres are raised and elevated surfaces known as gyri. In addition, insula is pyramid shaped and is located within each of the cerebral hemispheres beneath the temporal and frontal lobes. Its function is to assist with visceral functions of the autonomic nervous system. Each of these surface terms is usually preceded by a region or area of the brain to pinpoint its location. An example would be the middle temporal gyrus would be the raised surface in the middle of the temporal lobe (*The Free Dictionary*, n.d.).

Brain Maturation

Maturation of the brain occurs at different rates in males and females. De Bellis et al. (n.d.) conducted a study with 118 healthy children and adolescents between the ages of six and 17. The researchers examined cerebral white and gray matter volumes and corpus callosal areas using magnetic resonance imaging (MRI). Correlations relating to these areas of the brain were examined with regards to participants' sex and age. De Bellis et al. (n.d.) noted that there were sex differences in brain maturation, with female brains tending to mature two years ahead of male brains.

Brain Sex Differences: The Hemispheres

In 1967, Herbert Lansdell was the first to discover major structural differences in the female and male brain (as cited in Moir & Jessel, 1991, p. 42). Lansdell demonstrated that males and females were affected differently when the same section of the brain was damaged. Lansdell determined that men performed poorly on instruments

that tested their spatial skills when they had damage to the right side of their brain, the area that is largely responsible for non-verbal information. In similar tests, the same area of the brain could be damaged in women and their ability to complete spatial skills was barely affected (Bland, 2003; Moir & Jessel, 1991). The same results proved to be true with left-side brain damage. Males whom had left-side brain damage lost most of their language skills while females with similar damage retained most of their language skills.

According to Lansdell (as cited in Moir & Jessel, 1991, p. 42), men experienced language issues at three times the rate as females when the same section of the brain was damaged. This led to the hypothesis that spatial skills and language skills are controlled by both halves of the brain in women and are more specified to one area of the brain in men (Moir & Jessel, 1991). Numerous studies have confirmed Lansdell's initial findings (Obleser et al., 2004; Ruytjens et al., 2006; Shaywitz et al., 1995; Snodgrass & Harring, 2004-2005; Van Dyke et al., 2009).

The differences between the left and right hemispheres in males and females have been well documented (Bland, 2003; Brizendine, 2006; Gurian, 2001; James, 2007; Moir & Jessel, 1991; Obleser et al., 2004; Ruytjens et al., 2006; Shaywitz et al., 1995; Snodgrass & Harring, 2004-2005; Van Dyke et al., 2009). When communicating, males tend to use mostly the left hemisphere while females tend to use both hemispheres.

Hemispheres and Phonological Processing

Researchers have demonstrated sex differences in hemispheric activation during phonological processing. Shaywitz et al. (1995) examined 38 right-handed subjects using a functional magnetic resonance imager (fMRI). The subjects performed several tasks involving letter recognition (orthographic), rhyming (phonological), and semantic

categories (language meanings). During the phonological tasks, male brain activation was only in the left inferior frontal gyrus regions. During the same phonological tasks females tended to show activation on both the right and left inferior frontal gyrus (Shaywitz et al., 1995). The inferior frontal gyrus, which is mostly responsible for linguistics, is located in the frontal lobe or prefrontal cortex section of the brain. This is also where Broca's area is located (Rice University, 2000). Broca's area is responsible for producing words, processing grammatical structures, and formulating speech. Broca's area is more engaged in females and could be the reason for female dominance in verbal and communication skills (Gurian, 2001).

Shaywitz et al. (1995) conducted a study in which participants completed four distinct same-different tasks using visual stimuli. The four tasks included letter case, line judgment, semantic category, and rhyme. The subjects had to identify which items were the same or different by pushing a button. One of the areas activated in the participants' brains included the extrastriate (ES), which is associated with letter recognition or orthographic tasks. The other area activated was the inferior frontal gyrus surrounding Brodmann's areas 44/45. This study once again confirmed that hemispheric activation was different for the sexes. Activation during phonological (rhyming) tasks was lateralized in the males to the left inferior frontal regions. Females had stronger activation than males in the left and right inferior frontal regions. Right hemispheric areas within the female inferior frontal gyrus (Brodmann's areas 44/45) were utilized to a greater extent than males to complete the same task (Shaywitz et al., 1995).

In conclusion, the hemispheres of the brain in males and females process information quite differently. The male brain utilizes the right side for visual information

while the left side is almost entirely utilized for verbal functions. This isolation of the hemispheres is not the same for females. Females tend to communicate with both hemispheres of the brain during most activities (Bland, 2003; Brizendine, 2006; Gurian, 2001; James, 2007; Moir & Jessel, 1991; Obleser et al., 2004; Ruytjens et al., 2006; Shaywitz et al., 1995; Snodgrass & Harring, 2004-2005; Van Dyke et al., 2009).

Hemisphere Activation and Lip Reading

Males and females have different areas of the brain activated during lip-reading exercises. Lip reading exercises can be directly related to most choral classrooms as many choral directors give silent verbal cues during rehearsals and performances. Ruytjens, Albers, Van Dijk, Wit, and Willemsen (2006) conducted a study examining neural responses to silent lip-reading. Volunteers had their cerebral blood flow measured during different lip-reading tasks. Each of the 19 participants was scanned using a PET scan 12 times. The following areas were examined, pre-motor region of the face (precentral gyrus), motor language areas (Broca and its right homologue in the inferior frontal region), auditory-visual integration region (inferior parietal region: Brodmann's area 7, 39, and 40) (Rhawn, 2000), and the bilateral auditory association areas (superior temporal region). The probability maps of Brodmann areas 44 and 45 were used to define the bilateral inferior frontal regions (Ruytjens et al., 2006).

Researchers have found that male and female activation patterns were similar but not identical. Females showed many more activation clusters and larger activation clusters than males. The following areas were activated in both males and females: (a) the left inferior frontal gyrus extending to the left insula, (b) the left middle and inferior occipital gyrus, (c) the left fusiform gyrus (Brodmann's area 37), and (d) the left and

right superior and middle temporal gyrus. Females had larger clusters of activation, even though these areas were activated in both sexes. The cerebellar was the only activated area in the brain during silent lip-reading that was larger for males as compared to females (Rutjens et al., 2006). Rutjens et al. (2006) concluded that there were no other areas of the brain in which males had higher activation than females.

Rutjens et al. (2006) reported that there was significantly higher activation in females' brains in the following areas: (a) parietal region, (b) angular gyrus, (c) part of the middle temporal, (d) angular and inferior frontal gyri, (e) occipital gyri, and (f) temporal gyri. Males had more areas of deactivation than females. The deactivated areas of the male brain were located in the middle of the brain and the right hemisphere. Lack of female brain activation was only found in the right middle temporal gyrus and the middle frontal gyrus.

Female brains often show more activation in both hemispheres of the brain. The female participants in the study conducted by Rutjens et al. (2006) showed brain activation in both hemispheres in every region studied. Male participants in the study showed activation only in the left hemisphere. The researchers also reported a sex difference in the left inferior parietal region (Brodmann's area 40, 7), where females showed more activation than males. Brodmann's areas 40 and 7 (located in the parietal region) have been shown to be instrumental in multisensory integration. These findings support the idea that females can associate other sensory modalities to a visual image.

Based on this study, males showed a weaker connection between a visual image pertaining to speech and the auditory speech sound. This finding could be beneficial to conductors who are trying to show their choirs visual cues by using their mouths to form

vowel shapes, form words, or give silent direction during rehearsal or performance. It is suggested that males in a choir would have a harder time connecting a visual example from the director to an audible sound when they are singing. Further, females in a choir ought to be able to translate what the director is indicating into an audible sound. This information could affect the ways in which conductors provide instruction for a piece of music (Ruytjens et al. 2006).

Hemisphere Interaction and Verbal Stimuli

Females compared to males tend to utilize both hemispheres when processing verbal stimuli. The Van Dyke et al. (2009) study included 40 males and 42 female participants ages 18 to 40. Participants were asked to respond as accurately and quickly as possible to a series of words on the computer screen. While completing this task, participants' chins were stabilized in a chin rest 40 cm from the screen. Words and pseudo words, which appeared on the right or left side of the screen, were presented to the participants. Participants were asked to press a button when they saw a word. The purpose of the study was to determine if words were identified equally correctly and quickly within each hemisphere (Van Dyke et al., 2009). The researchers determined that women used more areas of the brain from both hemispheres when identifying words on the screen. Van Dyke et al. (2009) also reported that women seemed to respond faster than men to the words shown. In this study, women utilized their language processing regions bilaterally, while men seemed to utilize only their left hemisphere. This may suggest that women input verbal stimuli more efficiently than men. The concepts of speed and accuracy in word recognition could be beneficial to teachers when planning delivery of instruction.

Hemispheres and Language Processing

Assumptions regarding how individuals process speech could result from collective experiences of learning over time. Accordingly, males tend to hear males better, and females tend to hear females better. Therefore, males could potentially have difficulty hearing female teachers (Obleser, Rockstroh & Eulitz, 2004).

In one study, Oblesser et al. (2004) investigated how the right and left hemispheres process language. The researchers examined gender differences in processing sounds and specifically asymmetry between the hemispheres. The researchers used magnetic source imaging to accomplish this task. Participants were tested on their response to natural syllables with varying vowel and consonant sounds as well as non-speech noise. Participants were asked to categorize different syllables within the first 35milliseconds of stimuli (Oblesser et al., 2004). The researchers discovered that females needed more activation of left hemisphere language areas when analyzing auditory patterns. Males in this study could accomplish the same task with the same results by activating the auditory processing networks in both the right and left hemispheres (Oblesser et al., 2004).

Corpus Callosum

Researchers have stated that the female brain has better capacity to communicate between the hemispheres throughout almost every activity. When working on an abstract problem, for example, females use both sides of their brains while males utilize only the right side of their brains (Moir & Jessel, 1991). This could be due to the sex differences in the corpus callosum. The corpus callosum connects the two halves of the brain and is generally larger in females (Bland, 2003; Brizendine, 2006; Gurian, 2001; Gurian &

Stevens, 2004; Moir & Jessel, 1991; Mostafa, 2006). Gurian (2001) and Brizendine (2006) both reported that the corpus callosum is 20% larger in the female brain. Researchers have found that the female brain communicates bilaterally due to more connectors between the hemispheres; therefore, bilateral communication is easier for the female brain than for the male brain (Bland, 2003; Brizendine, 2006; Gurian, 2001, Gurian & Stevens, 2004; Moir & Jessel, 1991). Brain scans have shown the female brain is as active at rest as the male brain is when engaged (Brizendine, 2006).

Male and Female Auditory Differences

Hearing differences among the sexes are small but significant (Brizendine, 2006; Moir & Jessel, 1991; Sax, 2005). One of the major auditory differences between males and females is the size of the cochlea. The cochlea is the innermost part of the ear that tends to be slightly longer in males (James, 2007). This added length of the cochlea adds to the time it takes for sound to enter the ear and travel to the brain, therefore males have a slight hearing disadvantage compared to females. Females are more apt to hear somewhat better than males because their cochlea is not as long (Brizendine, 2006; Moir & Jessel, 1991; Sax, 2005). Hearing differences between the sexes could be attributed to sound taking longer to travel to the brain once it enters the male ear.

Females are also more sensitive to sound than males (Moir & Jessel, 1991; Sax, 2005). The average 12 year-old female has hearing at least seven times as acute as males of the same age (Moir & Jessel, 1991; Sax, 2005). Due to this hearing difference, females often perceive male teachers as yelling during regular instruction while males may have difficulty hearing the teacher. Males may seem distracted in the classroom when in reality they cannot hear what the teacher is saying (Sax, 2005). In fact, females

hear distracting sounds that are 10 times softer than sounds that will distract males. This hearing difference could contribute to the reason that females tend to learn best in an environment free from extraneous distractions (Sax, 2005).

Females tend to have an easier time when it comes to singing in tune and recognizing familiar tunes. They sing in tune six times more frequently than males (Moir & Jessel, 1991) and tend to have a left ear advantage when it comes to recognizing familiar sounds and melodies (Bland, 2003). Using a PET scan to investigate the activation of the cortex during auditory stimulation, Ruytjens et al. (2007) detected differences between males and females. Ten males and 10 females participated in the study, and three conditions were used for this research: baseline, which was no aural stimulation; white noise at 75 decibels; and music from the movie "The Piano" played at 75 decibels. The stimuli were randomly presented four times to both ears of the participants (Ruytjens et al., 2007). Male and female differences were found in the primary auditory cortex (PAC), also known as Brodmann area 41. Secondary auditory regions are labeled as Brodmann's area 22 and 42 (Ruytjens et al., 2007). Sex differences were discovered when music versus noise was presented to the participants in this study. The activation occurred for females in the secondary auditory areas while males had much larger activated clusters in both hemispheres of the brain. These areas encompassed both the secondary auditory areas and the PAC (Ruytjens et al., 2007).

Female and male differences were also found when processing noise versus the baseline. When listening to noise, males deactivated the prefrontal cortex, which is responsible for attention, working memory, and cognitive control. Females had no deactivation of areas being examined and had more activation in the primary auditory

cortex (PAC). Deactivation only occurred in the right hemisphere of the prefrontal cortex in the female brain (Ruytjens et al., 2007). The researchers determined that auditory attention tasks engaged the prefrontal cortex. When males were presented with noise and music they activated both hemispheres of the brain in the primary and secondary auditory areas whereas females only showed activation in the secondary auditory areas. When the participants were presented with noise versus a baseline, males disengaged the prefrontal cortex while females had no deactivation of the areas examined (Ruytjens et al., 2007). These findings are consistent with Brizendine's (2006) observation that the female brain is never at rest.

Emotional Sex Differences

Emotions can enhance or hinder learning in the classroom. A solid understanding of how emotions are processed in each of the sexes may be important for teacher and student success in the classroom. Males tend to lateralize emotions only in the right hemisphere, while females process emotions in both the right and left hemispheres (Gurian, 2001; James, 2007; Moir & Jessel, 1991).

Males and females process emotional content differently. It has been shown that males only recognize emotional content when it is shown to their left eye and, therefore, processed in the right hemisphere. Females are able to recognize emotional content regardless of which eye receives the material. This finding further supports that females use both hemispheres when processing emotions (Moir & Jessel, 1991).

Snodgrass and Harring's (2004-2005) study investigated responses to different levels of stimuli. The study consisted of four experiments in which undergraduates between the ages of 18 and 22 were shown seven images, such as a snake, gun, knife,

sun, and heart. Individuals were asked to rate the objects on a scale, with one being very negative and five being very positive. Twenty-eight random drawings of lines were used as distracters throughout the experiment. Sixteen neutral pictures (eight shown to the right hemisphere and eight shown to the left hemisphere) were also shown to the subjects. Participants in the first experiment were asked to place check marks next to their answers. The results of the first study showed that women were less sensitive to the negative pictures and more sensitive to the positive pictures. The second experiment involved 14 males and 27 females. The methodology was the same, except instead of placing check marks participants were instructed to point to their answers. Once again, Snodgrass and Harring (2004-2005) were able to demonstrate that the right hemisphere was far superior for identifying positive and negative stimuli and having greater attention to positive pictures. Gender differences for identifying positive and negative stimuli and for picture identification were not found. Snodgrass and Harring's (2004-2005) third experiment involved 14 male participants and 26 female participants. In this experiment, words were used to represent emotions. No gender differences were found. These findings were consistent with the second experiment. The final experiment included 10 males and 10 females. This time participants responded verbally to the emotional stimuli. Gender was not a consideration in this fourth experiment (Snodgrass & Harring, 2004-2005).

Gender differences based on emotions were not found when words or faces were used in Snodgrass and Harring's (2004-2005) study, but were evident when pictures were shown. Overall, women were less sensitive to negative stimuli and more sensitive to positive stimuli than men. Since musicians rely on symbols or pictures almost entirely to

process information that pertains to music, emotionally stimulated communication could impact the processing of important musical information.

Amygdala and Sex Differences

The amygdala is an integral part of the brain for managing emotions. Larger in males, the amygdala can cause males to be more aggressive (Gurian, 2001). Increases in the size of the amygdala have also been associated with a strong vocabulary, total estimated intellectual ability, basic arithmetic skills, and reading single words (James, 2007). Located in both hemispheres, the amygdala connects emotions with sensory information. Emotions are controlled in the right hemisphere and reactions to those emotions are controlled in the left hemisphere. Males tend to process emotions on the right side of their brain with little communication to the left side of their brain. The limited number of connectors between the hemispheres in the male brain can make expression of emotion difficult for males (Cable & Spradlin, 2008; Gurian, 2001; James, 2007). Conversely, females have difficulty separating reason from emotion because of their bilateral hemispheric communication. Bilateralism allows for more information to be shared between the two hemispheres. Sharing information and connections to the verbal side of the brain makes expressing emotions easier for females (Gurian, 2001; James, 2007).

Hippocampus and Sex Differences

The hippocampus, which is larger in females, is where memory and emotions are formed and stored (Brizendine, 2006; Gurian, 2001; Gurian & Stevens, 2004; James 2007). The increased size of the female hippocampus tends to help foster greater memory for females than males (Gurian, 2001). Academic strengths in verbal

intelligence, spelling, and reading are associated with an increased size of the left hippocampus while strengths in mathematical calculations are associated with an increased size of the right hippocampus (James, 2007). Gurian and Stevens (2004) reported that females tend to have language arts learning advantages because of the increased size of their hippocampus.

Hormonal Sex Differences

Hormones affect the manner in which someone acts and feels (Gurian, 2001); therefore, teachers need to understand the important function of hormones. The hypothalamus is the place in the brain where hormones are stored. The hypothalamus regulates temperature, heartbeat, and breathing (Gurian, 2001). Additionally, it helps organize sex hormones for males and females by communicating with the pituitary gland regarding how much and how often sex hormones should be released (Moir & Jessel, 1991). The hypothalamus in heterosexual males is twice as large as the hypothalamus in females and homosexual males (Mostafa, 2006).

Progesterone and estrogen are two female hormones that rise and fall with the female hormonal cycle. Hormonal changes caused by this fluctuation potentially affect the moods and learning of females. Progesterone is the bonding and growth hormone while estrogen controls reproduction and sexual characteristics. Females tend to score better on in-class and standardized tests when estrogen levels are high (Gurian, 2001). Estrogen tends to have a calming effect on testosterone, the aggression hormone (Moir & Jessel, 1991).

Testosterone is the male hormone released into the body. This hormone ignites sex-drive, aggression, and growth in males. Males have five to seven spikes of

testosterone daily beginning with the onset of puberty. Males tend to perform better on exams involving spatial problems when testosterone levels are elevated in the brain. Males do not perform as well on verbal tests when testosterone levels are low (Gurian, 2001).

Sex Differences in Aggression

Sex differences exist regarding levels of aggression. Based on the research literature, the male brain is made for potential aggression (Moir & Jessel, 1991) and consequently males are emotionally more active and volatile than females (Else-Quest et al., 2006). Aggression is fueled by rivalry and competition and tends to raise testosterone levels in males (Moir & Jessel, 1991). Conversely, females are often less aggressive than males (Coie et al, 1991).

In the male brain, the amygdala tends to be larger, triggers aggression, and registers fear. This may be the reason that male emotions can fluctuate from being calm to extremely agitate in a matter of seconds. Females, on the other hand, tend to calm situations down. Females tend to process conflict more deeply in the brain while males are more likely to deal with the conflict and forget about it (Brizendine, 2006).

The impact of testosterone on the brain not only produces assertiveness, aggression and dominance, it also tends to encourage the release of more testosterone. This additional hormone release adds to aggressive male tendencies. Moir and Jessel (1991) stated that the more testosterone that is released into the male brain the more self-reliant, self-confident, self-assertive, competitive, and aggressive males become. The average male is more likely to show aggressive behaviors and manage social situations

through dominance (Gurian, 2001) while the average female tends to resist aggressive behaviors (Moir & Jessel, 1991).

Dominate Male Behaviors

Males and females differ in their behaviors. Experienced teachers know that keeping the classroom loud and lively is the most effective way to motivate males to learn (Sax, 2009). Males tend to monopolize teachers' attention when they are a part of a mixed-sex classroom (Carp, 2004; Jorgensen & Pfeiler, 2008; Pollard, 1999; Wilson, 2010), and this attention tends to be negative (Pollard, 1999). Negative attention can result in peers rewarding males for negative behavior exhibited in the classroom (Downey & Vogt Yuan, 2005). Pollard (1999) noted that classroom enthusiasm and behavior improved in the same-sex classroom for both sexes.

Downey and Vogt Yuan (2005) examined the National Education Longitudinal Study to determine why males and females excel in different subjects in school. The researchers looked at why these differences occurred by examining sex differences as related to out-of-school activities and classroom behavior. Poor male behavior in school was found to be the main determinant of these achievement differences (Downey & Vogt Yuan, 2005). Based on the research literature, placing males in a single-sex classroom could potentially improve their behavior (Downey & Vogt Yuan, 2005).

Competition seems to be one of the motivating variables for males, and testosterone released from the brain fuels competition in males. Males are taught from a young age to be independent, active, and aggressive. Traditional schooling, however, is organized in ways that conflict with these social tendencies (Cable & Spradlin, 2008).

According to Sadker and Sadker's (1994) book about how schools cheat girls, schools also tend to expect males to be conforming, passive, and quiet.

Teachers need to be trained in order to be successful in dealing with the behaviors of males. Scholars have stated that teachers are more likely to successfully address the ways in which males learn when the sexes are separated. Knowing how to best teach students could improve classroom behavior in any classroom environment (Hannon & Ratliffe, 2007; Rex & Chadwell, 2009; Sax, 2005; Sax, 2009).

Dominate Female Behaviors

Compared to males, females tend to have different traits that could potentially affect their success in the classroom. These differences could potentially impact the method a teacher chooses to instruct the same-sex classroom. Females are more apt to want things orderly and quiet, and they enjoy group work and cooperative learning (Streitmatter, 2002). Further, females tend to have better grades (Barton, 2004) because of their favorable classroom behavior (Downey & Yaun Vogt, 2005).

Barton and Cohen (2004) conducted a study of children's peer relationships as they transitioned from a mixed-sex fourth grade classroom to a single-sex fifth and sixth grade classroom. Several tests were administered to the children, including the *Harter Self-Perception Profile for Children* and the *Friendship Quality* questionnaire. The participants were asked to rank their classmates according to how much they liked them. Students also completed a task assigning different roles to their classmates. The researcher reported that there are different results socially for males and females in a single-sex environment. These differences included social behaviors as well as friendships. Males tended to have more friends while females maintained the same

number of friends when going from a mixed-sex environment to a single-sex environment. Males in the sixth-grade single-sex classroom had a significant increase in aggressive behaviors while females had a significant decrease in victimization and withdrawn behaviors (Barton & Cohen, 2004).

One of the goals of same-sex classrooms is to improve classroom participation and behavior (Pollard, 1999). Pollard (1999) reported that same-sex classes create comfortable places for females to learn, explore gender identity issues, and find their role in society. This comfortable setting could potentially encourage more female participation in the classroom.

Same-sex classes may be particularly beneficial to females as they are going through puberty and trying to understand the maturation process (Pollard, 1999). Females tend to be much more sensitive and have a nuanced understanding of even the subtlest forms of non-verbal communication (Barton & Cohen, 2004). Females also have a tendency to be more mature than males; therefore, same-sex classes are more likely to help females stay focused on their academics (Pollard, 1999).

Based on the research literature, females often are given fewer opportunities for problem solving and learning in a mixed-sex classroom. Additionally, females are more likely to receive less teacher attention than males because of disruptive male behaviors (Pollard, 1999). Froesse-Germain (2006) and Sadker (2002) reported that teachers tend to focus on males in a mixed-sex classroom because of males' behavior. Females may sometimes feel constrained in mixed-sex classes; therefore, perform below their potential. Females may also have a tendency to be less willing to participate in classroom instruction in a mixed-sex classroom environment (Pollard, 1999).

Cable and Spradlin (2008) found that collaborative learning and noncompetitive environments seem to be where females thrive. Other researchers have found that females tend to be more motivated than males in school (Martino et al., 2005), are more likely to ask adults for help, and are more likely to set goals for themselves (Cable & Spradlin, 2008). Additionally, females tend to be more nurturing than males (Bjorklund & Bering, 2000), which in turn, creates a different behavioral situation in the classroom.

Temperament Sex Differences

Research and other scholarly literature have documented that there are temperamental sex differences. Else-Quest et al. (2006) completed a meta-analysis of sex differences in temperament. The authors discovered that females tended to be better at regulating their attention and temperament and superior at controlling inappropriate behaviors and responses. Else-Quest et al. (2006) also found that females were more apt to sense subtle differences in their environment compared to males. As related to gender equity, Sadker (2002) noted that males tend to externalize behavior problems while girls tend to control their impulses. Else-Quest et al. (2006) produced similar results from their meta-analysis investigation. Overall, males tend to gain more pleasure than females from high-intensity stimuli and are less shy than their female counterparts (Else-Quest et. al, 2006).

Learning Style Sex Differences

Understanding learning style differences has been shown to be beneficial to student and teacher success in the classroom (Honigsfeld & Dunn, 2003). Honigsfeld and Dunn (2003) conducted a study investigating learning style sex differences. The research included 1,637 adolescents from New Zealand, Sweden, Hungary, Brunei, and

Bermuda. Students were enrolled in grades five through 13 and were administered the LSI learning-style preference instrument. Results of the LSI were examined based on participant gender (Honigsfeld & Dunn, 2003). The researchers detected significant gender differences in nine of the 22 learning styles studied. These learning style differences included: (a) temperature, (b) motivated, (c) persistent, (d) responsible, (e) alone versus peers, (f) learn several ways, (g) kinesthetic, (h) parent motivated, and (i) teacher motivated. Honigsfeld and Dunn (2003) reported that males were more peer-oriented, perceptual, and kinesthetic than females. Females tended to have higher levels than males of parent and teacher motivation, sociological variety, need for warmer temperatures, responsibility, persistence, and self-motivation. Females needed more variety in their learning, while males tended to respond better to routine. Generally, only a few of these students were able to listen to a 40 to 50 -minute lecture on difficult and new material and recall 75% of what they heard (Honigsfeld & Dunn, 2003).

Teacher awareness of learning preferences can impact learning. Honigsfeld and Dunn (2003) concluded that teachers should be aware of male and female learning preferences so that improvement in learning can take place in the classroom. Males need to move or be kinesthetic in order to think and learn. Therefore, teachers should not require that male students be still throughout a lesson. Males are also more peer-oriented than females, thus they need to be learning with their peers instead of solely teacher directed learning. Females are more apt to need varied ways of learning compared to males. Teachers of females should consider having them work in different types of learning groups (e.g., in large groups, with the teacher, with peers, in pairs, and in independent settings).

Music Teacher Attrition

Teacher attrition is one of the many issues in which researchers and professional organizations have expressed concern. Hancock (2008) discovered that 20% of teachers left the profession within their first three years of teaching. Additionally, 40-50% of all teachers changed professions within the first five years. These data were gleaned from the 1999-2000 *Schools and Staffing Survey,* a national survey conducted by the National Center for Educational Statistics. Survey respondents were drawn from schools, principals, and teachers.

There has been little research done regarding music teacher attrition. Music teachers experience 17% percent attrition after the first 10 years of teaching (Hancock, 2009). Hancock (2009) reported that between 11-27% of all music teachers leave the profession every year. This fluctuation could be due to factors such as retirement, continued education, and attrition. Secondary music teachers were at a higher risk for leaving than elementary music teachers. Secondary regular education teachers did not have a high rate of attrition as compared to their elementary teacher peers (Hancock, 2008).

Sex Differences in Instrumental Music

While little has been written pertaining to sex differences in the choral classroom, the research literature is replete with examples for instrumental music. Literature pertaining to the instrumental classroom addresses (a) instrument selection (Abeles, 2009; Eros, 2011; Johnson & Stewart, 2004; Walker, n.d.), (b) jazz improvisation (Wehr-Flowers, 2006), and (c) participation in high school and collegiate instrumental jazz ensembles (McKeage, 2004). Even though there are many studies dealing with sex

differences in the instrumental classroom, none of the research pertains to the topics of interest in this research study.

Sex and Musical Instrument Selection

Students tend to label instruments as either masculine or feminine. These stereotypes can be minimized if instruments are properly introduced and the director is aware of instrumental sex stereotypes (Walker, n.d.). In a review of the literature, Eros (2008) examined gender stereotypes and instrument selection. He examined literature after 1996 and determined that, when choosing an instrument, students are significantly influenced by gender perception of the instruments. It was also noted that students could be harassed based on their instrument choice. Eros (2008) recommended that directors should be educated regarding gender stereotypes so that they can help their students see past the gender bias associated with instrument selection.

Past research has indicated that certain instruments have gender stereotypes attached with them. An example would be that the flute is feminine and the tuba is masculine. Abeles (2009) conducted a study regarding gender perceptions of different instruments to see if musical instrument gender associations had remained the same or changed over time. The first portion of the study investigated 180 college students and paired the gender of a student with an instrument. The researcher demonstrated that there were fewer perceived gendered instruments in 2009 than in the 1990s. Examples of gendered instruments include: only girls play flutes and only boys play tubas. In the second portion of the study, Abeles (2009) investigated whether or not the instruments males and females were playing had changed. The researcher concluded that there were few changes in the sex division based on instrument.

Additionally, there was a study conducted with band directors and university students to see if the participants would assign instruments according to gender bias (i.e., flutes for females and tubas for males) (Johnson and Stewart, 2004). Each of the participants went to a website to take the survey. Half of the participants were directed to a site in which they had to match the full heads of eight students to beginning band instruments. The other half was directed to a site in which they had to match beginning band instruments to pictures that only showed the lips and teeth of the students. The results showed that the sex of the student did not determine the instrument the participants recommended. The respondents to the survey did not believe they had enough information to make an educated decision regarding instrument selection of students (Johnson & Stewart, 2004).

Instrumental selection has traditionally been influenced by what is perceived as a male or female instrument. One study indicated that this perception has changed somewhat from 1990 to 2009 (Abeles, 2009), while the other study reported that students seem to be choosing instruments while ignoring previous instrument stereotypes.

Sex Differences in Jazz Improvisation

Based on the research literature, there are sex differences regarding jazz improvisation. In a study by Wehr-Flowers (2006), a survey was distributed to students in middle school and community jazz programs. The researcher reported that females were less confident than males with regards to learning jazz improvisation. Females also tended to lack confidence and were more anxious than their male counterparts.

McKeage (2004) conducted a study with 628 undergraduate college band students in which they were asked to complete a survey to determine attitudes towards

participation in high school and collegiate instrumental jazz ensembles. The author reported that jazz ensembles were predominately male in both high school and college. One of the documented reasons for women quitting jazz band was that they were more comfortable in a traditional ensemble (McKeage, 2004). Women tended to be the minority in the jazz band, which tended to make them feel uncomfortable. This tended to result in a lack of willingness to participate.

There is some research available pertaining to sex differences and instrumental music, but it mainly pertains to instrument selection and improvisation. The research does not address biological and sociological sex differences. The void of research in this area indicates that there is a need for research investigating biological and sociological sex differences in the instrumental classroom.

Same-Sex Teaching within the Choral Classroom

Same-sex music classrooms have been a part of the music curriculum for over 100 years. Koza (1993) reviewed the *Music Supervisors' Journal* from 1914 through, and found that single-sex as well as mixed-sex music organizations were plentiful during this decade. This study included both instrumental and choral music organizations.

There are many choral programs that offer same-sex choirs as a part of their curriculum (Carp, 2004; Jorgensen & Pfeiler, 2008; Wilson, 2010). Carp (2004) surveyed 174 members of the California Vocal Association and discovered that 91% of the 101 responses indicated that directors taught at least one same-sex choir. In their research, Jorgensen and Pfeiler (2008) discussed the long history and benefits of same-sex choirs. Wilson (2010) investigated choral programs that consisted of at least one all-female choir. This study will be discussed later in the review of literature. This body of

literature confirms the presence of same-sex choirs in many secondary choral programs, therefore indicating a need for more research in this area.

The American Choral Directors Association (ACDA) indicates through their many Repertoire and Standards divisions how important they feel same-sex choirs are. There are Repertoire and Standards positions representing Women's Choirs, Men's Choirs, and Boy's Choirs (acda.org). These Repertoire and Standards positions are active at the state, regional, and national levels of the ACDA organization.

Jorgensen and Pfeiler (2008) qualitatively investigated a choral program in which all-male and all-female classes were created because of voice change and socialization issues during instructional time. Through this investigation, the directors discovered that the male students were able to "be themselves" in an all-male classroom. Additionally, the authors noted that males sang without fear when there were no distractions from the opposite sex. Additionally, females, who tended to be intimidated by males, were no longer frightened or embarrassed when they were in a same-sex class. In general, females tended to feel more comfortable and relaxed, and both male and female students were much more likely to take risks when they were in a same-sex classroom (Jorgensen & Pfeiler, 2008). Ashley (2006) noted that boys seem to be more confident singing in an all-male setting versus a mixed-sex environment. Other researchers in regular education same-sex classrooms have found that students are more willing to take risks when they are in a same-sex classroom (Cable & Spradlin, 2008; Honigsfeld & Dunn, 2003; Pollard, 1999).

Research has shown that some teachers may not have a firm understanding of vocal pedagogy. In a study of differences in vocal development and male sensitivity to

the voice, videos were shown of boy singers (those whose voices had not changed), and reactions by females and males were recorded based on these videos. Through this research, Ashley (2010) demonstrated that teachers are not prepared to deal with male and female differences as related to singing.

The literature suggests that the success of the teacher could be dependent on their awareness of gender issues in the single-sex classroom. Single-sex classes for singers demand that teachers address gender issues in the classroom and provide gender appropriate pedagogies (Ashley, 2010). Teacher training and awareness for music educators are supported by research in the regular education setting (Hannon & Ratliffe, 2007; Martino, 2005; Rex & Chadwell, 2009; Sax, 2005). The literature states that teachers who have the willingness and subject knowledge to be aware of gender issues have a great impact on young male singers (Ashley, 2010). The author concluded that this willingness and knowledge of gender issues is more important than a male teacher instructing boys or the sexes being separated. Ashley (2010) argued that teachers might ignore gender issues because they have little understanding of gender issues in the classroom, limited expectations for boys, and a lack of knowledge pertaining to the subject taught.

Recently there have been a few research studies conducted relating to same-sex choirs. Carp (2004) reviewed Southern California choral directors' practices and attitudes about single gender choral ensembles. Despite a limited literature review and simple survey design, this survey is relevant to the current investigation because it showed that many teachers observed differences when teaching single gender choral ensembles. Carp (2004) distributed a survey to 174 members of the Southern California

Vocal Association, and 101 surveys were returned. One hundred percent of respondents indicated that they taught mixed-sex choirs, 91% taught a female choir, and 46% taught male choirs. Ninety percent of the respondents indicated that there were behavior differences between single-sex choirs and mixed-sex choirs. Carp (2004) listed the behavior differences as identified by the choir directors: (a) voice change differences, (b) socialization differences, (c) risk taking differences, (d) focus differences, (e) maturity differences, (f) learning differences, and (g) group enthusiasm and cohesiveness differences. These findings are consistent studies of same-sex regular education classes (Cable & Spradlin, 2008; Gray & Wilson, 2006; Hannon & Ratliff, 2007; Pollard, 1999; Sadker, 2002).

The study examined the behavior of older versus younger singers. Carp (2004) investigated whether or not directors saw a change in behavior with the more advanced (older) singers. Seventy percent of the respondents saw a behavior difference as the singers became more advanced. The responses were varied and included that (a) singers seemed to be more disciplined and more mature; (b) there was no change; and (c) males were still trying to impress the opposite sex. The respondents in Carp's study (2004) were asked if they saw behavior differences between same-sex choirs and mixed-sex choirs. Fifteen percent of the respondents reported that behavior was better in mixed-sex choirs than in single-sex choirs, while 57% indicated that behavior was better in same-sex choirs than mixed-sex choirs. Fifteen percent saw no difference and 13% responded "other" (Carp, 2004). These findings are consistent with studies in the general education setting by Gray and Wilson (2006) and Hannon and Ratliffe (2007).

Overall, choral directors who responded to Carp's questionnaire suggested that directing single-sex choirs created an atmosphere with fewer discipline problems and one in which students were not distracted by the opposite sex. Respondents also concluded that same-sex choirs promoted better teamwork and a classroom with less peer ridicule. Students in single-sex choirs were more willing to take risks and had less self-esteem issues. Classroom management was easier for choral directors of same-sex choirs, and the students were more motivated and tended to work harder (Carp, 2004).

A mixed-method study was done utilizing a gender separate middle school choral program (Nick, 2008). The researcher interviewed, observed, and surveyed the choral directors, students, and principal at a middle school in Northwest Ohio. Observations were conducted during same-sex choral rehearsals. The purpose of the study was to identify the disadvantages and advantages of single-sex choirs in a middle school. The researcher noted that same-sex choral ensembles decreased behavior issues, promoted positive social interactions, and was developmentally appropriate. Findings indicated that students were more willing to participate and take risks in the single-sex choral classroom. The students indicated that the same-sex choral classroom was a non-threatening environment in which they felt more likely to sing out and participate in class (Nycz, 2008). These findings are also consistent with research conducted in the regular education classroom (Cable & Spradlin, 2008; Honigsfeld & Dunn, 2003; Pollard, 1999).

One research study reported that all-female ensembles felt less important than the other choral ensembles at their school (Wilson, 2010). In this mixed-methods research study, only 11% of individuals responded to the survey, which is not a good return rate. One recurring theme throughout the study was that females tried hard to impress their

directors. The actions by females seemed to be based on making a good impression so that they would have a better chance of making the mixed-group (Wilson, 2010). This finding is consistent with research conclusions in the general education setting regarding females' emphasis upon pleasing the teacher (Martino et al., 2005; Pollard, 1999; Vogt, 2005).

There are several studies that investigated the behavior of boys and the language used by teachers in all-male classes. One study reported that male teachers used very direct language with the male classes compared to the language used with the all-female classes (Wilson, 2010). Several of the students interviewed said that boys were more easily distracted than girls. While observing a male sectional, the researcher observed more physical energy and movement than in the all-female sectional (Wilson, 2010). Gray and Wilson (2006) reported that general education teachers believed that all-male classes created a more active environment. Research findings by Trollinger (1993), Koza (1993), and O'Toole (1998) are consistent with Wilson's (2010) observations that male singers received more teacher attention than female singers. Jones and Dindia (2004) established similar findings within the regular education classroom. According to these studies males tended to be more active and responded better to very direct language.

Summary

This literature review provides a brief history of the same-sex classroom and summarizes selected biological and sociological sex differences of males and females. As demonstrated by this review, there are multiple authors who believe that student achievement in the classroom can greatly be enhanced by separating the sexes. This

literature review also addresses the importance of teacher training pertaining to sex differences.

There seems to be a gap in the literature regarding sex differences as related to the secondary choral classroom. More research is needed to see if there is a necessity for more education and training pertaining to biological and sociological sex differences in the secondary choral classroom. The purpose of this current study is to investigate the secondary choral directors' awareness of selected biological and sociological sex differences in the secondary choral classroom in order to fill this void.

CHAPTER 3

METHOD

The purpose of this study was to assess choral directors' knowledge of biological and sociological sex differences in the secondary choral classroom. This descriptive study was based on the following null hypotheses: (a) There will be no difference in directors' knowledge of sex differences based on sex of the choral director, years of experience, level currently teaching, highest degree earned, and directors who teach single-sex choirs and those who do not; (b) There will be no differences in directors' expressed need for more knowledge and training of sex differences based on sex of the choral director, years of experience, level currently teaching, highest degree earned, and directors who teach single-sex choirs and those who do not; (c) There will be no difference in regards to which same-sex choir directors prefer to work with based on sex of the choral director, years of experience, level currently teaching, highest degree earned, and directors who teach single-sex choirs and those who do not.

Population

The population surveyed was choral directors who attended the high school and middle school reading sessions and round table discussions during the ACDA 2012 Southern Division Conference in Winston-Salem, North Carolina. This site was chosen because of the assumption that choral directors present would be concerned about their knowledge and professional development regarding choral music. All participants at these sessions had the opportunity to complete the survey.

The ACDA 2012 Southern Division Conference occurred between February 28, and March 3, 2012. Attendees at the conference represented the following states: Alabama, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia and West Virginia. Choral directors who attended the reading sessions and round tables for middle school and high school were invited to participate.

The researcher at the door prior to every session handed out the survey. The researcher was granted permission to conduct the survey during each of the above-mentioned sessions. Choral directors who participated were asked to return their completed surveys to slotted boxes located at the exits. There were no identifying indicators on the surveys therefore the person's anonymity was maintained. This population provided the researcher with an acceptable return rate and a broad geographical sampling of choral directors. All research procedures were conducted in compliance with the Auburn University Institutional Review Board for Human Subjects Research.

Instrument

An 80-item paper and pencil questionnaire (Appendix A) was created by the researcher based on literature pertaining to biological and sociological sex differences related to education. Due to the limited nature of the target survey population, a pilot study was not practical, but a review of the survey by the researcher's committee and other colleagues was employed to establish face validity. The questionnaire was used to assess choral directors' knowledge of selected biological and sociological sex differences in the secondary choral classroom.

The opening section of the questionnaire solicited background information pertaining to participants' teaching career and education as well as how many mixed sex, all-female, and all-male choirs they taught during the school day. Scales were developed for the next two sections of the survey. The first scale was used to assess the choral director's knowledge of biological and sociological sex differences. Five answer choices were (a) generally true for both sexes, (b) generally true for females, (c) generally true for males, (d) generally not true for both sexes, and (e) I don't know. Each statement had a correct answer (based upon the literature). The incorrect answers were considered distractors. These distractors were included to decrease the likelihood that a respondent could guess and answer correctly. The survey concluded with a second scale asking the respondents if they believed choral directors needed more training regarding sex differences, would attend such training, and the type of choir they think is easier to teach. This scale included these options: (a) strongly disagree, (b) disagree, (c) neither agrees nor disagree, (d) agree, and (e) strongly agree.

The author's committee members and fellow secondary choral directors reviewed the survey for content validity. Changes to the survey were made based on the committee's and choral directors' recommendations. These revisions included wording and formatting. The revised survey and other required documentation were then submitted to the Auburn University Institutional Review Board for Research Involving Human Subjects for approval (See Appendix D).

Survey Distribution

The survey was distributed during the ACDA Southern Division Conference between February 28, and March 3, 2012, at the high school and middle school reading

session as well as the high school and middle school round tables. The surveys included an attached cover letter explaining that completing the survey implied consent to participate in the study. Additionally, a scripted invitation (Appendix B) to participate was used to introduce the survey prior to each of the sessions. Completed surveys were returned to the slotted boxes at the exits at the conclusion of each session.

Survey Returns

Surveys (N=278) were distributed during the high school and middle school reading sessions as well as the high school and middle school round table discussions during the ACDA Southern Division Conference. The overall return rate was 64.4% (*n*=179) with a 95% confidence level and 4.19 confidence interval. However, 30 surveys were determined to be invalid because seven were blank, and 23 surveys were from participants who indicated they had already completed the survey in a previous session at the conference. The adjusted response rate was 45% (*n*=149) with a confidence level of 95% and 5.19 confidence interval. In addition, response rates for some of the questions varied due to some survey participants not answering every question.

Data Analysis

The Statistical Package for the Social Sciences (SPSS 20.0) was employed for all quantitative data analysis. Frequencies and valid percentages were calculated for all demographic variables, including: sex of the director, years of experience, level currently teaching, highest degree earned, and whether they taught a same-sex choir. The biological and sociological statements were separated into groups in order to address research question one: "What were the differences in responses of choral directors concerning biological and sociological sex differences in the secondary choral classroom

based on sex, years of experience, level currently teaching, degrees earned, and whether they teach single-sex choirs?" These clusters included: pedagogical sociological statements, sociological statements, biological-processing statements, and biological statements. These groups were analyzed through frequencies and using a Chi-square to determine if each of the demographic variables were statistically significant.

Frequencies and ANOVAs were used to address research question two: What were the differences in choral directors' expressed need for more knowledge and training on biological and sociological sex differences in the secondary choral classroom based on sex, years of experience, level currently teaching, degrees earned, and whether they teach single-sex choirs? Each of the demographic variables was analyzed to test for statistical significance as they related to the statements: (a) secondary choral teachers need more knowledge about sex differences, and (b) I would attend professional development regarding sex differences if it were available. Each statement had the following response options: (a) strongly disagree, (b) disagree, (c) neither agree nor disagree, (d) agree, and (e) strongly agree. These options were then re-coded due to the ambiguity between strongly disagree and disagree, and agree and strongly agree to create three categories: 1= strongly disagree/disagree, 3= neither agree nor disagree, and 5=agree/strongly agree. Though this data may be considered ordinal data, it can be combined to eliminate data points and get closer to a standardized distribution and thus be considered interval. However, in this case, a standard distribution was assumed. Analysis of variance was used to compare the means for these items. According to Rea and Parker (2005, p. 108), comparing the means for this data is becoming the norm in data analysis because it is considered more valuable to compare means for different variables, even though the data

may be considered ordinal data. Statistical significance was then analyzed to determine if the null hypothesis should be accepted or if the data indicated no statistical significance among the variables.

Null hypothesis three stated: There will be no difference in regards to which same-sex choir directors prefer to work with based on sex of the choral director, years of experience, level currently teaching, highest degree earned, and directors who teach single-sex choirs and those who do not. Frequencies were conducted to determine who answered the statements correctly and who did not. Chi-square analysis was used to determine if the null hypothesis should be rejected or not.

Summary

This study was conducted to assess choral directors' knowledge of student biological and sociological sex differences in the secondary choral classroom. Sex differences addressed in this study were selected based on the research literature and what educators have written regarding the relevance of these differences in the classroom. As discussed earlier, the results of this survey may be beneficial to secondary choral directors, researchers, methods teachers, and scholars writing textbooks and creating pedagogical materials.

CHAPTER 4

RESULTS

The goal of this chapter is to describe the population, participants, statistical analysis, and results of the survey based on the null hypotheses. The results of the survey indicated that there were many variables that were statistically significant for the three hypotheses. Therefore suggesting that there were some statistically significant differences in participant responses regarding choral directors' knowledge of sex differences, directors' expressed need for more knowledge and training of sex differences, and which sex choir directors prefer to work with. These differences were found when examining the variables: (a) sex of the director, (b) level currently teaching, (c) years of experience, (d) highest degree earned, and (e) preferred sex to work with.

Participants

The population surveyed included choral directors who attended the high school and middle school reading sessions and round table discussions during the ACDA 2012 Southern Division Conference in Winston-Salem, North Carolina. All participants at these sessions had the opportunity to complete the survey.

The ACDA 2012 Southern Division Conference occurred between February 28, and March 3, 2012. Choral directors who attended the reading sessions and round tables for middle school and high school were invited to participate. The attendees responding to the survey represented the following states (N=148): 22 Alabama (14.9%), 6 Florida (4.1%), 11 Georgia (7.4%), 10 Kentucky (6.8%), 4 Louisiana (2.7%), 1 Mississippi

(0.7%), 15 North Carolina (10.1%), 12 South Carolina (8.1%), 3 Tennessee (2.0%), 19 Virginia (12.8%), and 4 West Virginia (2.7%). The other 27.7% of the respondents responded that they either did not teach (1, 0.7%) or "other" (40, 27.0%). The category of "other" could have indicated that individuals taught in another state or they were currently enrolled as university students.

Survey Returns

Surveys (*N*=278) were distributed during the high school and middle school reading sessions and round table discussions during the ACDA Southern Division Conference. A total of 178 surveys were returned (64.0%). However, 30 surveys were determined to be invalid because seven were blank, and 23 surveys were from participants who indicated they had already completed the survey in a previous session at the conference. The adjusted return rate was 53.2% (*N*=148) with a 95% confidence level and 5.52 confidence interval. In addition, response rates for some of the questions varied due to some survey participants not answering every question.

Demographics

There were more females (*n*=87, 58.8%) than males (*n*=60, 40.5%). One person (0.7%) did not indicate gender on his/her survey. Other demographic information gathered included years of experience, grade currently teaching, highest degree earned, and whether or not the choir director instructs a same-sex choir during the school day (Table 1). Originally there were more categories representing years of experience. The distribution was too widespread to facilitate statistical analysis so categories were collapsed to provide more meaningful age ranges.

Table 1

Years of Teaching Experience

Years of Experience	*f*	%
1-5 years	32	21.6
6-15 years	27	18.2
16+ years	32	21.6
Never taught	57	38.5
Total	148	100.0

Choral directors who took the survey indicated which grade(s) they were currently teaching. Several directors taught at more than one level, which resulted in the total percent being greater than 100%. One respondent (0.7%) did not identify which level(s) he/she taught. The smallest percentage of participants taught K-5 (6.8%) while the largest percentage of participants was not teaching (34.5%). Secondary choral directors represented the following percentages, middle school (23.0%) and high school (32.4%). Post-secondary choral directors comprised the remaining 18.2% of the choral directors who completed the survey. Of the respondents, the following degree levels were reported: 29.7% Bachelor's, 37.2% Master's, 1.4% Educational Specialist, and 10.8% Doctorate. The respondents remaining were represented by either undergraduate students (30.4%) or graduate students (8.8%). Several of the respondents indicated what degree they had and those they were a graduate student, which again resulted in the total percentage being greater than100% (Table 2).

Table 2

Level Currently Teaching and Degrees Earned (N=148).

	f	*%*
Level Currently Teaching		
K-5	10	6.8
Middle School/Junior High	34	23.0
High School	48	32.4
Post-Secondary	27	18.2
Not Currently Teaching	51	34.5
Total	170	114.9
Highest Degree Earned		
Bachelor's	44	29.7
Master's	55	37.2
Educational Specialist	2	1.4
Doctorate	16	10.8
Undergraduate Student	45	30.4
Graduate Student	13	8.8
Total	175	118.3

Note: Several participants answered that they taught more than one level. Several also indicated that they were graduate students as well as the highest degrees they had earned. These variables increased the total percentages to greater than 100% and the total responses more than the population (*N*=148).

Respondents could choose more than one answer for multiple survey items. For example, several respondents had multiple answers regarding to the type of choirs they taught during the school day. 60.1% indicated that they taught at least one mixed-sex choir during the school day, 32.4% taught at least one all-female choir during the school day, and 20.9% taught at least one all-male choir during the school day. Respondents were asked to identify the type of choir they preferred to teach. Some teachers indicated that they preferred to teach more than one choir. Overwhelmingly, choral directors indicated that they preferred to teach mixed-sex choirs (72.3%) over all-female choirs (41.2%) or all-male choirs (33.1%). Survey participants were asked to identify their least favorite choir with whom to work. Again, some respondents chose more than one answer. Respondents indicated that 38.5% did not have a least favorite choir to work with while 14.2% said their least favorite choir

was a mixed-sex choir. Participants responded that female choirs (26.4%) more so than male choirs (29.0%) were the least favored choir to direct (Table 3).

Table 3

Choirs Taught and Preferred (N=148)

	f	*%*
Choirs taught during the school day.		
At least one mixed-sex choir	89	60.1
At least one all-female choir	48	32.4
At least one all-male choir	27	18.8
Total	164	111.3
Preferred choir to teach.		
Mixed-sex choir	107	72.3
All-female choir	61	41.2
All-male choir	49	33.1
Total	217	146.6
Least favorite choir to teach.		
None indicated	59	39.8
Mixed-sex choir	21	14.2
All-female choir	39	26.4
All-male choir	29	19.6
Total	148	100.0

Note: Respondents could identify more than one answer for each of the prompts above. Therefore, the total frequencies for each category could be greater than *N*=148, and the percentages for each category could be greater than 100%.

Null Hypothesis One

The first null hypothesis stated there will be no difference in directors' knowledge of sex differences based on sex of the choral director, years of experience, level currently teaching, highest degree earned, and directors who teach single-sex choirs and those who do not. The answer choices on the survey were created to assess choral directors' knowledge of student biological and sociological sex differences as related to teaching in the secondary choral classroom.

Chi-Square Analysis of Responses

Prompts on the survey that pertained to the first null hypothesis were grouped into four clusters: (a) pedagogical sociological prompts, (b) other sociological prompts, (c) biological differences relating to processing, and (d) other biological prompts. Each prompt in the survey had only one correct answer and four additional false distractor answers. The false answers were created to ensure that participants could not easily guess the correct answer. The five choices for each prompt included: (a) generally true for both sexes, (b) generally true for females, (c) generally true for males, (d) generally not true for both sexes, and (e) I am not sure. When a respondent marked the correct answer for a prompt, his/her response was recorded as a "1." When he/she marked any of the four false distractor answers, his/her answer was recorded as a "0."

Each of the four clusters was analyzed for frequency and valid percent. In addition, chi-square (χ^2) analyses were used to determine if there were any significant differences between those who answered correctly and those who answered incorrectly when they were grouped by different demographic variables. An alpha level of .05 was adopted, which means ultimately that there would be a 95% or greater chance that a Type I error did not occur for each of the significant results. Levels of significance were obtained by analyzing specific demographic groups using chi square analysis. An example of what was compared for levels of significance were those respondents with bachelor's degrees versus the whole group, or those teaching less than five years and those in the other years of experience categories.

Pedagogical Sociological Prompts

Data for the first cluster, pedagogical sociological prompts, were analyzed first. Frequency and percent for each answer for each prompt are reported in Table 4 and the descriptive statistics showing the number of respondents answering each prompt correctly can be found in Table 5. Prompt two, "tend to receive little teacher attention for their behavior in the classroom," had the highest percentage (31.1%) of correct answers while prompt six "tend to prefer varied learning activities in the classroom" had the lowest percentage (2.3%).

Table 4

Respondent's Answers to Pedagogical Sociological Prompts

Statement	Answer Choices	*f*	%
Tend to respond best to a set routine in the classroom.	Non-respondents	7	4.7
	Generally true for both sexes	106	71.6
	Generally true for females	21	14.2
	*Generally true for males	11	7.4
	Generally not true for both sexes	0	0.0
	I am not sure	3	2.0
	Total	148	100
Tend to receive little teacher attention for their behavior in the classroom.	Non-respondents	16	10.8
	Generally true for both sexes	11	7.4
	*Generally true for females	41	27.7
	Generally true for males	7	4.7
	Generally not true for both sexes	57	38.5
	I am not sure	16	10.8
	Total	148	100

Note: Correct answers are marked with an asterisk (*).

Table 4 Continues

Table 4 Continued

Statement	Answer Choices	*f*	%
Tend to respond well to an active classroom environment.	Non-respondents	12	8.1
	Generally true for both sexes	87	58.8
	Generally true for females	4	2.7
	*Generally true for males	34	23.0
	Generally not true for both sexes	3	2.0
	I am not sure	8	5.4
	Total	148	100
Tend to prefer group work.	Non-respondents	12	8.1
	Generally true for both sexes	63	42.6
	*Generally true for females	20	13.5
	Generally true for males	21	14.2
	Generally not true for both sexes	18	12.2
	I am not sure	14	9.5
	Total	148	100
Tend to respond well to teacher-directed instruction.	Non-respondents	11	7.4
	Generally true for both sexes	92	62.2
	Generally true for females	23	15.5
	*Generally true for males	5	3.4
	Generally not true for both sexes	5	3.4
	I am not sure	12	8.1
	Total	148	100.0
Tend to prefer varied learning activities in the classroom.	Non-respondents	18	12.2
	Generally true for both sexes	110	74.3
	*Generally true for females	3	2.0
	Generally true for males	6	4.1
	Generally not true for both sexes	1	.7
	I am not sure	10	6.8
	Total	148	100.0

Note: Correct answers are marked with an asterisk (*). Not every participant completed every question resulting in a different reported *n* for each prompt.

A Chi-square (χ^2) test was performed on each of the pedagogical sociological prompts to determine if there were any significant differences between respondents' when their true/false responses were grouped by these independent variables: (a) sex of the director, (b) years of experience, (c) level currently teaching, (d) highest degree earned, and (e) whether or not directors. This may show one group or another of respondents has more or less knowledge of pedagogical sociological sex differences as they pertain to the secondary choral classroom. Only the statistically significant ($p<.05$) prompts were reported in the tables.

Table 5

Correct Answers of Pedagogical Sociological Clusters: Total Population

Pedagogical Sociological Clusters	Correct Answer	*n*	*f*	%
1. Tend to respond best to a set routine in the classroom.	Generally true for males.	141	11	7.4
2. Tend to receive little teacher attention for their behavior in the classroom.	Generally true for females.	132	41	31.1
3. Tend to respond well to an active classroom environment.	Generally true for males.	136	30	21.9
4. Tend to prefer group work.	Generally true for females.	136	20	14.7
5. Tend to respond well to teacher-directed instruction.	Generally true for males.	137	23	16.8
6. Tend to prefer varied learning activities in the classroom.	Generally true for females.	130	3	2.3

**The number of respondents (n) is based on who actually responded to the prompt.*

There were no statistically significant differences for prompts 2-6 (Table 5) for all of the demographic variables. However, there were some statistically significant differences for the statement 1, "tend to respond best to a set routine in the classroom." However, like the other statements, there were no statistically significant differences found for the following variables: (a) years of experience, (b) level of teaching (high school), (c) level of teaching (post secondary), (d) highest degree earned (Masters), (e) currently a graduate student, and (f) whether they taught a same-sex choir or not. However, the null hypothesis was rejected (there were significant differences among respondents) for the following variables: (a) sex of the director, (b) level of teaching (K-5), (c) level of teaching (middle school/junior high), (d) level of teaching (not currently teaching), (e) highest degree earned (Bachelor's), (f) highest degree earned (Educational Specialist), (g) highest degree earned (Doctorate), and (h) currently an undergraduate student.

Table 6 shows the data for the statistically significant differences for the statement "tend to respond best to a set routine in the classroom." Overall there were a significantly higher percentage of males (8.3%) compared to females (5.7%) who answered this statement correctly. In addition, answers given by directors currently teaching K-5 showed a significant difference. Of the K-5 teachers, 20% responded correctly and 80% did not. All respondents teaching in the middle/junior high school level (n=10) and all who are not currently teaching (n=51) answered this statement incorrectly. The majority of the participants who were not currently teaching (82.2%) also answered this pedagogical statement incorrectly versus those who indicated they were teaching. Similarly, a majority of undergraduate students (80.5%) answered this statement incorrectly when compared to those who were not undergraduate students. Reponses by students currently earning their Bachelor's degree were statistically significant for the prompt "tend to respond best to a set routine." All of the respondents whose highest degree was Educational Specialist answered this statement incorrectly (n=2). Finally, the majority (73.3%) of choral directors who had an earned Doctorate answered the statement incorrectly.

Table 6

Statistically Significant Tests for Variables Relating to the Pedagogical Sociological Prompt: Tend to Respond Best to a Set Routine in the Classroom

Variable	*n*	Value	*df*	Asymp. Sig. (2-sided)**
Sex of the director	119	13.86	4	.008
Currently teaching K-5	10	6.033	2	.049
Currently teaching middle school/junior high	34	12.985	2	.002
Currently not teaching	45	6.393	2	.041
Bachelor's	43	7.193	3	.044
Educational Specialist	2	6.082	2	.048
Doctorate	15	7.787	2	.020
Undergraduate Student	41	7.005	2	.030

Note: **p<.05

Sociological Prompts

The sociological prompts were analyzed for frequencies and valid percentages according to the respondent's answers (Table 7). The correct answers were indicated in the table. All of the sociological prompts were clustered together and correct answers and total participants responding were reported for each statement (Table 8).

The sociological prompts were analyzed for frequency and valid percent of correct answers for the whole population. There were three prompts in which more than 50% of the survey participants answered correctly: (a) tend to be distracted by social, non-academic issues in the classroom (64.9%), (b) tend to have outbursts and be rowdier in the classroom (60.8%), (c) tend to not be distracted by social, non-academic issues in the classroom (60.8%). The sex breakdown of the respondents answering indicated that the first statement had more females (73.6%) answer correctly than males (51.7%). More males answered correctly (71.7%) compared to females (6.9%) for the prompt "tend to have outbursts and be rowdier in the classroom."

Table 7

Correct Answers for Remaining Sociological Prompts

Statement	Answer Choices	Frequency	Valid Percent
Tend to be distracted by social, non-academic issues in the classroom.	Non-respondents	10	6.8
	*Generally true for both sexes	96	64.9
	Generally true for females	21	14.2
	Generally true for males	15	10.1
	Generally not true for both sexes	4	2.7
	I am not sure	2	1.4
	Total	148	100.0
Tend to be self-motivated in the classroom.	Non-respondents	11	7.4
	Generally true for both sexes	38	25.7
	*Generally true for females	73	25.7
	Generally true for males	5	3.4
	Generally not true for both sexes	13	8.8
	I am not sure	7	4.7
	Total	148	100.0
Tend to respond well to a calm classroom setting.	Non-respondents	13	8.8
	Generally true for both sexes	90	60.8
	*Generally true for females	35	23.6
	Generally true for males	5	3.4
	Generally not true for both sexes	3	2.0
	I am not sure	2	1.4
	Total	148	100.0
Tend to lack self-motivation in the classroom.	Non-respondents	14	9.5
	Generally true for both sexes	21	14.2
	Generally true for females	3	2.0
	*Generally true for males	58	39.2
	Generally not true for both sexes	37	25.0
	I am not sure	15	10.1
	Total	148	100.0
Tend to thrive in a mixed-sex environment.	Non-respondents	15	10.1
	Generally true for both sexes	65	43.9
	Generally true for females	13	8.8
	Generally true for males	7	4.7
	*Generally not true for both sexes	31	20.9
	I am not sure	17	11.5
	Total	148	100.0
Tend to not speak out in the classroom.	Non-respondents	11	7.4
	Generally true for both sexes	21	14.2
	*Generally true for females	30	20.3
	Generally true for males	11	7.4
	Generally not true for both sexes	67	45.3
	I am not sure	8	5.4
	Total	148	100.0
Tend to prefer confrontation and high stimuli situations.	Non-respondents	11	7.4
	Generally true for both sexes	5	3.4
	Generally true for females	11	7.4
	*Generally true for males	55	37.2
	Generally not true for both sexes	42	28.4
	I am not sure	24	16.2
	Total	148	100.0

Note: Correct answers are marked with an asterisk (*).

Table 7 Continues

Table 7 Continued

Correct Answers for Remaining Sociological Prompts

Statement	Answer Choices	f	%
Tend to have outbursts and be rowdier in the classroom.	Non-respondents	12	8.1
	Generally true for both sexes	18	12.2
	Generally true for females	8	5.4
	*Generally true for males	90	60.8
	Generally not true for both sexes	11	7.4
	I am not sure	9	6.1
	Total	148	100.0
Tend to not be distracted by social, non-academic issues in the classroom.	Non-respondents	11	7.4
	*Generally true for both sexes	20	13.5
	Generally true for females	12	8.1
	Generally true for males	8	5.4
	Generally not true for both sexes	90	60.8
	I am not sure	7	4.7
	Total	148	100.0
Tend to enjoy competition as a motivation to learn.	Non-respondents	12	8.1
	Generally true for both sexes	81	54.7
	Generally true for females	4	2.7
	*Generally true for males	45	30.4
	Generally not true for both sexes	2	1.4
	I am not sure	3	2.0
	Total	148	100.0
Tend to not be aggressive in nature.	Non-respondents	12	8.1
	Generally true for both sexes	12	8.1
	Generally true for females	60	40.5
	*Generally true for males	13	8.8
	Generally not true for both sexes	34	23.0
	I am not sure	17	11.5
	Total	148	100.0
Tend to speak out in the classroom.	Non-respondents	12	8.1
	Generally true for both sexes	66	44.6
	Generally true for females	22	14.9
	*Generally true for males	29	19.6
	Generally not true for both sexes	8	5.4
	I am not sure	11	7.4
	Total	148	100.0
Tend to want to please the teacher.	Non-respondents	11	7.4
	Generally true for both sexes	74	50.0
	*Generally true for females	49	33.1
	Generally true for males	6	4.1
	Generally not true for both sexes	4	2.7
	I am not sure	4	2.7
Tend to control their classroom behavior.	Non-respondents	17	11.5
	Generally true for both sexes	30	20.3
	*Generally true for females	68	45.9
	Generally true for males	6	4.1
	Generally not true for both sexes	19	12.8
	I am not sure	8	5.4
	Total	148	100.0

Note: Correct answers are marked with an asterisk (*).

Table 7 Continues

Table 7 Continued

Correct Answers for Remaining Sociological Prompts

Statement	Answer Choices	Frequency	Valid Percent
Tend to not be distracted by social, non-academic issues in the classroom.	Non-respondents	11	7.4
	Generally true for both sexes	20	13.5
	Generally true for females	12	8.1
	Generally true for males	8	5.4
	*Generally not true for both sexes	90	60.8
	I am not sure	7	4.7
	Total	148	100.0
Tend to not care about pleasing the teacher.	Non-respondents	16	10.8
	Generally true for both sexes	9	6.1
	Generally true for females	4	2.7
	*Generally true for males	19	12.8
	Generally not true for both sexes	88	59.5
	I am not sure	12	8.1
	Total	148	100.0
Tend to like situations to remain calm with no confrontations.	Non-respondents	18	12.2
	Generally true for both sexes	59	39.9
	*Generally true for females	52	35.1
	Generally true for males	5	3.4
	Generally not true for both sexes	7	4.7
	I am not sure	7	4.7
	Total	148	100.0
Tend to not prefer competition as a motivation to learn.	Non-respondents	21	14.2
	Generally true for both sexes	10	6.8
	*Generally true for females	27	18.2
	Generally true for males	7	4.7
	Generally not true for both sexes	58	39.2
	I am not sure	25	16.9
	Total	148	100.0
Tend to thrive in a single-sex environment.	Non-respondents	19	12.8
	*Generally true for both sexes	46	31.1
	Generally true for females	16	10.8
	Generally true for males	27	18.2
	Generally not true for both sexes	16	10.8
	I am not sure	24	16.2
	Total	148	100.0

Note: Correct answers are marked with an asterisk (*).

Table 8

Correct Answers of Remaining Sociological Cluster: Total Population

Sociological prompt	Correct answer	*n*	*f*	%
1. Tend to be distracted by social, non-academic issues in the classroom.	Generally true for both sexes.	138	21	15.2
2. Tend to be self-motivated in the classroom.	Generally true for females.	136	73	53.7
3. Tend to respond well to a calm classroom setting.	Generally true for females.	135	35	25.9
4. Tend to lack self-motivation in the classroom.	Generally true for males.	134	3	2.2
5. Tend to thrive in a mixed-sex environment.	Generally not true for either sex.	133	13	9.8
6. Tend to not speak out in the classroom.	Generally true for females.	137	30	21.9
7. Tend to prefer confrontation and high stimuli situations.	Generally true for males.	137	11	8.0
8. Tend to have outbursts and be rowdier in the classroom.	Generally true for males.	136	8	5.9
9. Tend to not be distracted by social, non-academic issues in the classroom.	Generally not true for either sex.	137	12	8.8
10. Tend to enjoy competition as a motivation to learn.	Generally true for males.	135	4	3.0
11. Tend to not be aggressive in nature.	Generally true for females.	136	60	44.1
12. Tend to speak out in the classroom.	Generally true for males.	136	22	16.2
13. Tend to want to please the teacher.	Generally true for females.	137	49	35.8
14. Tend to receive more negative teacher attention for their behavior in the classroom.	Generally true for males.	135	4	3.0
15. Tend to control their classroom behavior.	Generally true for females.	131	68	51.9
16. Tend to not care about pleasing the teacher.	Generally true for males.	132	4	3.0
17. Tend to like situations to remain calm with no confrontations.	Generally true for females.	130	52	40.0
18. Tend to not prefer competition as a motivation to learn.	Generally true for females.	127	27	21.3
19. Tend to thrive in a single-sex environment.	Generally true for both sexes.	129	16	12.4

Seven of 19 sociological prompts were statistically significant for at least one demographic variable. Five survey items were statistically significant for a single demographic variable, and two items were significant for sex of the choral director. Two prompts were only significant when respondents were grouped by sex of the director (Table 9).

Table 9

Statistically Significant Variables for Sociological Prompts Affected by Sex of the Director.

Prompt	Variable	*n*	value	*df*	Asymp. Sig. (2-sided)**
Tend to prefer confrontation and high stimuli situations.	Sex of the director	137	11.989	2	.002
Tend to not be distracted by social, non-academic issues in the classroom.	Sex of the director	137	6.67	2	.036

Note: **p<.05

Table 10 shows the five prompts that showed significant differences in different demographic areas. The two variables affected by the sex of the choral director were: (a) "tend to prefer confrontation and high stimuli situations" and (b) "tend to not be distracted by social, non-academic issues in the classroom." The responses to the first variable indicated that 30 females (*n*=87) out of the female population (34.5%) answered the prompt correctly and 25 males (*n*=60) out of the male population (41.7%) answered correctly. For the second one, 64.4% of the females answered correctly and 55.0% of the males answered correctly. These two prompts were not significantly significant for years of experience, level currently teaching, degrees earned, or whether they taught a single-sex choir.

Table 10

Sociological Prompts with Only One or Two Significant Variables.

Prompt	Variable	*n*	Value	*df*	Asymp. Sig. (2-sided)**
Tend to be distracted by social, non-academic issues in the classroom.	Choral directors who teach at least one all-female choir during the school day	48	4.120	1	.042
Tend to respond well to a calm classroom setting.	Choral directors who teach at least one all-male choir during the school day	25	5.235	1	.022
Tend to receive negative teacher attention for their behavior in the classroom.	Graduate Student	12	8.61	2	.013
Tend to not care about pleasing the teacher.	Highest degree earned: Educational Specialist	2	15.27	2	.000
Tend to like situations to remain calm with no confrontations.	Currently teach high school	46	8.68	2	.013
Tend to like situations to remain calm with no confrontations.	Years of experience	130	9.325	3	.025

Note: $^{**}p<.05$

Statistical significance was found for the variable "directors who taught at least one all-female choir during the school day" for the prompt "tend to be distracted by social, non-academic issues in the classroom." Specifically, just over 70% of directors who taught at least one all-female choir answered this prompt correctly; more answered it correctly than incorrectly.

Similarly, "directors who taught at least one all-male choir during the school day" was a significant variable for the sociological statement "tend to respond well to a calm classroom setting" (Table 10). Eleven (44%) of the 25 directors who taught an all-male choir answered this prompt correctly, but more answered it incorrectly than correctly.

The status of being a graduate student was a significant variable for the sociological prompt "tend to receive negative teacher attention for their behavior in the

classroom." This significance indicated that there was a difference between participants who were graduate students and those who were not. Only two (17%) graduate students (n=12) answered the prompt correctly, indicating that more answered the prompt incorrectly than correctly.

The final sociological prompt that showed statistical significance by a single demographic variable was "tends to not care about pleasing the teacher." One of two respondents (50%) whose highest earned degree was the Educational Specialist degree answered this item correctly which was significantly different statistically from those who had not earned the Education Specialist degree. There was no statistical significance for the following variables: (a) sex of the choir director, (b) level currently teaching (K-5, middle school/junior high, post-secondary, and currently not teaching), (c) degrees' earned (Bachelor's, Master's, Doctorate, undergraduate student, and graduate student), and (d) whether they taught a single-sex choir.

The statement "tends to like situations to remain calm with no confrontations" was significantly affected by two variables: (a) those who teach high school and (b) years of experience. There were 11 (23.9%) high school directors (n=46) who answered this prompt correctly, while 35 (76.1%) high school directors answered incorrectly. This statement was also significantly affected by years of teaching experience, no experience, 1-5 years, 6-15 years, and 16+ years. Those with the most teaching experience had the fewest percentage in that group who answered the question correctly; only 18.8% of answered it correctly. Conversely, the group of respondents who had no teaching experience had the highest percentage of respondents who answered this prompt correctly (43.9%). The group of respondents with 1-5 years of teaching experience had 34.4%

answer the prompt correctly and those with 6-15 years of experience had 37% answer it correctly. As a result, the null hypothesis was rejected these two variables (teaching high school and years of experience).

Respondents' answers for the sociological prompt "tend to thrive in a mixed-sex environment" were significantly different for five demographic variables related to participants' degree(s) earned, or for undergraduate or graduate students (Table 11). For each group of choir directors whose highest degree earned was a Bachelor's, an Education

Specialist, or a Doctorate, the null hypothesis was rejected. Three (7.1%) of the participants whose highest degree earned was a Bachelor's answered this statement correctly. One (50%) of the 2 choral directors who had an Educational Specialist answered this statement correctly and only 1 (6.7%) of the 15 whose held Doctorate degrees answered this question correctly. Chi-square indicated that there was a significant difference between the other educational groups and those who had a doctorate.

Undergraduate students and graduate students were also statistically significant for this statement "tend to thrive in a mixed-sex environment." Only three (7.9%) undergraduate students and two (16.7%) graduate students answered it correctly. Being an undergraduate or graduate student had a significant effect on how the statement was answered. There were no statistically significant differences for the variables: (a) sex of the director, (b) years of experience, (c) level of teaching, (d) highest degree earned (Master's), and (e) whether or not a single sex choir was taught.

Table 11

Statistically Significant Variables for: Tend To Thrive in a Mixed-Sex Classroom.

Variable	*n*	Value	*df*	Asymp. Sig. (2-sided)**
Highest degree earned: Bachelor's	42	10.63	3	.014
Highest degree earned: Educational Specialist	2	13.15	2	.001
Highest degree earned: Doctorate	15	9.41	2	.009
Undergraduate student	38	9.387	2	.009
Graduate student	12	10.160	2	.006

Note: $**p<.05$

Table 12 shows the variables that were statistically significant for the sociological prompt "tend to have outbursts and be rowdier in the classroom." The null hypothesis was rejected for all of the statistically significant variables listed in the table, indicating that there were differences. There were only two (4.7%) correct answers given to the statements by directors with their Bachelor's as their highest degree earned (n=43). Educational Specialists (n=2) only had 50% of their respondents answer correctly, and no directors who had earned a Doctorate answered the sociological statement correctly. Students currently working on their undergraduate degree (n=39) had only one person respond correctly, while graduate students (n=12) had two people respond correctly. The following variables were not statistically significant: (a) sex of the director, (b) years teaching, (c) current level teaching, (d) highest degree earned (Master's), and (e) whether or not a same-sex choir was taught during the school day.

Table 12

Statistically Significant Variables for: Tend to Have Outbursts and Be Rowdier in the Classroom

Variable	*n*	Value	*df*	Asymp. Sig. (2-sided)**
Highest degree earned: Bachelor's	43	16.43	3	.001
Highest degree earned: Educational Specialist	2	23.483	2	.000
Highest degree earned: Doctorate	2	16.93	2	.000
Undergraduate student	39	16.81	2	.000
Graduate student	12	19.26	2	.000

Note: $**p<.05$

Table 13 shows the statistically significant demographic variables for the statement "tend to enjoy competition as a motivation to learn." None of the participants in the following groups gave the correct answer for this statement: (a) teachers currently teaching K-5 (n=10), (b) post-secondary (n=25), (c) not teaching (n=42), (d) highest degree earned Educational Specialist (n=2), and (e) graduate student (n=12). Alternately, there were four variables in which one respondent answered correctly for the same prompt including: (a) currently teaching middle school (n=32), (b) high school (n=42), (c) not teaching (n=42), (d) highest degree earned Bachelor's (n=43), (e) Doctorate (n=15), and (f) undergraduate student (n=39). However, there were no significant interactions for the following variables: (a) sex of director, (b) years of experience, (c) highest degree earned Master's, and (d) whether or not they taught a same sex choir during the school day.

Table 13

Statistically Significant Variables for: Tend to Enjoy Competition As a Motivation to Learn.

Variable	*n*	Variable	*df*	Asymp. Sig. (2-sided)**
Currently teach K-5	7	33.12	2	.000
Currently teach middle school/junior high	34	33.07	2	.000
Currently teach high school	48	33.00	2	.000
Currently teach post-secondary	25	33.53	2	.000
Currently not teaching	42	33.00	2	.000
Highest degree earned: Bachelor's	43	33.09	3	.000
Highest degree earned: Educational Specialist	2	33.03	2	.000
Highest degree earned: Doctorate	15	34.15	2	.000
Undergraduate student	39	33.02	2	.000
Graduate student	12	33.22	2	.000

Note: $^{**}p<.05$

There were five demographic variables that were statistically significant for the prompt "tend to speak out in the classroom" (Table 14). Those variables were: (a) currently teaching middle school/junior high, (b) those not currently teaching, (c) participants who had only earned a Bachelor's degree, (d) undergraduate students, and (e) graduate students. The null hypothesis was rejected for each of these. Only three of 32 respondents (9.4%) who taught middle school/junior high answered the statement correctly. Participants who indicated that they were not currently teaching also came up as a significant variable with 10 (30.0%) survey respondents answering correctly. Four of 43 of respondents (9.3%) whose highest earned degree was a Bachelor's answered the prompt correctly. Finally, within each of the following demographic areas eight (25%) undergraduate students answered correctly and three (40%) graduate students answered correctly. There were no statistically significant differences for the variables: (a) sex of

the director, (b) years of experience, (c) current level teaching (K-5, high school, and post- secondary), (d) highest degree earned (Master's, Educational Specialist, and Doctorate), and (e) whether they taught a same-sex choir.

Table 14

Statistically Significant Variables for: Tend to Speak Out in the Classroom

Variable	*n*	Value	*df*	Asymp. Sig. (2-sided)**
Currently teach middle school/junior high	34	6.74	2	.034
Currently not teaching	43	7.98	2	.019
Highest degree earned: Bachelor's	43	8.85	3	.031
Undergraduate student	40	6.05	2	.049
Graduate student	12	6.09	2	.048

Note: $^{**}p<.05$

There were six statistically significant demographic variables for "tend to not prefer competition as a motivation to learn" (Table 15). The null hypothesis was rejected for the following variables. Years of experience (n =127) were significant with 27 survey respondents answering this prompt correctly. Two (6.3%) participants who taught middle school/junior high (n=32) answered the statement correctly. Of the survey respondents who taught high school (n=45), four (8.9%) individuals answered the prompt correctly.

Table 15

Statistically Significant Variables for: Tend to Not Prefer Competition as a Motivation to Learn

Variable	*n*	Variable	*df*	Asymp. Sig. (2-sided)**
Currently teach middle school/junior high	32	6.18	2	.046
Currently teach high school	45	6.85	2	.033
Highest degree earned: Master's	46	4.65	1	.031
Undergraduate student	39	7.34	2	.026
Years of experience	127	8.87	3	.031
Direct at least one all-female choir during the school day	45	4.288	1	.038

Note: **$p<.05$

The prompt "tend to thrive in a single-sex environment" had six demographic variables that were statistically significant (Table 16). There was failure to accept the null hypothesis for those listed variables. For the variable of sex of the director, 13.3% of the females (*n*=75) and 9.4% males of the males (*n*=53) responded to the prompt correctly. Ten percent of K-5 teachers (*n*=10) and 12.5% of the middle school/junior high teachers (*n*=32) responded correctly. High school teachers (*n*=45) only had 8.9% of their respondents answer the statement correctly. Respondents who taught at the post-secondary level (*n*=23) only had 8.7% respond correctly. Of the respondents who were currently not teaching (*n*=41), only two (4.9%) people answered correctly. The null hypothesis was accepted for these remaining variables: (a) years of experience, (b) highest degree earned, and (c) whether they taught a single-sex choir.

Table 16

Statistically Significant Variables for: Tend to Thrive in a Single-Sex Environment

Variable	*n*	Value	*df*	Asymp. Sig. (2-sided)**
Sex of the director	129	7.55	2	.023
Currently teach K-5	8	7.12	2	.028
Currently teach middle school/junior high	32	7.14	2	.028
Currently teach high school	45	7.63	2	.022
Currently teach post secondary	23	7.35	2	.025
Currently not teaching	41	12.93	2	.002

Note: **$p<.05$

Biological Prompts Relating to Processing

There were 17 survey items related to how the brain processes information. The frequency, percent, and correct answers are indicated in Table 17. As stated earlier, data were re-coded into nominal data (0 for false answers and 1 for true answers from respondents). The *n*, frequency, and valid percentage for each correct answer for each prompt are reported in Table 18. As a reminder, the number of people responding varied from question to question. For this cluster, there were only two statements in which more than half of the participants responded correctly: (a) “tend to express feelings verbally” and (b) “tend to process written words faster.”

Table 17

Respondents Answers for Biological-processing Prompts.

Statement	Answer Choices	*f*	%
Tend to utilize only auditory areas of the brain when analyzing auditory sounds.	Non-respondents	15	10.1
	Generally true for both sexes	29	19.6
	Generally true for females	8	5.4
	*Generally true for males	9	6.1
	Generally not true for both sexes	22	14.9
	I am not sure	65	43.9
Tend to process lip-reading into an auditory sound.	Non-respondents	14	9.5
	Generally true for both sexes	67	45.3
	*Generally true for females	29	19.6
	Generally true for males	3	2
	Generally not true for both sexes	9	6.1
	I am not sure	26	17.6
Tend to have more areas of the brain activated when at rest.	Non-respondents	12	8.1
	Generally true for both sexes	12	8.1
	*Generally true for females	29	19.6
	Generally true for males	15	10.1
	Generally not true for both sexes	11	7.4
	I am not sure	69	46.6
Tend to attach emotion to information they receive.	Non-respondents	11	7.4
	Generally true for both sexes	31	20.9
	*Generally true for females	89	60.1
	Generally true for males	3	2
	Generally not true for both sexes	3	2
	I am not sure	11	7.4
Tend to process information and emotion in one hemisphere of the brain.	Non-respondents	12	8.1
	Generally true for both sexes	11	7.4
	Generally true for females	21	14.2
	*Generally true for males	17	11.5
	Generally not true for both sexes	12	8.1
	I am not sure	75	50.7
Tend to be sensitive to both positive and negative visual stimuli.	Non-respondents	12	8.1
	Generally true for both sexes	83	56.1
	*Generally true for females	15	10.1
	Generally true for males	6	4.1
	Generally not true for both sexes	3	2
	I am not sure	29	19.6
Tend to express feeling verbally.	Non-respondents	14	9.3
	Generally true for both sexes	38	25.7
	*Generally true for females	81	54.7
	Generally true for males	6	4.1
	Generally not true for both sexes	4	2.7
	I am not sure	5	3.4

Note: Correct answers are marked with an asterisk (*).

Table 17 Continues

Table 17 Continued

Respondents Answers for Biological-processing Prompts.

Statement	Answer Choices	*f*	%
Tend to process written words faster.	Non-respondents	17	11.5
	Generally true for both sexes	12	8.1
	*Generally true for females	70	47.3
	Generally true for males	7	4.7
	Generally not true for both sexes	5	3.4
	I am not sure	37	25
Tend to have difficulty processing lip-reading into and auditory sound.	Non-respondents	16	10.8
	Generally true for both sexes	11	7.4
	Generally true for females	4	2.7
	*Generally true for males	18	12.2
	Generally not true for both sexes	47	31.8
	I am not sure	52	35.1
Tend to utilize language and auditory areas of the brain when analyzing auditory patterns.	Non-respondents	19	12.8
	Generally true for both sexes	32	21.6
	*Generally true for females	22	14.9
	Generally true for males	4	2.7
	Generally not true for both sexes	2	1.4
	I am not sure	69	46.6
Tend to refrain from expressing feeling verbally.	Non-respondents	12	8.1
	Generally true for both sexes	20	13.5
	Generally true for females	7	4.7
	*Generally true for males	6	4.1
	Generally not true for both sexes	71	48
	I am not sure	32	21.6
Tend to process information and emotion in both hemispheres of the brain.	Non-respondents	19	12.8
	Generally true for both sexes	26	17.6
	*Generally true for females	16	10.8
	Generally true for males	5	3.4
	Generally not true for both sexes	3	2
	I am not sure	79	53.4
Tend to have no brain activity during verbal stimuli that they deem not important.	Non-respondents	19	12.8
	Generally true for both sexes	20	13.5
	Generally true for females	4	2.7
	*Generally true for males	24	16.2
	Generally not true for both sexes	23	15.5
	I am not sure	58	39.2
Tend to attach no emotion to the information they receive.	Non-respondents	19	12.8
	Generally true for both sexes	4	2.7
	Generally true for females	1	0.7
	*Generally true for males	50	33.8
	Generally not true for both sexes	55	37.2
	I am not sure	19	12.8

Note: Correct answers are marked with an asterisk (*).

Table 17 Continues

Table 17 Continued

Respondents Answers for Biological-processing Prompts.

Statement	Answer Choices	*f*	%
Tend to be sensitive to positive visual stimuli.	Non-respondents	21	14.2
	Generally true for both sexes	80	54.1
	*Generally true for females	11	7.4
	Generally true for males	8	5.4
	Generally not true for both sexes	2	1.4
	I am not sure	26	17.6
Tend to show brain activity even when they deem the verbal stimuli not important.	Non-respondents	19	12.8
	Generally true for both sexes	28	18.9
	*Generally true for females	21	14.2
	Generally true for males	3	2
	Generally not true for both sexes	11	7.4
	I am not sure	66	44.6
Tend to have more areas of the brain activated when they process information.	Non-respondents	19	12.8
	Generally true for both sexes	33	22.3
	*Generally true for females	28	18.9
	Generally true for males	2	1.4
	Generally not true for both sexes	4	2.7
	I am not sure	62	41.9

Note: Correct answers are marked with an asterisk (*).

Table 18

Correct Answers of Pedagogical Sociological Cluster: Total Population

Prompt		Correct Answer	*n*	*f*	*%*
1.	Tend to utilize only auditory areas of the brain when analyzing auditory patterns.	Generally true for males.	133	8	6.0
2.	Tend to process lip-reading into an auditory sound.	Generally true for females.	134	29	21.6
3.	Tend to have more areas of the brain activated when they are resting.	Generally true for females.	136	29	21.3
4.	Tend to attach emotion to information they receive.	Generally true for females.	137	89	65.0
5.	Tend to process information and emotion in one hemisphere of the brain.	Generally true for males.	136	17	12.5
6.	Tend to be sensitive to both positive and negative visual stimuli.	Generally true for males.	126	6	4.8
7.	Tend to express feelings verbally.	Generally true for females.	134	81	60.4
8.	Tend to process written words faster.	Generally true for females.	131	70	53.4
9.	Tend to have difficulty processing lip-reading into an auditory sound.	Generally true for males.	132	18	13.6
10.	Tend to utilize language and auditory areas of the brain when analyzing auditory patterns.	Generally true for females.	129	22	17.1

Note: **p<.05

Table 18 continues

Table 18 Continued

Correct Answers of Pedagogical Sociological Cluster: Total Population

Prompt		Correct Answer	*n*	*f*	*%*
11.	Tend to refrain from expressing feelings verbally.	Generally true for males.	128	71	55.4
12.	Tend to process information and emotion in both hemispheres of the brain.	Generally true for females.	129	16	12.4
13.	Tend to have no brain activity during verbal stimuli that they deem not important.	Generally true for males.	129	24	18.6
14.	Tend to attach no emotion to the information they receive.	Generally true for males.	129	50	38.8
15.	Tend to be sensitive to positive visual stimuli.	Generally true for both sexes.	127	11	8.7
16.	Tend to show brain activity even when they deem the verbal stimuli not important.	Generally true for females.	129	21	16.3
17.	Tend to have more areas of the brain activated when they process information.	Generally true for females.	129	28	21.7

Note: **p<.05

Various demographic variables were statistically significant for 10 of the 17 statements. Demographic variables that significantly affected four of the biological prompts included: (a) “tend to process lip-reading into an auditory sound,” (b) “tend to process information and emotion in one hemisphere of the brain,” (c) “tend to process written words faster,” and (d) “tend to refrain from expressing feelings verbally” (Table 19).

Table 19

Statistically Significant Variables for: Biological-processing Prompts Affected by One or Two Demographic Variables

Prompts	Variables	*n*	value	*df*	Asymp. Sig. (2-sided)**
Tend to process lip-reading into an auditory sound.	Directors who teach at least one all-male choir during the school day	27	3.931	1	.047
Tend to process information and emotion in one hemisphere of the brain.	Sex of the director	135	7.117	2	.028
Tend to process written words faster.	Highest Earned Degree: Master's	47	4.138	1	.042
Tend to refrain from expressing feelings verbally.	Currently teaching high school	44	6.312	2	.043
Tend to refrain from expressing feelings verbally.	Highest degree earned: Master's	46	9.962	1	.002

Note: **p<.05

The null hypothesis was rejected for the statement "tend to process lip-reading into an auditory sound" for directors who taught at least one male choir during the day. Only two (7.4%) directors that taught at least one male choir a day (*n*=27) answered correctly. There were no statistically significant differences found for the following remaining variables: (a) sex of the director, (b) years of experience, (c) level currently teaching, (d) highest degree earned, and (e) whether they taught an all-female choir.

Sex of the director was statistically significant for the statement "tend to process information and emotion in one hemisphere of the brain." Nine of 80 females (11.3%) and seven of 55 males (12.7%) answered correctly. The data indicated that there was no statistical significance found for the remaining following variables: (a) years of experience, (b) level currently teaching, (c) highest degree earned, and (d) whether they taught a same-sex choir.

The prompt "tend to process written words faster" was significantly affected by the variable of highest degree earned: Master's. There were no respondents who answered this statement correctly; therefore the null hypothesis was rejected. There was no statistical significance found for the following remaining variables: (a) sex of the director, (b) years of experience, (c) level currently teaching, (d) highest degree earned (Bachelor's, Educational Specialist, Doctorate, undergraduate student, and graduate student) and (e) whether they taught a same-sex choir.

The final statement that was significantly significant in regards to the demographic variables was "tend to refrain from expressing feelings verbally." Of the 44 participants who were currently teaching high school, 18 (40.9%) responded correctly, while directors whose highest degree earned was a Master's had 17 of the total 46 (37.0%) people answer correctly. The null hypothesis was rejected overall for this variable indicating there was a difference between respondents who currently teach high school and those who do not, and for those who had a Master's degree and those who did not (or who had a higher level degree). There was were no statistically significant differences found for the following remaining variables: (a) sex of the director, (b) years of experience, (c) level currently teaching (K-5, middle school/junior high, post-secondary, and currently not teaching), (d) highest degree earned (Bachelor's, Educational Specialist, Doctorate, undergraduate student, and graduate student), and (e) whether they taught a same-sex choir.

The prompt "tend to utilize only auditory areas of the brain when analyzing auditory patterns" was statistically significant for six demographic variables, which can be found in Table 20. The null hypothesis was rejected for each of the variables listed.

Directors with the Bachelor's as the highest degree earned (*n*=43) was a statistically significant variable. Four (9.3%) directors answered this prompt correctly. None of the directors whose highest degree was Educational Specialist (*n*=2), answered the statement correctly.

Table 20

Statistically Significant Variables for: Tend to Utilize Only Auditory Areas of the Brain When Analyzing Auditory Patterns

Variable	*N*	value	*df*	Asymp. Sig. (2-sided)**
Highest degree earned: Bachelor's	43	16.963	3	.001
Highest degree earned: Educational Specialist	2	14.000	2	.001
Highest degree earned: Doctorate	14	14.794	2	.001
Undergraduate student	39	14.116	2	.001
Graduate student	12	13.990	2	.001
Directors who teach at least one all-female choir during the day	47	4.146	1	.042

Note: **$p<.05$

Respondents who had their Doctorate (*n*=14) and undergraduate students (*n*=39) had statistically significant responses to the variables for the prompt "tend to utilize only auditory areas of the brain when analyzing auditory patterns." There were no individuals with an earned Doctorate who answered this prompt correctly and three (7.7%) undergraduate students who answered it correctly. One (8.3%) graduate student (*n*=12) answered the statement correctly. Only six choral directors who currently teach at least one all-female choir (*n*=47, 12.8%) responded correctly to the statement. There were no significant for the following remaining variables related to this statement: (a) sex of the

director, (b) years of experience, (c) highest degree earned (Master's), and (d) whether they taught an all-male choir.

There were six demographic variables that were statistically significant for the biological-processing statement "tend to be sensitive to both positive and negative visual stimuli" (Table 21). The first, sex of the director, had two (2.5%) females (*n*=81) and three (5.6%) males (*n*=54) who answered correctly. No one answered the prompt correctly of the directors who indicated they taught K-5 (*n*=8). Middle school/junior high directors (*n*=34) had only one person (2.9%) respond with the correct answer and high school directors (*n*=48) had only one person (2.1%) respond correctly. Respondents who were currently teaching post-secondary (*n*=24) had two (8.3%) people answer correctly, and those not teaching (*n*=43) had three (7.0%) people answer correctly. There were no statistically significant differences found for the following remaining variables: (a) years of experience, (b) highest degree earned, and (c) whether or not they teach a single-sex choir.

The prompt "tend to have difficulty processing lip-reading into an auditory sound" had four demographic variables that showed statistical significance (Table 22). Of the survey respondents who indicated their highest degree was an Educational Specialist (*n*=2), no one responded correctly to the statement. Individuals whose highest degree was a Doctorate (*n*=14) had only two (14.3%) correct answers. Undergraduate and graduate students comprised the final two variables in which the null hypothesis was rejected for this statement. Undergraduate students (*n*=40) only had seven (17.5%) people respond correctly, while none of the graduate students (*n*=12) answered the statement correctly. The following remaining demographic variables showed no statistical significance: (a)

sex of the director, (b) years of experience, (c) level currently teaching, (d) highest degree earned (Bachelor's and Master's), and (e) whether they taught a same-sex choir.

Table 21

Statistically Significant Variables for: Tend to be Sensitive to Both Positive and Negative Visual Stimuli

Variable	*n*	value	*df*	Asymp. Sig. (2-sided)**
Sex of the director	135	22.559	2	.000
Currently teaching K-5	8	22.104	2	.000
Currently teaching middle school/junior high	34	21.890	2	.000
Currently teaching high school	48	22.291	2	.000
Currently teaching post secondary	24	23.311	2	.000
Currently not teaching	43	23.430	2	.000

Note: **$p<.05$

Table 22

Statistically Significant Variables for: Tend to Have Difficulty Processing Lip-Reading into an Auditory Sound

Variable	*n*	value	*df*	Asymp. Sig. (2-sided)**
Highest degree earned: Educational Specialist	2	6.672	2	.036
Highest degree earned: Doctorate	14	6.404	2	.041
Undergraduate student	40	7.382	2	.081
Graduate student	12	8.271	2	.016

Note: **$p<.05$

The statement "tend to process information and emotion in both hemispheres of the brain" had five demographic variables that were statistically significant (Table 23) and the null hypothesis was rejected for each of them. Responses given by those

respondents whose highest degree was a Bachelor's (*n*=40) was the first statistically significant variable. There were only three (7.5%) individuals who correctly responded to this statement. There were no correct answers given by respondents who indicated that their highest degree was an Educational Specialist (*n*=2) and Doctorate (*n*=14). Undergraduate students (*n*=40, 2.5%) and graduate students (*n*=12, 8.3%) had only one person who answered the statement correctly, The following remaining demographic variables were not statistically significant: (a) sex of the director, (b) years of experience, (c) current level teaching, and (d) highest degree earned (Master's), and (e) whether they taught a same-sex choir.

Table 23

Statistically Significant Variables for Tend to Process Information and Emotion in Both Hemispheres of the Brain

Variable	*n*	value	*df*	Asymp. Sig. (2-sided)**
Highest degree earned: Bachelor's	40	22.997	3	.000
Highest degree earned: Educational Specialist	2	25.047	2	.000
Highest degree earned: Doctorate	14	25.406	2	.000
Undergraduate student	40	25.055	2	.000
Graduate student	12	25.958	2	.000

Note: **$p<.05$

There were five demographic variables that were statistically significant for the statement "tend to attach no emotion to the information they receive" (Table 24) and the null hypothesis was rejected. The first variable was years of experience. For directors who had 1-5 years of secondary choral experience (*n*=30), eight (26.7%) individuals

responded correctly, 6-15 years of experience (*n*=22) seven (31.8%) individuals answered correctly, 16+ years of experience (*n*=30) nine (30%) individuals answered correctly, and those with no years of secondary choral experience (*n*=47) 26 (55.3%) individuals answered correctly. There were 24 (58.5%) correct responses given by directors currently not teaching (*n*=41).

Table 24

Statistically Significant Variables for Tend to Attach No Emotion to the Information They Receive

Variable	*n*	value	*df*	Asymp. Sig. (2-sided)**
Years of experience	129	8.694	3	.034
Currently teaching: Not currently teaching	41	12.019	2	.002
Highest degree earned: Master's	47	5.450	1	.020
Undergraduate student	40	10.646	3	.005
Teach at least one all-female choir during the school day	45	4.258	1	.039

Note: *$p<.05$

The following variables in the category "highest degree earned" were statistically significant. Survey participants who indicated that their highest degree was a Master's (*n*=47) had 12 (35.5%) people who answered correctly. Undergraduate students (*n*=40) had 23 (57.5%) individuals who answered correctly. The final demographic variable affecting this statement was directors who taught at least one all-female choir (*n*=45) during the school day. There were 12 (26.7%) individuals who answered this prompt correctly. The data indicated there were no statistically significant differences for the following remaining demographic variables: (a) sex of director, (b) level currently teaching (K-5, middle school/junior high, high school, and post-secondary), (c) highest

degree earned (Bachelor's, Educational Specialist, Doctorate, and graduate student), and (d) whether they taught an all-male choir during the school day.

The prompt "tend to be sensitive to positive visual stimuli" was significantly affected by five demographic variables (Table 25). The null hypothesis was rejected for all of these demographic variables (currently teaching: k-5, middle school/Jr. high, high school, post secondary, not teaching). The following three demographic variables had only a person answer correctly: directors currently teaching K-5 (*n*=8, 12.5%), directors currently teaching middle school/junior high (*n*=31, 3.2%), and directors currently teaching post-secondary (*n*=23, 4.3%). There were three correct answers given by directors teaching high school (*n*=45, 6.7%) and two correct answers given by individuals not currently teaching (*n*=40, 5%). There were no statistically significant differences found for the following demographic variables: (a) sex of the director, (b) years of experience, (c) highest degree earned, and (d) whether they taught a same sex choir.

Table 25

Statistically Significant Variables for Tend to Be Sensitive to Positive Visual Stimuli

Variable	*n*	value	*df*	Asymp. Sig. (2-sided)**
Currently teaching: K-5	8	15.691	2	.000
Currently teaching: Middle school/junior high	31	15.371	2	.000
Currently teaching: High school	45	15.129	2	.001
Currently teaching: Post-secondary	23	15.463	2	.000
Currently not teaching	40	15.024	2	.001

Note: **$p<.05$

Biological Prompts

All of the other remaining biological prompts were categorized together. Statistics and correct answers for those prompts were reported in Table 26. Table 27 shows the frequency and percent for the population for those who answered correctly. There were five statements in which more than half of the participants responded correctly.

The other biological prompts were analyzed for the frequency and valid percent of correct answers for the entire surveyed population. As a reminder, the *n* is not constant because not every survey respondent answered every statement. There were six prompts in which more than 50% of the survey participants answered correctly: (a) "tend to experience voice change issues," (b) "tend to experience drastic voice change issues during puberty," (c) "tend to have high levels of testosterone," (d) "tend to have no voice change issues," (e) "tend to experience minimal voice change issues and vocal cord growth throughout puberty," and "tend to have high levels of estrogen."

Table 26

Respondents' Answers to Remaining Biological Prompts (N=148)

Statement	Answer Choices	*f*	%
Tend to experience voice change issues.	Non-respondents	7	4.7
	*Generally true for both sexes	88	59.5
	Generally true for females	2	1.4
	Generally true for males	45	30.4
	Generally not true for both sexes	3	2.0
	I am not sure	3	2.0
Tend to have no difficulty hearing female teachers.	Non-respondents	11	7.4
	Generally true for both sexes	56	37.8
	*Generally true for females	23	15.5
	Generally true for males	4	2.7
	Generally not true for both sexes	12	8.1
	I am not sure	42	28.4

Note: Correct answers are marked with an asterisk (*).

Table 26 Continues

Table 26 Continued

Respondents' Answers to Remaining Biological Prompts (N=148)

Statement	Answer Choices	*f*	%
Tend to have a weaker sense of hearing.	Non-respondents	12	8.1
	Generally true for both sexes	8	5.4
	Generally true for females	6	4.1
	*Generally true for males	32	21.6
	Generally not true for both sexes	47	31.8
	I am not sure	43	29.1
Tend to be sensitive to light levels.	Non-respondents	16	10.8
	Generally true for both sexes	15	10.1
	Generally true for females	10	6.8
	*Generally true for males	6	4.1
	Generally not true for both sexes	36	24.3
	I am not sure	65	43.9
Tend to experience drastic voice change issues during puberty.	Non-respondents	11	7.4
	Generally true for both sexes	11	7.4
	Generally true for females	0	0.0
	*Generally true for males	120	81.1
	Generally not true for both sexes	0	0.0
	I am not sure	6	4.1
Tend to have high levels of testosterone.	Non-respondents	11	7.4
	Generally true for both sexes	6	4.1
	Generally true for females	3	2.0
	*Generally true for males	119	80.4
	Generally not true for both sexes	0	0.0
	I am not sure	9	6.1
Tend to have difficulty hearing female teachers.	Non-respondents	12	8.1
	Generally true for both sexes	4	2.7
	Generally true for females	2	1.4
	*Generally true for males	29	19.6
	Generally not true for both sexes	49	33.1
	I am not sure	52	35.1
Tend to have no voice change issues.	Non-respondents	11	7.4
	Generally true for both sexes	2	4.1
	Generally true for females	28	18.9
	Generally true for males	1	.7
	*Generally not true for both sexes	98	66.2
	I am not sure	8	5.4
Tend to experience minimal voice change issues and vocal cord growth throughout puberty.	Non-respondents	11	7.4
	Generally true for both sexes	6	4.1
	*Generally true for females	69	46.6
	Generally true for males	5	3.4
	Generally not true for both sexes	45	30.4
	I am not sure	12	8.1
Tend to have high levels of estrogen.	Non-respondents	12	8.1
	Generally true for both sexes	3	2.0
	*Generally true for females	120	81.1
	Generally true for males	0	0.0
	Generally not true for both sexes	4	2.7
	I am not sure	9	6.1

Note: Correct answers are marked with an asterisk (*).

Table 26 Continues

Table 26 Continued

Respondents' Answers to Remaining Biological Prompts (N=148)

Statement	Answer Choices	*f*	%
Tend to be sensitive to light levels.	Non-respondents	11	7.4
	Generally true for both sexes	19	12.8
	Generally true for females	5	3.4
	*Generally true for males	7	4.7
	Generally not true for both sexes	24	16.2
	I am not sure	82	55.4
Tend to experience hormone releases several times a day.	Non-respondents	11	7.4
	Generally true for both sexes	53	35.8
	Generally true for females	14	9.5
	*Generally true for males	4	2.7
	Generally not true for both sexes	0	0.0
	I am not sure	66	44.6
Tend to have a stronger sense of hearing.	Non-respondents	16	10.8
	Generally true for both sexes	24	16.2
	*Generally true for females	48	32.4
	Generally true for males	2	1.4
	Generally not true for both sexes	9	6.1
	I am not sure	48	32.4

Note: Correct answers are marked with an asterisk (*).

Table 27

Correct Answers For Remaining Biological Cluster: Total Population

Prompt	Correct Answer	*n*	*f*	%
1. Tend to experience voice change issues.	Generally true for both sexes.	141	88	62.4
2. Tend to have no difficulty hearing female teachers.	Generally true for females.	137	23	16.8
3. Tend to have a weaker sense of hearing.	Generally true for males.	136	32	23.5
4. Tend to be sensitive to light levels.	Generally true for males.	132	6	4.5
5. Tend to experience drastic voice change issues during puberty.	Generally true for males.	137	120	87.6
6. Tend to have high levels of testosterone.	Generally true for males.	137	119	86.9
7. Tend to have difficulty hearing female teachers.	Generally true for males.	136	29	21.3
8. Tend to have no voice change issues.	Generally not true for either sex.	137	98	71.5
9. Tend to experience minimal voice change issues and vocal cord growth throughout puberty.	Generally true for females.	137	69	50.4
10. Tend to have high levels of estrogen.	Generally true for females.	136	120	81.1
11. Tend to be sensitive to light levels.	Generally true for males.	137	7	4.7
12. Tend to experience hormone releases several times a day.	Generally true for males.	137	4	2.7
13. Tend to have a strong sense of hearing.	Generally true for females.	131	48	32.4

A Chi-square analysis was conducted for each of the biological prompts. Seven of the prompts were significantly affected by one or two different demographic variables. The null hypothesis was rejected for these prompts (Table 28).

Table 28

Statistically Significant Variables for Remaining Biological Prompts Affected by One or Two Demographic Variables

Prompts		*n*	value	df	Asymp. Sig. (2-sided)**
Tend to have higher levels of testosterone.	Directors who teach at least one all-female choir during the school day.	48	5.687	1	.017
Tend to have no voice change issues.	Directors who teach at least one all-female choir during the school day.	48	4.563	1	.033
Tend to have difficulty hearing female teachers.	Teachers currently teaching K-5	8	7.140	2	.028
Tend to have a weaker sense of hearing.	Highest degree earned: Educational Specialist	2	10.037	2	.007
Tend to experience voice change issues.	Highest degree earned: Educational Specialist	2	3.931	2	.000
	Directors who teach at least one all-female choir during the school day.	48	34.247	2	.000
Tend to experience minimal voice change issues and vocal cord growth throughout puberty.	Directors who teach at least one all-female choir during the school day.	48	4.892	1	.027
	Directors who teach at least one all-male choir during the school day.	27	3.936	1	.047
Tend to have high levels of testosterone.	Highest degree earned: Educational Specialist	2	21.671	2	.000
	Directors who teach at least one all-male choir during the school day.	27	4.078	1	.043

Note. **p<.05

With regard to the statement "tend to have high levels of testosterone," three (6.3%) directors teaching at least one all-female choir during the school day (*n*=48) responded correctly. The data showed no statistical significance for the following

remaining variables: (a) sex of the director, (b) years of experience, (c) level currently teaching, (d) highest degree earned, and (e) whether they taught an all-male choir.

Directing an all-female choir and highest degree earned: Educational Specialist were statistically significant for the statement "tend to experience voice change issues." Two respondents who direct an all-female choir answered this prompt correctly (n=48, 4.2%). There were no statistical differences found for the following remaining variables: (a) sex of the director, (b) years of experience, (c) level currently teaching, (d) highest degree earned, and (e) whether they taught an all-male choir. Highest degree earned: Educational Specialist was the other demographic variable that was statistically significant (50%, n=2). There was a 100% chance that a Type I error did not occur for this variable; therefore the null hypothesis was rejected. There were no statistical differences found for the following variables: (a) sex of the director, (b) years of experience, (c) level currently teaching, (d) highest degree earned (Bachelor's, Master's, Doctorate, undergraduate student, and graduate student), and (e) directors who taught an all-male choir.

Eighteen of 48 (38.0%) respondents who indicated they taught at least one all-female choir, and nine (33.0%) of the 27 participants who indicated they taught an all-male choir correctly answered the prompt "tend to experience minimal voice change issues and vocal cord growth through puberty." There were no statistically significant differences for the following remaining variables: (a) sex of the director, (b) years of experience, (c) current level teaching, and (d) highest degree earned.

The variable, "directors who taught at least one female choir" was shown to be statistically significant for the statement "tend to have no voice change issues." Five

(10%, *n*=48) respondents answered the prompt correctly. The data for this statement indicated that there were no statistically significant differences for the following remaining demographic variables: (a) sex of the director, (b) years of experience, (c) level currently teaching, (d) highest degree earned, and (e) directors who taught at least one male choir.

The prompt "tend to have high levels of testosterone" showed statistical significance for teachers whose highest degree was Educational Specialist. Half (50%, *n*=2) of the respondents answered the statements correctly. Teachers who taught an all-male choir demonstrated statistical significance for this prompt. Two participants (7.4%, *n*=27) answered this statement correctly. There were no statistically significant differences found for the following remaining variables: (a) sex of the director, (b) years of experience, (c) level currently teaching, (d) highest degree earned (Bachelor's, Master's, Doctorate, undergraduate student, and graduate student), and (e) whether they taught an all-female choir.

The demographic characteristic of currently teaching K-5 was a statistically significant variable for the statement, "tend to have difficulty hearing female teachers." There was one correct response (12.5%, *n*=8) to this prompt. There was a lack of statistical significance for the following remaining demographic variables: (a) sex of the director, (b) years of experience, (c) level currently teaching (middle school/junior high, high school, post-secondary, and currently not teaching), (d) highest degree earned, and (e) whether they taught a same-sex choir.

The biological prompt "tend to have a weaker sense of hearing" was statistically significant for the variable of sex of the director. Females (5.0%, *n*=80) tended to have a

slightly higher percentage of correct answers than males (3.6%, *n*=55). There was a lack of statistical significance for the following remaining variables: (a) years of experience, (b) level currently teaching, (c) highest degree earned, and (d) whether they taught a same-sex choir.

The statement "tend to experience hormone releases several times a day" had six demographic variables that were statistically significant (Table 29). The first statistically significant variable was years of experience (*n*=137). Teachers who indicated that they have been teaching for 1-5 years had one respondent who answered the prompt correctly (3.2%, *n*=31), those teaching 6-15 years had no one who answered the statement correctly (*n*=26), teachers with 16+ years had four people who responded correctly (12.5%, *n*=32), and participants who are not currently teaching had nine people who responded with the right answer (18.8%, *n*=48). There was one correct answer given by respondents who indicated their highest degree was a Bachelor's (2.3%, *n*=2). There were no correct answers for the respondents who held an Educational Specialist as their highest degree (*n*=2). Respondents whose highest degree was a Doctorate (*n*=15) also had no one who answered the prompt correctly.

Undergraduate students (*n*=40) had eight people (20.0%) answer the statement correctly. Graduate students (*n*=12) only had one respondent (8.3%) answer the prompt correctly. There was a lack of statistical significance for the following remaining demographic variables: (a) sex of the director, (b) currently level teaching, (c) highest degree earned (Master's), and (d) whether they taught a same-sex choir.

Table 29

Statistically Significant Variables for: Tend to Experience Hormone Releases Several Times a Day

Variable	*n*	value	df	Asymp. Sig. (2-sided)**
Years of experience	137	8.601	3	.035
Highest degree earned: Bachelor's	43	12.726	3	.005
Highest degree earned: Educational Specialist	2	9.052	2	.011
Highest degree earned: Doctorate	15	10.529	2	.005
Undergraduate student	40	15.584	2	.000
Graduate student	12	8.872	2	.012

Note: $^{**}p<.05$

The final remaining biological prompt to be analyzed was "tend to be sensitive to light levels." There were four demographic variables that were statistically significant for this statement which are listed in Table 30. The null hypothesis was rejected for each of these. There were no correct responses given by participants whose highest degree were an Educational Specialist (n=2). Additionally, there were two correct responses given by respondents whose highest degree was a Doctorate (13.3%, n=15), and respondents who were undergraduate students (5.4%, n=37). Furthermore there were no correct answers given by respondents who were graduate students (n=10). There was a lack of statistical significance for the following remaining demographic variables: (a) sex of the director, (b) years of experience, (c) level currently teaching, (d) highest degree earned (Bachelor's and Master's), and (d) whether they taught a same-sex choir.

Table 30

Statistically Significant Variables for: Tend to Be Sensitive to Light Levels

Variable	*n*	value	df	Asymp. Sig. (2-sided)**
Highest degree earned: Educational Specialist	2	12.430	2	.002
Highest degree earned: Doctorate	15	13.304	2	.001
Undergraduate student	37	12.451	2	.002
Graduate student	10	13.023	2	.001

Note: **$p<.05$

Null Hypothesis Two

Null Hypothesis two stated there will be no differences in directors' expressed need for more knowledge and training of sex differences based on (a) sex of the director, (b) years of experience, (c) whether or not they teach a same-sex choir (male and/or female), (d) highest degree earned, and (e) current teaching level. There were two statements at the end of the survey that pertained specifically to this research question: "secondary choral teachers need more knowledge about sex differences," and "I would attend professional development regarding sex differences if it were available." Each statement had the following answer choices: (a) strongly disagree, (b) disagree, (c) neither agree nor disagree, (d) agree, and (e) strongly agree which were then recoded to create three categories: 1= disagree, 3= neutral, and 5= agree. Table 31 has the frequencies and valid percentages for each of the statements showing that over half of the respondents agreed with both statements.

To determine whether or not the null hypothesis would be rejected, one-way between subjects ANOVAs were conducted to compare the effect of sex of the director, years of experience, and whether or not they teach a same-sex choir to respondents' answers for each statement. Those results are reported below.

Table 31

Frequencies and Valid Percentages for Null Hypothesis Two

Statements	Answer	*N*	*f*	%
Secondary choral teachers need more knowledge about sex differences.	Non-respondents	148	18	12.2
	Disagree	148	11	7.5
	Neutral	148	26	17.6
	Agree	148	99	62.8
I would attend professional development regarding sex differences if it were available.	Non-respondents	148	21	14.2
	Disagree	148	21	14.2
	Neutral	148	18	12.2
	Agree	148	88	59.4

Statement One: Secondary Choral Directors Need More Knowledge of Sex Differences

As previously mentioned, respondents had 5 answer choices that were then recoded into three categories disagree, neutral, and agree. One-way between subjects ANOVAs were conducted to compare the effect of three variables: (a) sex of the director, (b) years of experience, (c) whether or not they teach a same-sex choir (male and/or female), (d) highest degree earned, and (e) current teaching level to respondents' answers to the statement "Secondary choral teachers need more knowledge about sex differences." The alpha level adopted for these analyses was .05.

Sex of director, years of experience, and teaching same-sex choir(s). Table 32 shows the ANOVA data for sex of the director, years experience, and teaching same-sex choirs. Data indicated there were no significant differences between participants for their agreement levels (disagree, neutral, agree) and sex of the director [$F(5, 142)=1.572$, $p=.172$], or years of experience [$F(5, 142)=.445$, $p=.861$]. Similarly, there were no significant differences between participants for their agreement levels (disagree, neutral, agree) and teaching at least one all-female choir [$F(5, 142)=1.126$, $p=.349$], and teaching

at least one all-male choir [F(5, 142)=.831, *p*=.530]. The null hypothesis was accepted for these variables and statement one.

Table 32

ANOVA for Secondary Choral Directors Need More Knowledge About Sex Differences and the Variables Sex of Director, Years of Experience, Teach at Least One All-female Choir, and Teach at Least One All-male Choir

Variable		*SS*	*df*	*MS*	*F*	*P*
Sex of the Director	Between Groups	1.966	5	.393	1.572	.172
	Within Groups	35.514	142	.250		
	Total	37.480	147			
Years of Experience	Between Groups	3.152	5	.630	.445	.816
	Within Groups	201.038	142	1.416		
	Total	204.189	147			
All-female Choir	Between Groups	1.237	5	.247	1.126	.349
	Within Groups	31.196	142	.220		
	Total	32.432	147			
All-male Choir	Between Groups	.641	5	.128	.831	.530
	Within Groups	21.296	138	.154		
	Total	21.938	143			

Note ***p*<.05

Highest degree earned. One-way between subjects ANOVAs were conducted to compare the effect of highest degree earned to respondents' answers to the statement "secondary choral teachers need more knowledge about sex differences" (Table 33). There were no significant effects at the *p*<.05 level between respondents' agreement levels (disagree, neutral, agree) and the following variables: highest degree earned: Bachelor's, [F(5, 142)=.730, *p*=.602], highest degree earned: Master's [F(5, 142)=.1.291, *p*=.271], highest degree earned: Educational Specialist [F(5, 142)=.390, *p*=.855], and Doctorate [F(5, 142)=1.030, *p*=.403]. Likewise, there were no significant effects at the *p*<.05 level for undergraduate students [F(5, 142)=.170, *p*=.973] or graduate students

[F(5, 142)=.411, *p*=.841] for the three answers for this statement. The null hypothesis was accepted for these variables and statement one.

Table 33

ANOVA for Secondary Choral Teachers Need More Knowledge About Sex Differences and the Variable Highest Degree Earned

Variable		SS	*df*	MS	*F*	*p*
Bachelors	Between Groups	1.043	5	0.209	0.73	0.602
	Within Groups	40.599	142	0.286		
	Total	41.642	147			
Masters	Between Groups	1.503	5	0.301	1.291	0.271
	Within Groups	33.058	142	0.233		
	Total	24.561	147			
Educational Specialist	Between Groups	0.08	5	0.016	0.39	0.855
	Within Groups	5.812	142	0.041		
	Total	5.892	147			
Doctorate	Between Groups	0.623	5	0.125	1.03	0.403
	Within Groups	17.188	142	0.121		
	Total	17.811	147			
Undergraduate	Between Groups	0.203	5	0.041	0.17	0.973
	Within Groups	33.872	142	0.239		
	Total	34.074	147			
Graduate	Between Groups	0.221	5	0.044	0.411	0.841
	Within Groups	15.259	142	0.107		
	Total	15.48	147			

Note. $p<.05$ significance level.

Current level teaching. A one-way between subjects ANOVA was conducted to compare the effect of current level teaching to respondents' answers to the statement "secondary choral teachers need more knowledge about sex differences" (Table 33). Data revealed no significant effects at the $p<.05$ level between respondents' agreement levels

(disagree, neutral, agree) and the following variables: (a) current level teaching: K-5 when considering agreement level (disagree, neutral, or agree) [F(5, 142)=.417, *p*=.417], (b) current level teaching: middle school/junior high [F(5, 142)=.943, *p*=.455], current level teaching: high school [F(5, 142)=1.316, *p*=.261], (c) current level teaching: post-secondary [F(5, 142)=.314, *p*=.904], and (d) current level teaching: not teaching [F(5, 142)=.810, *p*=.545].

Table 34

ANOVA for Secondary Choral Teachers Need More Knowledge About Sex Differences and Current Level Teaching

Variable		SS	*df*	MS	*F*	*p*
K-5	Between Groups	.445	5	.089	.417	.417
	Within Groups	12.582	142	.089		
	Total	13.027	147			
Middle/Jr. High	Between Groups	.939	5	.188	.943	.455
	Within Groups	28.304	142	.199		
	Total	29.243	147			
High School	Between Groups	1.554	5	.311	1.316	.261
	Within Groups	33.554	142	.236		
	Total	35.108	147			
Post Secondary	Between Groups	.276	5	.055	.314	.904
	Within Groups	25.041	142	.176		
	Total	25.318	147			
Not Teaching	Between Groups	.998	5	.200	.810	.545
	Within Groups	35.022	142	.247		
	Total	36.020	147			

*Note: *p*<.05

Statement Two: I Would Attend Professional Development Regarding Sex Differences if it was Available

As previously mentioned, respondents had 5 answer choices that were then recoded into three categories disagree, neutral, and agree. One-way between subjects ANOVAs were conducted to compare the effect of three variables: (a) sex of the director,

(b) years of experience, (c) whether or not they teach a same-sex choir (male and/or female), (d) highest degree earned, and (e) current teaching level to respondents' answers to the statement "I would attend professional development regarding sex differences if it were available." The alpha level adopted for these analyses was .05.

Sex of director, years of experience, and teaching same-sex choir(s). One-way between subjects ANOVAs were conducted to compare the effect of sex of the director, years of experience, and whether or not choral directors teach a same-sex choir to respondents' answers to the statement, "I would attend professional development regarding sex differences if it were available" (Table 35). Data showed no significant effects at the $p<.05$ level between respondents' agreement levels (disagree, neutral, agree) and the following variables: (a) sex of the director, [$F(5, 142)=.574$, $p=.719$], (b) years of experience [$F(5, 142)=1.105$, $p=.360$], (c) directors who taught at least one all-female class during their school day [$F(5, 142)=1.587$, $p=.167$], and (d) directors who taught at least one all-male choir during their school day [$F(5, 142)=1.278$, $p=.277$).

Table 35

ANOVA for I Would Attend Professional Development Regarding Sex Differences if it were Available and the Variables Sex of the Director, Years of Experience, and Directing at Least One Same-Sex Choir

Variable		SS	*df*	MS	*F*	*p*
Sex of the Director	Between Groups	0.743	5	0.149	0.574	0.719
	Within Groups	36.737	142	0.259		
	Total	37.48	147			
Years of Experience	Between Groups	7.647	5	1.529	1.105	0.36
	Within Groups	199.542	142	1.384		
	Total	204.189	147			
All-female Choir	Between Groups	1.717	5	0.343	1.587	0.167
	Within Groups	30.716	142	0.216		
	Total	32.432	147			
All-male Choir	Between Groups	0.971	5	0.194	1.278	0.277
	Within Groups	20.966	138	0.152		
	Total	21.938	143			

Note: $**p<.05$

Highest degree earned. One-way between subjects ANOVAs were conducted to compare the effect of highest degree earned to respondents' answers to the statement "I would attend professional development regarding sex differences if it were available" (Table 36). There were no significant effects at the $p<.05$ level between respondents' agreement levels (disagree, neutral, agree) and the following variables: (a) highest degree earned: Bachelor's when considering agreement level (disagree, neutral, or agree) [$F(5, 142)=.673$, $p=.644$], (b) highest degree earned: Master's [$F(5, 142)=.402$, $p=.847$], (c) highest degree earned: Educational Specialist [$F(5, 142)=.430$, $p=.827$], (d) highest degree earned: Doctorate [$F(5, 142)=.997$, $p=.422$], (e) undergraduate students [$F(5, 142)=.407$, $p=.843$], and (f) graduate student [$F(5, 142)=1.389$, $p=.232$]. Therefore, the null hypothesis fails to be rejected for each of these variables.

Table 36

ANOVA for I Would Attend Professional Development Regarding Sex Differences if it were Available and the Variable Highest Degree Earned

Variable		SS	*df*	MS	*F*	*p*
Bachelors	Between Groups	0.964	5	0.193	0.673	0.644
	Within Groups	40.678	142	0.286		
	Total	41.642	147			
Masters	Between Groups	0.482	5	0.096	0.402	0.847
	Within Groups	34.079	142	0.24		
	Total	24.561	147			
Educational Specialist	Between Groups	0.088	5	0.018	0.43	0.827
	Within Groups	5.804	142	0.041		
	Total	5.892	147			
Doctorate	Between Groups	0.604	5	0.121	0.997	0.422
	Within Groups	17.207	142	0.121		
	Total	17.811	147			
Undergraduate	Between Groups	0.481	5	0.096	0.407	0.843
	Within Groups	33.593	142	0.237		
	Total	34.074	147			
Graduate	Between Groups	0.722	5	0.144	1.389	0.232
	Within Groups	14.758	142	0.104		
	Total	15.48	147			

Note: **$p<.05$

Current teaching level. One-way between subjects ANOVAs were conducted to compare the effect of current level teaching to respondents' answers to the statement "I would attend professional development regarding sex differences if it were available" (Table 37). There were no significant effects at the $p<.05$ level between respondents' agreement levels (disagree, neutral, agree) and the following variables: current level teaching: K-5 when considering agreement level (disagree, neutral, or agree) [$F(5, 142)=.376$, $p=.864$], current level teaching: middle school/junior high, [$F(5, 142)=1.067$, $p=.382$], current level teaching: high school [$F(5, 142)=.1.007$, $p=.416$], current level teaching: post-secondary [$F(5, 142)=.898$, $p=.484$], and current level teaching: not

teaching [F(5, 142)=1.384, *p*=.234]. Therefore, there was a lack of statistical significance for each of these variables.

Table 37

ANOVA for I Would Attend Professional Development Regarding Sex Differences if it were Available and the Variable Current Level Teaching

Variable		SS	*df*	MS	*F*	*p*
K-5	Between Groups	0.17	5	0.034	0.376	0.864
	Within Groups	12.857	142	0.091		
	Total	13.027	147			
Middle/Jr. High	Between Groups	1.058	5	0.212	1.067	0.382
	Within Groups	28.185	142	0.198		
	Total	29.243	147			
High School	Between Groups	1.202	5	0.24	1.007	0.416
	Within Groups	33.906	142	0.239		
	Total	35.108	147			
Post Secondary	Between Groups	0.776	5	0.155	0.898	0.484
	Within Groups	24.542	142	0.173		
	Total	25.318	147			
Not Teaching	Between Groups	1.674	5	0.335	1.384	0.234
	Within Groups	34.346	142	0.242		
	Total	36.02	147			

Note: *p<.05

Overall Result

The majority of the participants' agreed with each of the statements regarding the need for more training and more knowledge regarding sex differences. Furthermore, there was a lack of statistical significance for any of the demographic variables.

Null Hypothesis Three

The final null hypothesis stated there will be no difference in regards to which sex directors prefer to work with based on sex of the choral director, years of experience, level currently teaching, highest degree earned, and directors who teach single-sex choirs

and those who do not. Participants had the option of choosing which choir they preferred to work with. The options were mixed sex choir, all-female choir, or all-male choir. There were 148 people who responded to the question with 13 (8.8%) who chose not to indicate if they preferred all-female choirs, and 14 (9.5%) choosing not to indicate if they preferred all-male choirs. There were 61 (41.2%) survey respondents who indicated they preferred teaching an all-female choir, while 49 (33.1%) preferred teaching an all-male choir (Table 37).

Table 38

Participants Preference of Same-Sex Choirs (N=148)

Prompt	Responses	*n*	%
Prefer to work with an all-female choir	Non-respondents	13	8.8
	Yes	61	41.2
	No	74	50.0
Prefer to work with an all-male choir.	Non-respondents	14	9.5
	Yes	49	33.1
	No	85	57.4

Chi-Square Analysis of Responses

Chi-square analysis was conducted for all of the demographic variables and preference for teaching an all-female choir. Demographic variables included the following: (a) sex of the director, (b) years of experience, (c) level currently teaching, (d) highest degree earned, and (e) whether they teach a single-sex choir. For these analyses, an alpha level of .05 was adopted which indicates that for each significant result, there was a 95% chance that a Type I error did not occur.

There were six variables that were statistically significant (Table 38). Years of experience were a statistically significant variable. Teachers who had been teaching 1-5 years (*n*=32) had 13 (40.6%) directors who responded that they preferred to teach an all-

female choir, 6-15 years (*n*=27) had 18 (66.7%) directors respond that they preferred teaching an all-female choir, 16+ years (*n*=32) had 16 (50%) directors who responded that they preferred to teach an all-female choir, and those not currently teaching (*n*=57) had 14 (24.6%) who responded that they preferred to teach an all-female choir. Thirteen (25.5%) participants who are not currently teaching responded that they preferred to teach an all-female choir. Answers given by respondents whose highest degree was a Bachelor's degree were statistically significant with 28 (63.7%) preferring to teach an all-female choir. There were eight undergraduates (17.8%) who responded that they would rather teach an all-female choir. Directors who teach at least one all-female choir had 29 (60%) respondents answer that they preferred an all-female choir while directors who teach at least one all-male choir had 18 (66.7%) answer that they preferred teaching an all-female choir over an all-male or mixed sex choir. The null hypothesis was rejected for all of the above variables. There were no statistical significances found for the following variables: (a) sex of the director, (b) current level teaching (K-5, middle school/junior high, high school, and post-secondary), and (c) highest degree earned (Master's, Educational Specialist, Doctorate, and graduate student).

Table 39

Statistically Significant Variables for Directors Who Prefer Teaching an All-female Choir

Variable	*n*	value	*df*	Asymp. Sig. (2-sided)**
Not teaching	51	13.562	4	.009
Highest degree earned: Bachelor's	44	19.788	6	.003
Highest degree earned: Undergraduate student	45	18.261	4	.001
Years of experience	148	21.786	6	.001
Teach at least one all-female choir during the school day	48	10.820	2	.004
Teach at least one all-male choir during the school day	27	8.765	2	.012

Note: ***p*<.05

A Chi-square analysis was conducted for the survey item inquiring which directors prefer to teach an all-male choir. There were no statistically significant effects for the item regarding directors who prefer to teach an all-male choir and the following variables: (a) sex of the director, (b) years of experience, (c) level currently teaching, (d) highest degree earned, and (e) whether they teach a single-sex choir.

Summary

The following is a summary of the results. It is organized by the same or similar headings that were used in the results section for consistency.

Null Hypothesis One

The first null hypothesis stated "there will be no difference in directors' knowledge of sex differences based on sex of the choral director, years of experience, level currently teaching, highest degree earned, and directors who teach single-sex choirs and those who do not." Chi-square (χ^2) analyses revealed some significant differences in how participants responded to questionnaire items. Specifically, these significant differences showed whether or not directors answered correctly or incorrectly according the various variables.

Pedagogical sociological prompts. The sociological prompts were divided into "pedagogical sociological prompts" and "other sociological prompts." For all of the prompts in these two areas, a majority of the respondents in each of the following grouping variables answered incorrectly. However, there were significant differences found between respondents for the statement "tend to respond best to a set routine in the classroom" for the variables (a) sex of the director (a higher percentage of males answered correctly), (b) currently teaching K-5, middle school/junior high, or not

teaching (for each, a majority answered incorrectly), and (c) highest degree earned, Bachelor's, Educational Specialist, Doctorate, and undergraduate students (a majority answered incorrectly)

Other sociological prompts. The data indicated that some of the remaining sociological prompts were influenced by variables that were statistically significant. Two of the statements were answered correctly by over 50% of the respondents: (a) tend to be distracted by social, non-academic issues in the classroom and (b) tend to have outbursts and be rowdier in the classroom. These two statements were statistically significant for the variable "sex of the director." Additionally the data showed that the first statement was statistically significant for the variable "choral directors who teach at least one all-female choir during the school day." There were statistically significant variables that related to some of the remaining statements. These statements and variables were: (a) tend to respond well to a calm classroom setting (choral directors who teach at least one all-male choir during the school day), (b) tend to receive negative teacher attention for their behavior in the classroom (graduate students), (c) tend to not care about pleasing the teacher (highest degree earned Educational Specialist), and (d) tend to like situations to remain clam with no confrontations (currently teaching high school and years of experience).

There were statistically significant variables for the sociological prompts "tend to thrive in a mixed-sex classroom" and "tend to have outbursts and be rowdier in the classroom." The statistically significant variables were highest degree earned: (a) Bachelor's, (b) Educational Specialist, (c) Doctorate, (d) undergraduate student, and (e) graduate student. The following variables: (a) currently teaching K-5, (b) currently

teaching middle school/junior high, (c) currently teaching high school, (d) currently teaching post-secondary, (e) currently not teaching, (f) highest degree earned Bachelor's, (g) highest degree earned Educational Specialist, (h) highest degree earned Doctorate, (i) undergraduate student, and (j) graduate student were statistically significant for the statement "tend to enjoy competition as a motivation to learn."

There were a number of variables that were statistically significant for the prompt "tend to speak out in the classroom." They were: (a) currently teaching middle school/junior high, (b) currently not teaching, (c) highest degree earned Bachelor's, (d) undergraduate student, and (e) graduate student. Additionally, there were six statistically significant variables for "tend to not prefer competition as a motivation to learn." They were: (a) currently teaching middle school/junior high, (b) currently teaching high school, (c) highest degree earned Master's, (d) undergraduate student, (e) years of experience, and (f) direct at least one all-female choir during the school day. Six variables also were statistically significant for the sociological statement "tend to thrive in a single-sex environment." They were: (a) sex of the director, (b) currently teaching K-5, (c) currently teaching middle school/junior high, (d) currently teaching high school, (e) currently teaching post secondary, and (f) currently not teaching.

Brain-processing biological prompts. The biological prompts were also divided into those that related to brain processing and other biological prompts. There were only two statements in which more than half of the participants responded correctly. Those were "tend to express feelings verbally" and "tend to process written words faster." Chi-square (c^2) analyses revealed some statistically significant differences in how participants responded to questionnaire items. Various demographic variables were statistically

significant for 10 of the 17 statements. Demographic variables revealed statistical significance for four of the biological prompts, including: (a) "tend to process lip-reading into an auditory sound" (directors who teach at least one all-male choir during the school day), (b) "tend to process information and emotion in one hemisphere of the brain" (sex of the director), (c) "tend to process written words faster" (highest degree earned Master's), and (d) "tend to refrain from expressing feelings verbally" (currently teaching high school and highest degree earned Master's). Nine females (n=80) and seven males (n=55) answered the statement correctly "tend to process information and emotion in one hemisphere of the brain."

The prompt "tend to utilize only auditory areas of the brain when analyzing auditory patterns" was statistically significant and affected by six demographic variables. The statistically significant variables were: (a) highest degree earned Bachelor's, (b) highest degree earned Educational Specialist, (c) highest degree earned Doctorate, (d) undergraduate student, (e) graduate student, and (f) directors who teach at least one all-female choir during the day. There were six demographic variables that were statistically significant for the biological-processing statement "tend to be sensitive to both positive and negative visual stimuli." The first, sex of the director, had two (2.5%) females (n=81) and three (5.6%) males (n=54) who answered correctly. Statistically significant prompts were: (a) currently teaching K-5, (b) currently teaching middle school/junior high, (c) currently teaching high school, (d) currently teaching post secondary, and (e) currently not teaching.

The biological prompt "tend to have difficulty processing lip-reading into an auditory sound" had four significant variables. They were: (a) highest degree earned

Educational Specialist, (b) highest degree earned Doctorate, (c) undergraduate student, and (d) graduate student. The statement "tend to process information and emotion in both hemispheres of the brain" was significantly affected by: (a) highest degree earned Bachelor's, (b) highest degree earned Educational Specialist, (c) highest degree earned Doctorate, (d) undergraduate student, and (e) graduate student.

There were five demographic variables that showed statistical significance for the prompt "tend to attach no emotion to the information they receive. The first variable was years of experience. The remaining statistically significant variables were: (a) not currently teaching, (b) highest degree earned Master's, (c) undergraduate student, and (d) those directors that teach at least one all-female choir during the school day. The data for "tend to be sensitive to positive visual stimuli" indicated statistical significance for the following variables: (a) currently teaching K-5, (b) currently teaching middle school/ junior high, (c) currently teaching high school, (d) currently teaching post-secondary, and (e) currently not teaching.

Other Biological Prompts. Statistical significance was found for the remaining biological prompts. There were six prompts in which more than 50% of the survey participants answered correctly, including: (a) "tend to experience voice change issues," (b) "tend to experience drastic voice change issues during puberty," (c) "tend to have high levels of testosterone," (d) "tend to have no voice change issues," (e) "tend to experience minimal voice change issues and vocal cord growth throughout puberty," and "tend to have high levels of estrogen."

A Chi-square analysis was conducted for each of the biological prompts. There were one or two variables that exhibited statistical significance for seven of the biological

prompts. These included: (a) “tend to have high levels of testosterone” (directors who teach at least one all-female choir during the school day), (b) “tend to experience voice change issues” (highest degree earned Educational Specialist and directors who teach at least one all-female choir during the school day), (c) “tend to experience minimal voice change issues and vocal cord growth throughout puberty” (directors who teach at least one all-female choir and directors who teach at least one all-male choir during the school day), (d) “tend to have no voice change issues” (directors who teach at least one all-female choir during the school day), (e) “tend to have high levels of testosterone” (highest degree earned Educational Specialist and directors who teach at least one all-female choir during the school day), (f) “tend to have difficulty hearing female teachers” (currently teaching K-5), and (g) “tend to have a weaker sense of hearing” (highest degree earned Educational Specialist).

There were six statistically significant variables for the prompt “tend to experience hormone releases several times a day.” The first statistically significant variable was years of experience (n=137). The remaining statistically significant variables were: (a) highest degree earned Bachelor’s, (b) highest degree earned Educational Specialist, (c) highest degree earned Doctorate, (d) undergraduate student, and (e) graduate student. The final biological prompt to show statistical significance was “tend to be sensitive to light levels.” The demographic variables statistically significant were: (a) highest degree earned Educational Specialist, (b) highest degree earned Doctorate, (c) undergraduate student, (d) graduate student.

The data indicated that at least one of the demographic variables were statistically significant for the above-mentioned prompts. Therefore, null hypothesis one (There will

be no difference in directors' knowledge of sex differences based on sex of the choral director, years of experience, level currently teaching, highest degree earned, and directors who teach single-sex choirs and those who do not.) was rejected for all of the variables discussed above.

Null Hypothesis Two

Null Hypothesis two stated there will be no differences in directors' expressed need for more knowledge and training of sex differences based on sex of the choral director, years of experience, level currently teaching, highest degree earned, and directors who teach single-sex choirs and those who do not. There were two statements at the end of the survey that pertained to this research question. The first was "Secondary choral teachers need more knowledge about sex differences," and the second was "I would attend professional development regarding sex differences if it were available." Over half of the respondents for each question answered that they agreed with the statement. One-way ANOVA analysis was conducted for each of the above statements. There were no demographic variables that were statistically significant for either statement.

Null Hypothesis Three

The final null hypothesis stated there will be no difference in regards to which sex directors prefer to work with based on sex of the choral director, years of experience, level currently teaching, highest degree earned, and directors who teach single-sex choirs and those who do not. Participants had the option of choosing which choir they preferred to work with. The options were mixed sex choir, all-female choir, or all-male choir. There were 61 (41.2%) survey respondents who indicated they preferred an all-female

choir, while 49 (33.1%) preferred to teach an all-male choir. Chi-square analysis was conducted for all of the demographic variables and preference for teaching an all-female choir. Demographic variables included the following: (a) sex of the director, (b) years of experience, (c) level currently teaching, (d) highest degree earned, and (e) whether they teach a single-sex choir. There were six variables that were statistically significant.

The statistically significant variables affecting directors who prefer teaching an all-female choir were: (a) currently not teaching, (b) highest degree earned Bachelor's, (c) undergraduate student, (d) years of experience, (e) teach at least one all-female choir during the school day, and (f) teach at least one all-male choir during the school day. Teachers who had been teaching 1-5 years (n=32) had 13 (40.6%) directors who responded that they preferred to teach an all-female choir, 6-15 years (n=27) had 18 (66.7%) directors respond that they preferred teaching an all-female choir, 16+ years (n=32) had 16 (50%) directors who responded that they preferred to teach an all-female choir, and those not currently teaching (n=57) had 14 (24.6%) who responded that they preferred to teach an all-female choir. The null hypothesis was rejected for all above-mentioned variables.

A Chi-square analysis was conducted for all demographic variables against which directors preferred to teach an all-male choir. There were no statistically significant variables for the item regarding directors who prefer to teach an all-male choir. Non-statistically significant variables included: (a) sex of the director, (b) years of experience, (c) level currently teaching, (d) highest degree earned, and (e) whether they teach a single-sex choir.

CHAPTER 5

DISCUSSION

The purpose of this study was to assess choral directors' knowledge of biological and sociological sex differences in the secondary choral classroom. There were three null hypotheses: (1) there would be no differences in directors' knowledge of sex differences based a variety of different variables; (2) there will be no differences in directors' expressed need for more knowledge and training of sex differences based on several variables; and (3) there will be no difference in regards to which sex choral directors prefer to work with based on several variables. The following chapter is a discussion of results, conclusions, limitations of this study, and suggestions for additional research. This section is organized by subject area to further clarify the results and draw some overall conclusions from the data.

Pedagogical Sociological Processes

There were several areas of interest when considering the social and pedagogical situations teachers and students face each day in the choral classroom. This section is organized to further clarify the discussion and potential implications of the results from the study. The sections include: (a) classroom routine, (b) classroom activity levels, (c) confrontation and classroom stimuli, (d) non-academic social issues and attention, and (e) competition and motivation.

Classroom Routine

Based on the same-sex literature, males tend to respond better to a set routine in the classroom (Honigsfeld & Dunn, 2003). Over 70% of the directors indicated that both sexes benefit from a set routine. This could suggest that choral directors are encouraged in their education and methods classes to consistently have a set routine, which is generally good teaching practice. However, the participant responses indicate that the sex of the student may rarely be discussed in regards to set routine.

Another potential reason for this is the evaluation of teaching they go through, sometimes as often as four times per year. They have been trained to begin each lesson in a certain way (i.e. state your objectives, etc.). This could certainly have an effect on what teachers believe. In addition, those who are not currently teaching, or those who have only earned a Bachelor's degree may not have had a specific secondary choral methods course. Respondents who were in the midst of their Bachelor's degree may not have taken the course yet. Alternately, those with just a Bachelors degree may not actually have a degree in music education. Through alternative certification programs, sometimes offered through educational service centers, teachers can become certified by completing a minimal number general teaching methods courses and passing certification tests. Of course, that data was not collected in this study, so this is only a potential reason. Furthermore, though this is not as common, some teachers whose music education degree was geared only for elementary-level students may be teaching in a high school and yet would not have secondary-level music education methods classes. Finally, respondents who have their Educational Specialist or Doctorate degrees may have been exposed to many classes stressing the need for set routine in the secondary

classroom. They also may have more experience in the classroom then other respondents. As a result, their answers may have been significant because of their amount of knowledge concerning the need for a set routine.

Classroom Activity Levels

According to the literature, males tend to respond well to an active classroom environment (Sax, 2009) and they need lots of movement to think and learn (Honigsfeld and Dunn, 2003). Close to 60% of the participants indicated that having an active classroom was good for both sexes. As the literature suggests, successfully teaching boys would entail a classroom that is full of activity and directors who teach an all-male choir should keep the classroom full of movement and energy. A possible reason for the large number of respondents answering incorrectly on the statements about activity level and sex is that they confused the idea of "active classroom" with a classroom that has a lot of activities. Though another potential, and maybe more serious, reason is that there is no differentiation between the sexes in collegiate methods courses; perhaps methods teachers are indicating that active classrooms are positive, while not considering the differences between male and female learners.

Research suggests that female learners tend to prefer varied learning activities in the classroom and that teachers should consider having females work in different types of learning groups (e.g., in large groups, with the teacher, with peers, in pairs, and in independent settings) (Honigsfeld & Dunn, 2003). However almost 75% of the survey participants said both male and female learners preferred varied learning activities.

Streitmatter's (2002) research supports that females tend to respond well to a calm classroom setting. All of the directors in this study (regardless of their own gender) who

taught an all male choir knew that males do not prefer a calm classroom, indicating that possibly through their experiences working with all-male choirs they have found that a calm classroom setting is not the best for males, which mirrors several researchers' findings (Gray & Wilson, 2006; Jones & Dindia, 2004; Wilson, 2010).

In addition, those who did not teach an all male choir had a lower percentage of correct responses regarding female preference for a calm classroom. It is unclear the reason for this discrepancy. Perhaps, since they do not teach their males in a separate class they do not consider that there is a difference between the sexes regarding classroom atmosphere. Often, teachers are faced with 50 or more students in a mixed choir setting and they may force their own teaching style and preferences on the learners, regardless of the research-supported best practices. Finally, it would seem logical that females who teach all female choirs would know that female students prefer a calmer classroom setting. However, in this study, that was not the case; only about a quarter of them knew this. Again, perhaps teachers are more focused on teaching, reaching a certain performance level, and are less aware of learning atmosphere preferences by students of different genders, or perhaps they are unaware of the differences, as stated before, because of lack of training during their degree program(s) or other training opportunities.

The overwhelming choice of the same wrong answers respondents provided for the prompts that focus on classroom activity levels may mean that that practitioners often generalize available research literature/knowledge regarding the mixed-sex classroom to both sexes; they do not distinguish between the sexes when teaching. Furthermore, it is possible that the majority of participants had little to no exposure to pedagogical issues

pertaining to the same-sex classroom as part of course textbooks. Zittleman's & Sadker's (2006) review of textbook materials supports this; only 3% of textbooks they reviewed addressed gender differences. However, it could be also that respondents received training but do not remember or did not take the training seriously. Additionally, perhaps music methods teachers are spending two or less hours on this topic during a typical semester-long course, like most of the math and science teachers did in Campbell's and Sanders' study (1997).

Textbook authors may find it beneficial include sex differences and their potential impact in the secondary choral classroom. Training in general education classes, music methods instructors, and conducting professors may also see the benefit of instructing their students regarding the differences between the sexes and its impact in the choral classroom. Ultimately, this could also affect teacher retention levels among secondary music educators. Research has stated that retention rates are 95% higher for elementary music teachers compared to secondary music teachers (Hancock, 2008).

Confrontation and Classroom Stimuli

Just fewer than 38% of all respondents knew that males prefer confrontation and high stimuli situations. The ratio of correct versus incorrect answers between male and female respondents is interesting. In general, a larger percentage of male respondents knew the answer, while female respondents answered correctly and incorrectly in about equal amounts. Males could have had a higher number of correct responses because they are male, understand this about themselves, and think this is applicable to their male students. However, this does not mean they necessarily know the reasons behind this preference. For females, those who answered correctly may have more experience

teaching males and understand the best ways to approach teaching them. Those who answered incorrectly may not be as experienced, may not prefer confrontation themselves, or as stated several times previously, may not have had the education necessary to understand gender differences.

One might also consider the types of people who become, and remain, choral directors in secondary schools. Could the small percentage of correct responses in this area be indicative of the type of people who become choral directors? Choral directors generally are expected to be leaders with significant personal experiences as choral members in high school and collegiate music program. They are not typically confrontational in the way they lead, but generally work in a more cooperative way with students. Both director and students work together to achieve desired performance results. Furthermore, choral directors, music educators in general, are familiar with high stimuli situations, such as constantly preparing for concerts and programs. As a result, they may not see them as high stimuli situations, but a normal part of their occupation.

Non-Academic Social Issues and Attention

Research showed that social, non-academic issues in the classroom could be limited for students (Carp, 2004). Just over 60% of the respondents knew their students (both male and female) tend to be distracted by non-academic and/or social issues. Almost 25% more of female respondents verses male respondents answered this correctly. Interestingly, when male teachers taught all-female groups, they had a better chance of knowing this information; about 15% more of them knew this answer versus those who got it wrong. This could indicate that males are not as in tune as females with all of the social distractions that take place. Additionally, males who teach an all-female

group may understand the social distractions that take place in the classroom. Unlike male directors, there was very little difference between the number of female directors who taught an all female choir and those who did not (overall about 70% correct). Is it possible that females inherently understand that non-academic issues are distractions? Or, perhaps, as females, they understand from their own experiences.

Sadker (2002) found that males receive more negative teacher attention as compared to females. Less than 20% of graduate students got this correct, but almost 60% of those who were not graduate students got the answer right. This is somewhat boggling since it seems that graduate students may know this. However, perhaps these students have not taught yet while those who are not graduate students were teaching or in the midst of their undergraduate degrees. Given typical graduate program coursework, it seems logical that sex differences in the classroom may never be taught, especially given that graduate students have more flexibility in their course choices. Additionally, perhaps undergraduates got this right because they remember or have classes where males receive more negative attention; many practicing teachers got it right because they have male students who receive more of their negative attention.

Even though schools expect males to be conforming, passive, and quiet, the literature supports that this is not the best learning environment for males (Sax, 2005). Furthermore, though research indicates that females prefer one learning environment and males prefer a different type of environment (Sadker, 1995; Sax, 2005; Streitmatter, 2002), it appears that schools and/or teachers expect females and males to learn in the same types of environments. Choral directors could benefit from knowing such

information considering that they are trained to teach all-female, all-male choirs, and mixed choirs.

Competition and Motivation

Collaborative learning and noncompetitive environments seem to be the types of classrooms in which females thrive, while competition seems to be one of the motivating variables for males (Cable & Spradlin, 2008). However, around 55% of the respondents said that both males and females "tend to enjoy competition as a motivation to learn." This supports Cable's And Spradlin's (2008) research that says traditional schools are structured in ways that discourage males' tendencies to be independent, active, and aggressive. It appears teachers are either unaware of the research, or are trying to create a classroom based on their personal teaching styles or based on the ways teachers are typically advised to teach. Furthermore, less than one third of male respondents and female respondents (each) got this answer correct, that males prefer competition. Perhaps these respondents are familiar with the research, or they have learned through their own teaching experiences about the differences between males and females.

Sax (2010) found that male students generally do not care about pleasing their teacher if they do not like the subject or care about their grades, but females do want to please the teacher as long as they feel the teacher cares about them. Fewer than 5% of the respondents in this study knew that male students do not generally care about pleasing the teacher. That leaves over 95 of respondents that did not know this; clearly for most of these respondents, this area has been non-existent in their training either as college students or during in-services experiences. Choral directors need to understand that in general males do not care about pleasing the teacher unless they like the subject. There

are a multitude of situations in which students may be placed in choir or students sign up for choir just to get their fine arts credit. Based on the literature written pertaining to general education, choral directors who can win over the male students in their classrooms could be more successful because the boys may care about pleasing them. In addition, choral directors would benefit from knowing that girls want to please a teacher they know cares about them. As a result, an all-female class may need to be taught differently than an all-male class.

One might consider that choral students tend to be different from the general population (those not in choir). They may be more extraverted, conscientious, tend to be more outspoken in the classroom, and more. Considering that these traits may be true for choral students, responses to the sociological prompts could be skewed because of the population (choral students) that choral directors were asked to consider.

Biological Processing

Several of the biological-processing prompts were statistically significant based on a number of demographic variables. The first statement that had any demographic variables that were statistically significant was "tend to process lip-reading into an auditory sound." Directors who teach at least one all-male choir during the school day (n=31) was a statistically significant variable for the prompt "tend to process lip-reading into an auditory sound." The majority of the participants answered this statement incorrectly (n=130). This trend was true for directors who teach at least one all-male choir as well. There were only seven correct answers given by directors who teach an all-male choir. There were two female directors who teach an all male choir (n=16) who answered correctly and five male directors who teach an all male choir (n=15) who

answered correctly for the statement "tend to process lip-reading into an auditory sound." The research indicates that females have an easier time processing lip-reading into auditory sounds (Ruytjens et al., 2006) and interestingly in this research, it was the male choral directors who teach an all-male choir who had more correct responses than the females who direct an all-male choir. There was no statistical significance for all other demographic variables, including: (a) sex of the director, (b) years of experience, (c) current level teaching, (d) highest degree earned, and (e) whether they taught an all-female choir.

Research indicates that males tend to process information and emotion in one hemisphere of the brain due to lack of communication between the hemispheres (Bland, 2003; Brizendine, 2006; Gurian, 2001, Gurian & Stevens, 2004; Moir & Jessel, 1991; Rutjens et al., 2006; Van Dyke et al., 2009). Around 50% of the respondents were not sure of the correct answer in this area; they did not know if this was true for males, females or both. When separated by male and female, a larger percentage of male respondents knew this. This is strong evidence that the majority of the respondents in this study had little to no knowledge of sex differences in the hemispheres of the brain. This knowledge could assist secondary choral directors in their questioning of students, their expectations of students, and the content they teach to students. This would especially be true in a same-sex class where the teacher can tailor questions, expectations, and content to each of the sexes.

Research supports that females tend to process written words faster than males (Van Dyke et al., 2009). In this study, a majority of those with a Masters degree answered this correctly and a larger percentage of males who had earned a Masters

answered this correctly (almost 70%) than females (almost 55%). Perhaps male respondents inherently know this about themselves, or have more experience or exposure to the research in this area, which may explain the larger number for female respondents. However, it is not completely clear why participants with their Masters were statistically significant over the other demographic variables. Again, perhaps it is because they have studied this in their graduate work, or perhaps through becoming researchers themselves (through graduate work), they are more thoughtful and curious about teaching better or reaching their students in the best ways possible.

Males tend to refrain from expressing feelings verbally (Gurain, 2001; James (2007). In general, about half of the respondents knew this. However, only around a third of respondents who teach high school and a third of those with Masters degree got this right. It seems strange that those who teach high school and those with a Masters would not intuitively know that males do not typically express their feelings verbally, especially considering the stereotypes of male and females in this area. Perhaps these respondents were trying to eliminate their thoughts about stereotyping. Alternately, as stated before, it is very possible that brain sex differences are not addressed in most collegiate programs and/or professional development opportunities. A secondary choral director who understands it is difficult for males to express themselves verbally hopefully would question their male students differently than someone who does not understand this sex difference. Ultimately, for successful classroom teaching, the choral director needs to understand the differences between males and females, regardless of the type(s) of choir(s) they teach.

Males tend to utilize more auditory areas of their brains when analyzing sound, while females utilize less auditory areas (Rutjens et al., 2007). Most participants whose highest degree was Bachelors or Doctorate, current undergraduate and graduate students, and those who taught at least one all female choir indicated they were not sure about this information. These findings further solidify the researcher's assumption that sex differences in the brain are not being addressed during collegiate work at either the undergraduate or graduate levels.

Females generally tend to be sensitive to both positive and negative visual stimuli (Snodgrass & Harring, 2004-2005). Over 56% of all respondents in this study thought (incorrectly) this was true for both males and females. Conversely, only 10% knew this was true for females. Interestingly, a larger percentage of female respondents versus male respondents did not know this information. This is further evidence that the participants in this study have not been exposed to brain sex differences that could potentially make a difference in their classroom. Directors who believe that motivation can be accomplished through a tyrant and yelling may want to reconsider their approach, especially when instructing female singers.

Males in a choir would have a harder time connecting a visual example from the director to an audible sound when they are singing (Ruytjens et al. 2006). Around 12% of respondents knew this was true for males and around 31% were not sure about this information. This finding could be beneficial to conductors who are trying to show their choirs visual cues by using their mouths to form vowel shapes, form words, or give silent direction during rehearsal or performance. Directors of all male choirs or choirs with males in them need to understand that much of the preparatory work must be done

verbally or visually prior to their singing or after their singing. This result is further indication that many biological and sociological sex differences are not discussed in education, music education classes, or professional development.

Researchers have found that the female brains more than male brains communicate bilaterally due to more connectors between the hemispheres (Bland, 2003; Brizendine, 2006; Gurian, 2001, Gurian & Stevens, 2004; Moir & Jessel, 1991). Furthermore, female brains tend to communicate bilaterally all of the time, even when females are not thinking of anything. Brain scans have shown the female brain is as active at rest as the male brain is when engaged (Brizendine, 2006). Just over 50% of all respondents were unsure of the correct information for this area. Because the male brain does not communicate bilaterally, it is potentially more efficient in processing certain types of information; males may have a harder time attaching emotion to information they receive. When choral directors realize that the female brain is "constantly in motion" and processing even while at rest, there are certain techniques that could be used. Perhaps listening at night, during rest, would benefit females either in learning music or help with auditory processing. Conversely, those directors that understand males are more straightforward may realize that a more direct approach for learning is necessary.

Males tend to lateralize emotions only in the right hemisphere while females process emotions in both the right and left hemispheres (Gurian, 2001; James, 2007; Moir & Jessel, 1991). As a result, males may not be able to express emotions as readily as females. One third of the respondents knew this information while around 37% thought it was true for both sexes. This may be the reason that males can separate emotions from logic but in females, emotion is connected to logic. This information is helpful to know

for choral directors when questions pertain to creativity. Most of the creativity questions would be processed in the right hemisphere of the brain. Males would not be able to express emotions as easily as females when trying to process creative or subjective questions. Consequently, using correct terminology with males is important. Simply asking them to explain how music makes them feel would lead to some initial discord. Asking males to connect the musical devices used and perhaps the composer's emotional intent may lead to a more productive discussion.

Snodgrass and Harring (2004-2005) were able to demonstrate that the right hemisphere was far superior for identifying positive and negative stimuli and having greater attention to positive pictures. Women were less sensitive to the negative pictures and more sensitive to the positive pictures. Only 7.4% of all respondents knew females tend to be sensitive to positive visual stimuli. The remaining respondents answered incorrectly on this question. The result of this again shows there is little information about this area either taught or retained from collegiate work or professional development. Furthermore, understanding this difference can help with bridging the education gap between the teacher and students. For example, choral directors who enter their classroom like a drill sergeant, and/or who rarely use positive visual images or stimuli may not be as appealing to female students. Considering all that is learned in traditional conducting classes and music methods courses, that teachers need to provide appropriate situational verbal and nonverbal information, leaving out the positive part of this either in teaching or conducting is tantamount to providing a disconnect for female singers.

Biological Processing: Further Analysis

The study's results show a variety of different things. Some inferences and observations can be made from the respondents' answers to the questions in this study. The following paragraphs will address some critical observations based on the knowledge of the survey participants.

For seven of the biological-processing statements, a range of 40% to 50% of respondents indicated that they were not sure of the correct answer. Those prompts were: (a) tend to utilize only auditory areas of the brain when analyzing auditory sounds, (b) tend to have more areas of the brain activated when at rest, (c) tend to process information and emotion in one hemisphere of the brain, (d) tend to utilize language and auditory areas of the brain when analyzing auditory patterns, (e) tend to process information and emotion in both hemispheres of the brain, (f) tend to show brain activity even when they deem the verbal stimuli not important, and (g) tend to have more areas of the brain activated when they process information. It is not reasonable to think that 40% to 50% of these respondents are "bad" teachers. Most likely they are very successful choral directors who, regardless of the type(s) of choir(s) they teach, could increase their effectiveness and efficiency by understanding more about the differences between the ways males and females process information.

Conversely, there were three prompts in which at least 45% of the participants answered correctly: (a) tend to attach emotion to information they receive, (b) tend to express feelings verbally, and (c) tend to process written words faster. All of these statements had the same correct answer: generally true for females. At minimum, the answers to the first two of these (a and b) could be deduced through basic understanding

and experiences teaching females. Many teachers may also have experience working with females who process the written word much faster than males and so they were able to answer this correctly from experiential knowledge. Although 45% knew this information, the majority (over half) did not know it. Knowledge of the fact that females tend to attach emotion to information they receive, express feelings verbally, and process written words faster should dictate the methods in which choral directors question their students, the time given to students to formulate answers, and the responses to those questions. When choral directors understand that females are more emotion-based students whose written verbal capacity is higher than males, they may realize that they could be more effective teachers who help all students reach their full potential.

The researcher chose these biological-processing statements because they all have to do with the way in which the brain processes information. Understanding how the brain works for each of the sexes could be very beneficial to every teacher, especially choral directors. These prompts might be important to understand in order for teachers and students to achieve optimal success in the classroom.

The information pertaining to utilizing auditory areas of the brain when analyzing auditory sounds is important for the secondary choral director to understand based on their subject matter. Since males tend to utilized more auditory areas of their brains when analyzing sound while females utilize less auditory areas, the ways we run rehearsals should reflect this. A typical technique for sectional rehearsal is to tell the sections not rehearsing to hum, think through, or audiate (hear it internally) while the teacher is working with the other section(s). Females may have a harder time processing their own part while another section is rehearsing alone since most sound will be processed.

However, males may have less trouble as they may process their own "sound" and block out the other section. Understanding this is key for directors. They would need to teach their female students the ability to focus their thoughts and hearing on a single item rather than a "room full" of sound. Additionally, male singers need training to focus on "the whole" instead of just their own part. Blocking out all other parts can be detrimental to blend and balance in a choir. Furthermore, helping males to focus is important when providing instructions or examples. They must be able to hear it as something important rather than just "noise." Vice versa, females may very well be able to multi-task aurally. They may b able to look at music, sing it internally, and process instructions simultaneously.

As stated before, males will disengage if they do not care about the subject and/or they do not like the instructor. This makes it crucial for choral teachers to connect in some meaningful, educational way to their male students. As Martino et al indicated (2005, p. 250) one of the keys to teaching boys is, "…developing teachers' knowledge about boys and in the ways that the teachers taking the boys' classes sought to utilize pedagogical practices and curriculum materials that connected to their perceptions of boys' interests." Professional development for current teachers and providing additional information to pre-service teachers would be beneficial.

Should teachers use the same verbiage to question males and females? Some common advice to pre-service teachers is to make sure they can say the same thing in multiple ways and from multiple perspectives. Perhaps teachers do this as "good practice" without realizing the reason. Asking a male how something makes him feel is not a "fair" question because his brain does not necessarily communicate that way. There

seems to be a disconnect; Around 60% knew females tend to attach emotion to the information they receive, but 50% were not sure that males tend to process information and information in one hemisphere of the brain. How is it that a large number knew females were emotional and connect that emotion to several parts of their learning and lives, but did not know that males compartmentalize their emotions versus their logical thought? This result is perplexing because it seems logical that these two are opposite in nature. However, it appears that respondents were not as familiar with thinking about their students' brain differences. They deduce the correct answer because they can see/experience that females react with generally more thoughtful and emotional responses, they connect their actions and memories to emotion. However, they cannot see male brains processing only one hemisphere. To get that answer correct, they would have to know the biological processes.

Over 40% of respondents knew that females tend to process written words faster. Singers process written words. This is an inherent part of choral singing; text is almost always present in some way. The written music and words are a road map with a variety of symbols that have to be processed simultaneously. Though it is unclear if music reading and word reading are closely related in processing, one could infer that words and musical notation can be processed in similar ways, since both are often consumed simultaneously from choral sheet music. On the other hand, males process this kind of information differently, and perhaps more "slowly" than females. The result of knowing this could be that a choral director has male students focus on words first, then the rhythms, followed by the pitches. Alternately, female students may be able to process words and rhythm together, or rhythm and melody together, or all three (or more) of

these simultaneously because they process each faster. Choral directors who have a greater understanding of what each of the sexes' brains is doing improve their students' success in choral rehearsals.

Statements regarding lip-reading could be beneficial to many choral directors who tend to mouth cues to their choirs in rehearsals and concerts would benefit from knowing that males generally have harder time turning these cues into an auditory sound. Understanding this and that females process verbal stimuli faster could eliminate some frustrations for students and teachers alike and explain why in some cases males seem to not be "getting it" as fast as their female peers.

Other Biological Items

The statements in this area center around three main areas: (a) hormones, (b) voice change issues, and (c) sight and hearing. The following section is divided into these three areas to better facilitate the discussion.

Hormones

A larger number of the respondents (78% of females and 83% of males) knew that males generally have higher levels of testosterone. The difference in the number of female versus male respondents (more females) shows that less females knew this answer (though it was still a large number who knew the correct answer). This seems to be somewhat common knowledge so that does not explain why over 20% of female and 17% of male respondents did not know this information. Perhaps the difference is that these numbers represent younger respondents (undergraduates and younger teachers) who simply are not aware that testosterone is primarily associated with male biology.

The demographic variables highest degree earned (Educational Specialist), and those directors who taught at least one male choir during the school day significantly affected "Tend to have high levels of testosterone." Based on the statistical significance of the two variables, the null hypothesis was rejected.

The demographic variables years of experience and highest degree earned (Bachelor's, Educational Specialist, Doctorate, undergraduate student, and graduate student) were statistically significant for the statement "tend to experience hormone releases several times a day." The null hypothesis was rejected regarding no difference in directors' knowledge of sex differences based on the variables of: (a) sex of the choral director, (b) years of experience, (c) level currently teaching, (c) highest degree earned, and (d) directors who teach single-sex choirs and those who do not.

Voice Change Issues

Two-thirds of all respondents knew that both males and females could have voice change issues. That leaves around 33% who did not know this. In addition, almost 69% knew that both males and females tend to experience voice change issues. So, around the same percentage answered correctly for both of these statements. When looking that the data breakdown by certain demographic variables, however, there are some perplexing results. Three quarters (75%) of directors who teach an all female choir indicated that both sexes generally tend to have no voice change issues. Is the reason for this because they do not have experience teaching males, or that they do not "hear" the change in the female voice, or ultimately, perhaps because they do not have the education they need? Furthermore, the fact that 20% of female respondents and 17% of male respondents

indicated that females tend to have no voice change issues leads one to wonder about these respondents.

The results for these two statements (tends to have no voice change issues, tends to have voice change issues) could be a direct reflection on the lack of teaching and/or awareness of the changing female voice. Choral methods classes focus heavily on the male changing voice, but perhaps neglect the female changing voice. On the whole, a fairly large percentage of participants indicated the wrong answer. Considering that the majority of participants are either currently studying the field of choral music or working in the field of choral music, it does not seem logical that they would get this wrong, and it is a little shocking that a higher percentage of these musicians did not answer these two statements correctly. Obviously based on the answers given by this population more time is needed on voice change issues.

Directors who direct an all-female choir or an all-male choir during school day showed statistical significance with regards to the prompt "tend to experience minimal voice change issues and vocal cord growth throughout puberty tend to experience minimal voice change issues and vocal cord growth throughout puberty."

Hearing and Sight

Research has shown (a) the male cochlea tends to be longer than the female cochlea (Brizendine, 2006; James, 2007; Moir & Jessel, 1991; Sax, 2005), (b) males generally hear male voices better than female voices, and vice versa for females, and (c) males male seem distracted, but in reality just cannot hear what the teacher is saying (Sax, 2005). Just under 20% of the choral directors in this study knew that male students tend to have difficulty hearing female teachers, which means that over 80% did not know

this. Furthermore, around 60% of the respondents did not know that males tend to have a weaker sense of hearing; they answered that it was generally not true for both sexes, or they indicated they were not sure of the answer. Secondary choral directors who understand these auditory differences could be more effective in the classroom. Female choral directors should be more aware that the males in their classes could have difficulty hearing their voices. Placing males in the back of the room or to the far sides may not the best place for them to hear the female teacher. In addition, considering the acoustics of a room, it may be more effective for female directors to use some kind of microphone and amplifier to ensure students hear clearly. These results reiterate that hearing differences among the sexes is either not taught or discussed in classes required for music education degrees, not represented in professional development opportunities, or that respondents do not remember the information from these two learning sources.

Only 4.1% of respondents knew that males tend to be sensitive to light levels. There were some significant differences between respondents with different levels of college degrees, but given that over 95% of the respondents got this wrong, those significant differences exist between those who most likely answered incorrectly. Clearly this is an issue that needs to be addressed, not just in the choral classroom, but also in other educational settings, and it needs to be addressed in methods and other education courses as well as professional development. Knowing this could help male students learn faster or better, or it could affect the way male students act in the classroom. Furthermore, since this is not inherently true for females, it is important to explore a variety of lighting settings when teaching for students' best learning environments.

Further Analysis: Other Biological Items

The demographic variables that are statistically significant ($p<.05$) for the above-mentioned biological prompts do not reveal much about the data. Statistical significance only tells us that the answers probably did not occur by chance (Type I error). When examining the answers to the remaining biological prompts it is interesting to note which statements had the most respondents answering correctly. There were two statements in which 60% to 66% answered correctly: (a) tend to experience voice change issues, and (b) tend to have no voice change issues. There were three in which 80% to 81% of respondents answered correctly (a) tend to experience drastic voice change issues during puberty, (b) tend to high levels of testosterone, and (c) tend to have high levels of estrogen. Three of these questions are related to adolescent voice change, which is one of the topics that should be covered in most undergraduate music education program. Even though this topic should be discussed in music education classes, there were low percentages considering that most music education students should have gotten these answers correct. Finally, the percentages ranged from 60% to 81%. Potentially 19% of the population did not know the correct answer for several of the statements corresponding to the voice change, though it is unclear which specific respondents represented that 19% (could be different respondents for each question).

The questions pertaining to male and female hormones were also answered correctly. However, respondents did not have a clear sense of which sex tends to release hormones several times a day. The answer to this statement is generally true for males. Males have five to seven spikes of testosterone daily beginning with the onset of puberty (Gurian, 2001). Testosterone not only produces assertiveness, aggression and

dominance, it also tends to encourage the release of more testosterone. This additional hormone release adds to aggressive male tendencies. The more testosterone that is released into the male brain the more self-reliant, self-confident, self-assertive, competitive, and aggressive males become (Moir & Jessel, 1991). The average male is more likely to show aggressive behaviors and manage social situations through dominance (Gurian, 2001) while the average female tends to resist aggressive behaviors (Moir & Jessel, 1991). Understanding how testosterone can affect males and their behavior can only improve the pedagogies of teachers.

The rest of the biological statements had a wide range of answers. These statements were related to light levels and sense of hearing. For the purposes of this study, the hearing issue is probably the most important. Hearing differences between the sexes could be attributed to the sound taking longer to travel to the brain once it enters the male ear. Therefore, teachers might find it helpful to move the males closer to the front of the room or make sure that the level of the instructor's voice is loud enough for everyone to sufficiently hear.

Opportunities to Gain Sex Differences Knowledge

There were two statements at the end of the survey that focused on choral directors' expressed need for more knowledge and training of sex differences: (a) secondary choral teachers need more knowledge about sex differences, and (b) I would attend professional development regarding sex differences if it were available. Around 70% of respondents indicated that they agreed or strongly agreed with both of these statements. Though there were no significant results when considering a variety of variables, it is important to note that either before, or as a result of this study, survey

respondents obviously see the value in receiving more knowledge and training. So, it would be wise to include this information in a more prominent way in undergraduate or graduate music education programs and provide other professional development opportunities in this area for choral directors.

Preferred Choral Class Types

Finally, the last part of the survey focused on respondents preferred choral class types: (a) all male, and/or (b) all female. While some participants indicated they did not prefer to work with either all male or all female choirs, around 40% said they preferred all female choirs and around 33% preferred all male choirs. Working with an all-male choir may have a lower percentage because there are, in general, more all female than all male choirs. In addition, only 18.8% of these respondents taught at least one male choir during the school day versus around 33% who taught an all female choir during the school day. Flipping these numbers shows that most of the respondents do not teach all male or all female choirs; over 81% do not currently work with all male choirs, and around 66% do not currently work with all female choirs.

It is possible that many choir directors do not have as many opportunities to work with single sex choirs. In addition, it may be that they prefer not working with these types of groups because they have had no experience doing that and lack the knowledge or understanding to see these settings as valuable ways to teaching students. Alternately, those that have had the opportunity to work with single sex choirs may have had negative teaching and learning experiences because they lacked the knowledge necessary for success.

From this one could infer that most choral programs have a mixed choir that is their top group, or perhaps their only choral group. An all female choir, when available, is sometimes a lower ranking group in the program. Typically, a women's group is usually made up of females who did not make the mixed group. Wilson's research (2010) supports this; women's choirs were usually not the top ensembles. There may be a perception among choral directors that a mixed choir is better or more prestigious and thus they should aspire to work with these types of choirs. This perception would help to explain the low percentage of choral directors who prefer to work with an all-female or an all-male choir.

General education research and scholars support that instructors must be given tools in order to successfully teach boys, to be able to manage the myriad of behaviors they display each day. In choral teaching, many advocate that separating the sexes into all male and all female groups allows for much more teaching and learning success. Furthermore knowing how to best teach students could improve classroom behavior in any classroom environment (Hannon & Ratliffe, 2007; Rex & Chadwell, 2009; Sax, 2005; Sax, 2009).

Limitations

Several limitations should be taken into account when reviewing the data and results of this study.

1. Participants were chosen based on their attendance at the middle school and high school reading sessions and round table discussions at the 2012 ACDA Southern Division Conference. Results may not be applied to all choral directors or even all choral directors who attend ACDA divisional conferences.

2. Participants may have more basic knowledge than the general population because they attended at an ACDA divisional conference.
3. The survey was lengthy and therefore may have inhibited a higher return rate.
4. There were a high percentage of students and full-time church musicians who responded to the survey.
5. The survey was not piloted; therefore, there were no statistics with which to compare the results.
6. The survey was created for the purpose of this study.
7. Sex differences being examined were by no means a comprehensive list of all male and female sex differences.

Summary

The purpose of this study was to assess choral directors' knowledge of biological and sociological sex differences in the secondary choral classroom. There were three null hypotheses: (1) there would be no differences in directors' knowledge of sex differences based on sex a variety of different variables; (2) there will be no differences in directors' expressed need for more knowledge and training of sex differences based on several variables; and (3) there will be no difference in regards to which sex choral directors prefer to work with based on several variables.

Based on the results of this study, multiple demographic variables were statistically significant as related to the biological and sociological prompts. Therefore, many of the answers to the statements did not occur by chance for many of the demographic variables. There was also an overwhelming response for the need for more knowledge and training regarding biological and sociological sex issues. Further, survey

respondents (71%) indicated that they would attend professional development opportunities regarding sex differences if it were available. There were no demographic variables that statistically affected participants who preferred to teach an all-female choir while several demographic variables were statistically significant for those respondents who preferred to teach an all-male choir.

Based on these findings, the researcher has concluded that many of the participants do not know the answers to biological and sociological statements that pertain to the classroom. Findings also suggest that there is a need and a desire for more knowledge and training regarding biological and sociological sex differences. Finally, survey respondents overwhelmingly responded that they would attend more training regarding sex differences. Professional organizations, school districts, and venues offering professional development need to consider the need and desire for further instruction and professional development opportunities. Success regarding training in biological and sociological sex differences has been documented in regular education literature, so there is no reason that this type of training would not greatly benefit secondary choral directors; especially those directors who teach same-sex choirs.

Implications for Music Educators

The results of this study may yield these implications for music educators:

1. Sex differences may affect secondary choral classrooms.
2. Teaching pedagogies in the secondary choral classroom may be enhanced if they are patterned after knowledge pertaining to sex differences.

3. Institutions of higher learning might consider knowledge of sex differences as an important tool for future music educators to help them be successful in the classroom.
4. Based on perceived needs, professional organizations may wish to offer more training opportunities regarding the topic of sex differences in the choral classroom.

Recommendations for Future Research

The following recommendations are suggested for future research:

1. A replication of this study with a larger population.
2. A quantitative investigation of the questioning and language used when teaching same-sex choirs versus mixed-sex choirs.
3. A study that examines the pacing of the choral director when teaching same-sex choirs versus mixed-sex choirs.
4. A qualitative study investigating the preferences of male and female choral directors about teaching same-sex choirs versus mixed-sex choirs.
5. A study investigating whether or not the sexuality of the choral director affects the outcome of pacing, language used in the choral classroom, and the preferences of which type of choir they prefer to direct.

Conclusion

Sex differences have been a topic of research and discussion in the regular education classroom since the inception of No Child Left Behind, yet there is little research regarding sex differences in the choral classroom. This seems counterintuitive since many choir directors instruct same-sex choirs, and all choir directors exit their

undergraduate programs prepared to teach same-sex choirs. ACDA also seems to place value on same-sex choirs based on the national, divisional, and state chairs for both male choirs and female choirs. Yet, few seem to be instructing or providing professional development opportunities beyond the changing voice and literature selection.

Based on a review of the literature and the results of this research it seems likely that increased knowledge pertaining to sex differences could positively impact teacher retention. This would be consistent with the literature on the regular education classroom pertaining to this issue. The literature in the regular education setting has indicated that teachers are more successful because of sex difference knowledge.

Perhaps the results of this survey will be beneficial for future researchers interested in pursuing this line of inquiry; professional music organizations in planning for future professional development opportunities; secondary methods teachers in planning their courses; and the planning of future teacher training. Most importantly, this research may provide valuable insights for secondary choral directors and their students in the choral classroom. Based on the responses from choral directors who were surveyed for this research, there seems to be a strong desire for more information pertaining to this topic as well as a willingness to attend professional development opportunities regarding sex differences.

REFERENCES

Abeles, H. (2009). Are musical instrument gender associations changing? *Journal of Research in Music Education*, *57*(2), 127-139.

ACDA. (n.d.). Repertoire. Retrieved from http://acda.org/repertoire.

Ashley, M. (2006). You sing like a girl? An exploration of 'boyness' through the treble voice. *Sex Education, 6*(2), 193-205.

Ashley, M. (2010). Slappers who gouge your eyes: Vocal performance as exemplification of disturbing inertia in gender equality. *Gender and Education, 22*(1), 47-62.

Barham, T. J. (2001). *Strategies for teaching junior high & middle school male singers: Master teachers speak.* Santa Barbara, CA: Santa Barbara Music Publishing.

Barton, B. K., & Cohen, R. (2004). Classroom gender composition and children's peer relations. *Child Study Journal*, *34*(1), 29-45.

Bjorklund, D. F., & Bering, J. M. (2000). The evolved child: Applying evolutionary developmental psychology to modern schooling. *Learning and Individual Differences*, *12*(4), 347-373.

Blair, H., & Sanford, K. (1999). Single-sex classrooms: A place for transformation of policy and practice. Paper presented at the annual meeting of the American Educational Research Association. ERIC Retrieved February 5, 2007.

Bland, J. (2003) About gender: Sex differences. Retrieved from http://www.gender.org.uk/about/07neur/77_diffs.htm.

Brizendine, L. (2006). *The female brain*. New York: Broadway Books.

Brunner, D. L. (1992). Choral repertoire a director's checklist. *Music Educators Journal, 79*(1), 29.

Buchanan, H. J., & Mehaffey, M. W. (Eds.). (2005). *Teaching music through performance in choir: Volume 1*. Chicago, IL: GIA Publications, Inc.

Buchanan, H. J., & Mehaffey, M. W. (Eds.). (2007). *Teaching music through performance in choir: Volume 2*. Chicago, IL: GIA Publications, Inc.

Cable, K. E., & Spradlin, T. (2008). Single-sex education in the 21st century. *Education Policy Brief*, 6(9), 1-12. Retrieved from www.ceep.indiana.edu/projects/PDF/PB_V6N9_Fall_2008_EPB.pdf

Campbell, P. B., & Sanders, J. (2002). Challenging the system: Assumptions and data behind the push for single-sex schooling. In A. Datnow & L. Hubbard (Eds.), *Gender in policy and practice: Perspectives on single-sex and co-educational schooling*, 31-46. New York, NY: Routledge-Falmer.

Carp, R. S. (2004). *Single gender choral ensembles, attitudes and practices: A survey of southern California high school choir directors.* Retrieved June 30, 2011 from Dissertations & Theses: A&I. (Publication No. AAT 3145167).

Coie, J. D., Dodge, K. A., Terry, R. Wright, V. (1991). The role of aggression in peer relations: An analysis of aggression episodes in boys' play groups. *Child Development, 62*(4), 812-826.

Col, J. (2001). Enchanted Learning. Retrieved from http://www.enchantedlearning.com/subjects/anatomy/ear/

Col, J. (2001). Enchanted Learning. Retrieved from http://www.enchantedlearning.com/subjects/anatomy/brain/Structure.shtml

Cooksey, J. M. (1977a). The development of a contemporary, eclectic theory for the training and cultivation of the junior high school male changing voice: Part I. *The Choral Journal, 18*(2), 5–14.

Cooksey, J. M. (1977b). The development of a contemporary, eclectic theory for the training and cultivation of the junior high school male changing voice: Part II. *The Choral Journal, 18*(3), 5–16.

Cooksey, J. M. (1977c). The development of a contemporary, eclectic theory for the training and cultivation of the junior high school male changing voice: Part III. *The Choral Journal, 18*(4), 5–15.

Cooksey, J. M. (1978). The development of a contemporary, eclectic theory for the training and cultivation of the junior high school male changing voice: Part IV. *The Choral Journal, 18*(5), 5–18.

De Bellis et al. (n.d.). Sex differences in brain maturation during childhood and adolescence. *Cerebral Cortex, 11*(6), 552-557. Retrieved from http://cerdor.oxfordjournals.org/content/11/6/552.full.

Downey, D. B., & Vogt Yuan, A. S. (2005). Sex differences in school performance during high school: Puzzling patterns and possible explanations. *The Sociological Quarterly, 46,* 299-321.

Else-Quest, N., Hyde J. S., Goldsmith, H. H., & Van Hulle, C. A. (2006). Gender differences in temperament: A meta-analysis. *Psychological Bulletin, 132*(1), 33-72.

Eros, J. (2008). Instrument selection and gender stereotypes: A review of recent literature. *UPDATE: Applications of Research in Music Education, 27*(1), 57-64.

Froese-Germain, B. (2006). Educating boys: Tempering rhetoric with research. *McGill Journal of Education, 41*(2), 145-154.

Gackle, L. (1987). The effect of selected vocal techniques for breath management, resonation, and vowel unification on tone production in the junior high school female voice. *Dissertation Abstracts International, 48*(4), 862A. (UMI No. 8716155).

Gackle, L. (1991). The adolescent female voice: Characteristics of change and stages of development. *Choral Journal, 31*(8), 17–25.

Gray, C., & Leith, H. (2004). Perpetuating gender stereotypes in the classroom: A teacher perspective. *Educational Studies*, *30*(1), 3-17.

Gray, C., & Wilson, J. (2006). Teachers' experiences of a single-sex initiative in a co-education school. *Educational Studies*, *32*(3), 285-298.

Gurian, M. (2001). *Boys and girls learn differently: A guide for teachers and parents*. San Francisco, CA: Jossey-Bass.

Gurian, M., & Stevens, K. (2004). Closing achievement gaps: With boys and girls in mind. *Educational Leadership, 62*(3), 21-26.

Hancock, C. B. (2008). Music teachers at risk for attrition and migration. *Journal of Research in Music Education, 56*(2), 130-144.

Hancock, C. B. (2009). National estimates of retention, migration, and attrition. *Journal of Research in Music Education, 57*(2), 92-107.

Hannon, J., & Ratliffe, T. (2007). Opportunities to participate and teacher interactions in coed versus single-gender physical education settings. *Physical Educator, 64*(1), 11-20.

Honigsfeld, A., & Dunn, R. (2003). High school male and female learning-style similarities and differences in diverse nations. *Journal of Educational Research*, *96*(4), 195-206.

Hutchings, M., Carrington, B., Francis, B., Skelton, C., Read, B., & Hall, I. (2008). Nice and kind, smart and funny: What children like and want to emulate in their teachers. *Oxford Review of Education. 34*(2), 135-137.

Jackson, J. (2010). Dangerous presumptions: How single-sex schooling reifies false notions of sex, gender, and sexuality. *Gender and Education, 22*(2), 227-238.

Jackson, C., & Smith, I. (2000). Poles apart? An exploration of single-sex and mixed-sex educational environments in Australia and England. *Educational Studies, 26*(4), 409-422.

James, A. N. (2007). *Teaching the male brain: How boys think, feel, and learn in school*. Thousand Oaks, CA: Corwin Press.

Johnson, C. M., & Stewart, E. E. (2004). Effect of sex identification on instrument assignment by band directors. *Journal of Research in Music Education, 52*(2), 130-140.

Jones, S. M., & Dindia, K. (2004). A meta-analytic perspective on sex equity in the classroom. *Review of Educational Research, 74*, 443-471.

Jordan-Young, R. (2010). *Brain storm: The flaws in the science of sex differences*. Cambridge, MA: Harvard University Press.

Jorgensen, N. S., & Pfeiler, C. (2008). Successful single-sex offerings in the choral department. *Music Educators Journal, 94*(5), 36-40.

Koza, J. E. (1992). Picture this. *Music Educators Journal, 78*(7), 28.

Koza, J .E. (1993). The 'missing males' and other gender issues in music education: Evidence from the *Music Supervisors' Journal,* 1914-1924. *Journal of Research in Music Education, 41*(3), 212-232.

Marshall, G. (1998). "Gender stereotypes." *A Dictionary of Sociology*. Retrieved from Encyclopedia.com: http://www.encyclopedia.com/doc/1O88-genderstereotypes.html

Marsh, H., Blair, K., Jones, M., Soliman, N., & Blair, R. (2008). Dominance and submission: The ventrolateral prefrontal cortex and responses to status cues. *Journal of Cognitive Neuroscience, 21*(4), 713-724.

Martino, W., Mills, M., & Lingard, B. (2005). Interrogating single-sex classes as a strategy for addressing boys' educational and social needs. *Oxford Review of Education, 31*(2), 237-254.

McArthur, T. (1998). "Gender bias." *Concise Oxford Companion to the English Language.* Retrieved from Encyclopedia.com: http://www.encyclopedia.com/doc/1O29-GENDERBIAS.html

McKeage, K. M. (2004). Gender and participation in high school and college instrumental jazz ensembles. *Journal of Research in Music Education, 52*(4), 343-356.

Moir, A., & Jessel, D. (1991). *Brain sex: The real difference between men and women*. New York: Dell Publishing.

Mostafa, O. M. (2006). Male/Female Brain Differences: Medical education online. Retrieved from http://www.medicaleducationonline.org/index.php?option=com_content&task=view&id=46&Itemid=69.

Nycz, T. J. (2008) A description of a gender separate middle school choral program. (Master Thesis). Bowling Green State University. Retrieved from http://etd.ohiolink.edu/view.cgi/Nycz%20Tracey%20J.pdf?bgsu121389779 3.

Obleser, J., Rockstroh, B., & Eulitz, C. (2004). Gender differences in hemispheric asymmetry of syllable processing: Left-lateralized magnetic N100 varies with syllable categorization in females. *Psychophysiology, 41*, 783-788.

O'Toole, P. (1998). A missing chapter from choral methods books: How choirs neglect girls. *Choral Journal, 39*(5), 9-31.

No Child Left Behind. (n.d.) U.S. Department of Education. Retrieved from http://www2.ed.gov/nclb/landing.jhtml.

Pollard, D. (1999). Single-sex education. *WEEA Digest, October*. Retrieved from http://secure.edc.org/WomensEquity/pubs/digests/digest-singlesex.html.

Rea, L. M. & Parker, R.A. (2005). Designing and conducting survey research, 3rd ed. San Francisco, CA: John Wiley & Sons, Inc.

Rex, J., & Chadwell, D. (2009). Single-gender classrooms. *The School Administrator, 8*(66), 28-33.

Rhawn, J. (2000). The inferior parietal lobe. *Neuropsychiatry, Neuropsychology, and Clinical Neuroscience*. New York, NY: Academic Press. Retrieved from http://brainmind.com/InferiorParietal.html

Rice University (2000). Retrieved from http://www.ruf.rice.edu/~lngbrain/cglidden/frontal.html

Ruytjens, L., Albers, F., Van Dijk, P., Wit, H., & Willemsen, A. (2006). Neural responses to silent lipreading in normal hearing male and female subjects. *European Journal of Neuroscience, 24*, 1835-1844.

Ruytjens, L., Georgiadis, J. R., Holstege, G., Wit, H. P., Albers, F. W. J., & Willemsen, A. T. M. (2007). Functional sex differences in human primary auditory cortex. *European Journal of Neuroscience, 34,* 2073-2081.

Sadker, D. (1999). Gender equity: Still knocking at the classroom door. *Educational Leadership*, *56*, 22-27.

Sadker, D. (2002). An educator's primer on the gender war. *Phi Delta Kappan, 92*(5), 81-88.

Sadker, M., & Sadker, D. (1994). *Failing at fairness: How our schools cheat girls*. New York, NY: Touchstone.

Sadker, D., & Zittleman, K. (2004). Single-sex schools: A good idea gone wrong? *The Christian Science Monitor*, 9-10.

Sanders, J. (1997). Teacher education and gender equity. *ERIC Digest, 96*(3), 25-29.

Sax, L. (2005). *Why gender matters: What parents and teachers need to know about the emerging science of sex differences*. New York, NY: Broadway Books.

Sax, L. (2009). *Boys Adrift: The five factors driving the growing epidemic of unmotivated boys and underachieving young men.* New York, NY: Basic Books.

Sax, L. (2010). *Girls on the edge: The four factors driving the new crisis for girls*. New York, NY: Basic Books.

Shaywitz, B. A., Shaywitz, S. E., Pugh, K. R., Constable, R. T., Skudlarski, P., Fulbright, R. K., …. Gores, J. C. (1995). Sex differences in the functional organization of the brain for language. *Letter to nature, 373*(6615), 607-609.

Snodgrass, L. L., & Harring, K. E. (2004-2005). Right hemisphere positivity bias in preconscious processing: Data from five experiments. *Current Psychology: Developmental, Learning, Personality, Social, 23*(4), 318-335.

Steinberg, E. N. (2001). "Take a solo": An analysis of gender participation and interaction at school jazz festivals. *Dissertation Abstracts International, 62, 3329.*

Streitmatter, J. (2002). Perceptions of a single-sex class experience: Females and males see it differently. In A. Datnow & L. Hubbard (Ed.), *Gender in policy and practice* (pp. 212-226). New York, NY: Routledge-Falmer.

Trollinger, L. M. (1993). Sex/gender research in music education: A review. *The Quarterly Journal of Music Teaching and Learning, 4*(5), 22-39.

United States Department of Labor. (2011). Title IX, educational amendments of 1972 (Title 20 U.S. C. Sections 1681-1688). Retrieved from http://www.dol.gov/oasam/regs/statutes/titleix.htm.

Van Dyke, S. A., Zuverza, V., Hill, L. A., Miller, J. B., Rapport, L. J., & Whitman, R. D. (2009). Gender differences in lateralized semantic priming. *Developmental Neuropsychology, 34*(4), 381-392.

Vasich, T. (2005). Intelligence in men and women is a gray and white matter. Retrieved from http://today.uci,edu/news/release_detail.asp?key=1261.

Walker, M. (n.d.). Influences of gender and sex-stereotyping of middle school students' perception and selection of musical instruments: A review of literature. Retrieved from www.rider.edu/-vrme/articles4/walker/index.htm.

Weaver-Hightower, M. (2003). The "boy turn" in research on gender and education. *Review of Education Research, 73*(4), 471-498.

Wehr-Flowers, E. (2006). Differences between male and female students' confidence, anxiety, and attitude toward learning jazz improvisation. *Journal of Research in Music Education, 54*(4), 337-349.

White, C., & White, D. (2001). Commonsense training for changing male voices. *Music Educators Journal, 87*(6), 39-43.

Wilson, J. (2010). *Practices of and attitudes toward high school treble clef choral ensembles.* (Doctoral Dissertation). Retrieved from Dissertations & Theses: A&I. (Publication No. AAT 3430419).

Zittleman, K., & Sadker, D. (n.d.). Teacher education textbooks: The unfinished gender revolution. Retrieved from www.american.edu/sadker/textbooks.htm.

Appendix A

(Note: DO NOT AGREE TO PARTICIPATE UNLESS AN IRB APPROVAL STAMP WITH CURRENT DATES HAS BEEN APPLIED TO THIS DOCUMENT.)

INFORMATION LETTER
Regarding a research study titled:
"Choral directors' knowledge and perceived importance of biological and sociological sex differences in the choral classroom."

Dear Colleague,

I would like to take this opportunity to invite you to participate in a research study. This study is investigating choral directors' knowledge and perceived importance of sex differences in the choral classroom. You were selected as a participant because you are attending the middle school and high school reading sessions or roundtable sessions held during the 2012 ACDA Southern Division Conference. Megan W. Rudolph, doctoral student, is conducting this research. She is under the advisement of Dr. Nancy H. Barry, music education professor at Auburn University.

If you choose to participate you will be asked to fill out the enclosed survey and return it at the end of the session in the slotted boxes located at the exits. There are no risks involved with participating in this survey and you will remain anonymous. The survey will take no longer than 15 minutes to complete.

The information gathered in this survey may prove to be very beneficial to choir directors all over the country. Results may be used at clinics and workshops to bring an awareness of this topic to other choral directors. Additionally, this information may be used to write articles for professional journals, and for further research on this topic.

I know that your time is valuable at a conference, but please take a quick moment to assist a fellow choral director! Your decision about whether or not to participate will not jeopardize your future relations with Auburn University, the Department of Curriculum and Teaching or the Music Education Program.

Your anonymity will be secure throughout this entire process. There is no way to associate whom answered what questions. If you have any questions or concerns, please feel free to contact me at any time wicksml@auburn.edu or 205-402-5293. If you have any questions about your rights as a research participant, you may contact the Auburn University Office of Human Subjects Research or the Institutional Review Board by hsubject@auburn.edu or IRBChair@auburn.edu or by phone 334-833-5966.

If you decide to participate, the answers you provide will serve as an agreement for participation in this research study.

Sincerely,

Megan W. Rudolph
PhD Candidate

Sex Differences in the Secondary Choral Classroom

Please take a moment to fill out this anonymous survey. This research is being conducted as a portion of the requirements for a Ph.D. in Music Education at Auburn University. Please answer the questions truthfully and to the best of your ability. For this survey, "secondary" refers to Middle, Jr. High, and High School level choral ensemble classes.

At the end of the session please drop your survey in the slotted box at the exits. *Thank you in advance for your time!*

1. Have you already filled out this survey at another session?

_____ Yes – *Thank you for your time. Please deposit this survey in the slotted box at the end of the session, you do not need to continue any further.*
_____ No – *Please continue to the next questions.*

2. What is your sex?

_____ Female
_____ Male

3. In what state do you currently teach?

____	Alabama	____	South Carolina
____	Florida	____	Tennessee
____	Georgia	____	Virginia
____	Kentucky	____	West Virginia
____	Louisiana	____	I currently do not teach. *Please list your state:* _____
____	Mississippi		
____	North Carolina	____	Other, please specify: _____

4. How long have you taught secondary choral music?

____	0 years	____	11-15 years
____	1-5 years	____	16-20 years
____	6-10 years	____	20+ years

5. What grade level do you currently teach? (*Check all that apply*.)

____	Elementary (K-5)	____	10th
____	6th	____	11th
____	7th	____	12th
____	8th	____	Post Secondary
____	9th	____	I currently do not teach.

6. What is the highest degree you have earned? (*Please check one*.)

_____ I am an undergraduate student.
_____ Bachelor's
_____ Master's
_____ EDS
_____ Doctorate
_____ I am a graduate student in the following degree program_____.

7. How many mixed sex choirs do you teach during the school day?
(A mixed sex choir is any choir that has both males and females present in the class at the same time.)

_____

8. How many all female choirs do you teach during the regular school day?

_____

9. How many all male choirs do you teach during the regular school day?

_____

10. Which type of choir do you prefer to work with? (Check all that apply.)

_____ Mixed Sex Choir
_____ All Female Choir
_____ All Male Choir

11. Which type of choir is your least favorite to work with? (Check all that apply.)

_____ Mixed Sex Choir
_____ All Female Choir
_____ All Male Choir

The following statements are generalizations that may or may not be true for the male and female student population. Please respond to each item by placing a circle around the answer that best fits your beliefs. *Circle only ONE answer per question.*	Generally true for *BOTH SEXES*. **(1)**	**Generally true for *FEMALES.*** **(2)**	**Generally true for *MALES.*** **(3)**	**Generally NOT true for *EITHER SEX.*** **(4)**	**I am not sure.** **(5)**
Tend to experience voice change issues.	1	2	3	4	5
Tend to respond best to a set routine in the classroom.	1	2	3	4	5
Tend to be distracted by social, non-academic issues in the classroom (i.e. flirting, social status, etc.).	1	2	3	4	5
Tend to have no difficulty hearing female teachers.	1	2	3	4	5
Tend to be self-motivated in the classroom.	1	2	3	4	5
Tend to respond well to a calm classroom setting.	1	2	3	4	5
Tend to lack self-motivation in the classroom.	1	2	3	4	5
Tend to utilize only auditory areas of the brain when analyzing auditory patterns.	1	2	3	4	5
Tend to thrive in a mixed-sex environment.	1	2	3	4	5
Tend to receive little teacher attention for their behavior in the classroom.	1	2	3	4	5
Tend to have a weaker sense of hearing.	1	2	3	4	5
Tend to be sensitive to light levels.	1	2	3	4	5
Tend to process lip-reading into an auditory sound (i.e. directors showing students vowel formations, giving text reminders during a rehearsal or performance, etc.).	1	2	3	4	5
Tend to experience drastic voice change issues during puberty.	1	2	3	4	5

Tend to have more areas of the brain activated when they are resting.	1	2	3	4	5
Tend to attach emotion to information they receive.	1	2	3	4	5
Tend to process information and emotion in one hemisphere of the brain.	1	2	3	4	5
Tend to be sensitive to both positive and negative visual stimuli.	1	2	3	4	5
Tend to not speak out in the classroom.	1	2	3	4	5
Tend to respond well to an active (kinesthetic) classroom environment.	1	2	3	4	5
Tend to have high levels of testosterone.	1	2	3	4	5
Tend to prefer group work.	1	2	3	4	5
Tend to have difficulty hearing female teachers.	1	2	3	4	5
Tend to express feelings verbally.	1	2	3	4	5
Tend to prefer confrontation and high stimuli situations.	1	2	3	4	5
Tend to have no voice change issues.	1	2	3	4	5
Tend to have outbursts and be rowdier in the classroom.	1	2	3	4	5
Tend to experience minimal voice change issues and vocal cord growth throughout puberty.	1	2	3	4	5
Tend to not be distracted by social, non-academic issues in the classroom.	1	2	3	4	5
Tend to enjoy competition as a motivation to learn.	1	2	3	4	5
Tend to have high levels of estrogen.	1	2	3	4	5
Tend to not be aggressive in nature.	1	2	3	4	5
Tend to speak out in the classroom.	1	2	3	4	5
Tend to want to please the teacher.	1	2	3	4	5
Tend to be sensitive to light levels.	1	2	3	4	5
Tend to respond well to teacher-directed instruction.	1	2	3	4	5
Tend to experience hormone releases several times a day.	1	2	3	4	5
Tend to receive more negative teacher attention for their behavior in the classroom.	1	2	3	4	5
Tend to process written words faster.	1	2	3	4	5

Tend to have difficulty processing lip-reading into an auditory sound (i.e. directors showing students vowel formations, giving text assistance during a rehearsal or performance, etc.).	1	2	3	4	5
Tend to control their classroom behavior.	1	2	3	4	5
Tend to enjoy competition as a motivation to learn.	1	2	3	4	5
Tend to have a stronger sense of hearing.	1	2	3	4	5
Tend to not care about pleasing the teacher.	1	2	3	4	5
Tend to like situations to remain calm with no confrontations.	1	2	3	4	5
Tend to utilize language and auditory areas of the brain when analyzing auditory patterns.	1	2	3	4	5
Tend to not prefer competition as a motivation to learn.	1	2	3	4	5
Tend to refrain from expressing feelings verbally.	1	2	3	4	5
Tend to process information and emotion in both hemispheres of the brain.	1	2	3	4	5
Tend to have no brain activity during verbal stimuli that they deem not important.	1	2	3	4	5
Tend to prefer varied learning activities in the classroom.	1	2	3	4	5
Tend to thrive in a single-sex environment.	1	2	3	4	5
Tend to attach no emotion to the information they receive.	1	2	3	4	5
Tend to be sensitive to positive visual stimuli.	1	2	3	4	5
Tend to show brain activity even when they deem the verbal stimuli not important.	1	2	3	4	5
Tend to have more areas of the brain activated when they process information.	1	2	3	4	5

Please respond to the following statements by placing an "X" in the box that best fits your beliefs.	**Strongly Agree (1)**	**Agree (2)**	**Neither agree nor Disagree (3)**	**Disagree (4)**	**Strongly Disagree (5)**
12. **Secondary choral teachers need more knowledge about sex differences.**	❑	❑	❑	❑	❑
13. **I would attend professional development regarding sex differences if it were available.**	❑	❑	❑	❑	❑
14. **Females are easier to teach than males.**	❑	❑	❑	❑	❑
15. **Males are easier to teach than females.**	❑	❑	❑	❑	❑

Please feel free to write any comments you have about this survey or research topic below, or write any comments you would like to communicate to the researcher.

Thank you for taking the time to complete this survey!

Your participation is deeply appreciated!!

If you have any questions, please feel free to contact the researcher, Megan Wicks-Rudolph at wicksml@auburn.edu **or her supervisor Dr. Nancy Barry at** NHB0002@auburn.edu. **You may also contact the Office of Human Subjects Research at Auburn University at** hsubject@auburn.edu **or by phone 334-833-5966.**

Thank you again!

Appendix B

RECRUITMENT SCRIPT for Megan Wicks-Rudolph

My name is Megan Wicks-Rudolph and I am a Ph.D. Candidate from the Department of Curriculum and Teaching at Auburn University. I would like to invite you to participate in my research study entitled "Sex Differences in the Secondary Choral Classroom". Any choral director may participate.

As a participant, you will be asked to complete a survey. This survey will take no longer than 15 minutes and is anonymous. If you would like to participate in this research study, please complete the survey and return it to the slotted boxes at the door at the conclusion of the session. If you have already completed this survey once, please mark the appropriate box and turn in the survey.

Do you have any questions?

If you have questions later, please feel free to contact me at 205-402-5293, or you may contact my advisor, Dr. Nancy Barry, at NHB2002@auburn.edu.

Thank you in advance for helping me!

Appendix C

From: "Batey, Angela Lynn" <abatey@utk.edu>
Date: December 6, 2011 9:43:37 PM CST
To: "Megan W. Rudolph" <rudolphmw@vestavia.k12.al.us>
Cc: Tom Shelton <tshelton@fpcgreensboro.org>
Subject: Re: Regional ACDA

Hi, Megan!

I was actually in on this discussion with all the parties that you mentioned. It my understanding you were given approval to contact the Divisional R & S Chairs related to your research about having these available at their roundtable sessions.

I hope you will take the advice to go to the exhibit hall and ask permission from one of the exhibitors to stand around their booth and greet people requesting their assistance for your research.

The Reading Sessions are completely different from the roundtable sessions, but, in consultation with Tom, we agreed you could place your surveys on the chairs in the room immediately prior to the Reading Session for the Middle School and High School R & S areas.

Best of luck!

AB

Appendix D

Human Subjects [HSUBJEC@auburn.edu]

Tuesday, February 21, 2012 1:25 PM

Dear Ms. Wicks,

Your protocol entitled "Secondary Choral Directors' Awareness of biological and Sociological Sex Differences in the Choral Classroom" has received final approval as "Exempt" under federal regulation 45 CFR 46.101(b)(2).

Official notice:
This e-mail serves as official notice that your protocol has been approved. A formal approval letter will not be sent unless you notify us that you need one. By accepting this approval, you also accept your responsibilities associated with this approval. Details of your responsibilities are attached. Please print and retain.

Consent document:
Your approved, stamped consent will soon be forwarded by mail to your Vestavia Hills address.

Please note that *you may not begin your research that involves human subjects until you receive the consent* with an IRB approval stamp applied. You must use copies of that document when you consent participants, and provide a copy (signed or unsigned) for them to keep.

Expiration:
Your protocol will **expire on February 18, 2013**. Put that date on your calendar now. About three weeks before that time you will need to submit a final report or renewal request. (You might send yourself a delayed e-mail reminder for next January.)

If you have any questions, please let us know.

Best wishes for success with your research!
Susan

Susan Anderson, IRB Administrator
IRB / Office of Research Compliance
115 Ramsay Hall (basement) ** **NOTE ADDRESS** ***
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hsubjec@auburn.edu