

Music and Student Performance: A Conceptual Analysis of the Literature

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ABSTRACT

Related topics to music and student performance that have emerged from scholarly research will be discussed in this article. Specifically, the field of study that involves how the physiology and neurology of the brain is affected by music will be explored. The effect of music and musical training on emotion and cognition will be examined, with Brofenrenner's (1979) ecological systems theory and Bandura's (1986) social cognitive theory utilized as theoretical frameworks to provide a context for music and student achievement. Specific to this article, the history of standardized testing, as well as standardized testing in Texas, will be considered. Studies will be described in which race and gender were identified as mediating factors in academic achievement. Because the focus of this article is related to how musical training in a public high school might affect or improve academic achievement, the music curriculum in Texas public schools will be overviewed. This review also includes a brief discussion of the history of public school music in the United States, as well as a description of Texas public school music courses. Finally, extant studies of the impact of music education on academic achievement are reviewed. This article concludes with a description of gaps in scholarly literature, which may be addressed by future research.

Keywords:

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Finally, extant studies of the impact of music education on academic achievement are reviewed. Dissertations, quantitative studies, and meta-analyses conducted since 2000 are discussed and critiqued. Also, studies about academic achievement as it relates to race or ethnicity will be discussed. This article concludes with a description of gaps in scholarly literature, which may be addressed by future research.

Music and the Brain

Music and the fine arts have been championed as a means to increase whole-brain engagement and to address increased academic engagement and positive behavioral changes (Respress & Lutfi, 2006; Walker, 1985). Neuroscientists have studied the interaction of music with cognition, emotion and physical phenomena. Zatorre and McGill (2004) commented that "the ability to perceive and process music is not some recent add-on to our cognition,

but that it has been around long enough to be expressed from the earliest stages of our neural development” (p. 314). Zatorre and McGill (2004) also discussed ways in which music may affect brain structure formation. Using medical data and equipment, Gaser and Schlaug (2003) actually demonstrated physical differences in the structure of the brains of musicians and non-musicians.

The idea that brain formation can be positively affected by music was discussed by Wan and Schlaug (2010) as they commented, “research over the past 2 decades has demonstrated that intense musical training can result in plastic changes in the developing brain as well as the adult brain” (p. 567). Similarly, music has been examined as a medical intervention to promote desired behavior and responses in dementia patients (Choi, Lee, Cheong, & Lee, 2009). Further, Wan and Schlaug (2010) have explored the use of musical treatment interventions in children with autism.

Several studies have been conducted to compare the effects of music with musically trained and non-musically trained participants (Baumann, Meyer, & Jancke, 2008; Brattico et al., 2008; Fujioka, Trainor, Ross, Kakigi, & Pantev, 2005; Schon & Besson, 2005; Schon, Magne, & Besson, 2004). The central focus of the comparative studies (i.e., Baumann et al., 2008; Brattico et al., 2008; Fujioka et al., 2005) has been to distinguish differences in brain mapping between musically trained and non-musically trained participants. The three highlighted studies were conducted in Canada (Fujioka et al., 2005), Finland (Brattico et al., 2008), and Switzerland (Baumann et al., 2008).

In each of the studies, researchers confirmed that musical training had a positive measurable effect on brain structure and processing capabilities. Fujioka et al. (2005) revealed implicit musical recognition in both musicians and non-musicians, but higher levels of memory encoding and auditory discrimination in trained musicians. Brattico et al. (2008) confirmed higher levels of auditory discrimination and increased neural activity for trained musicians, as they were able to distinguish non-prototypical chords in harmonic progressions. In respect to higher levels of neural activity, Baumann et al. (2008) discovered that the effects of musical expertise were long-term changes in plasticity of the brain, as well as the processes involved in hearing music.

Another interesting aspect of the effect of music on the brain was highlighted in the research of Wong and Gauthier (2010). Based on neuroimaging data, they described the ways in which music affects multiple areas of the brain. Specifically, they discovered the extensive effects of musical notation on a variety of areas in the brain,

Musical notation automatically engages an extensive multimodal network of areas. Various areas outside the visual cortex, including the primary and associative auditory areas, the somatosensory areas, the audiovisual areas, the parietal areas, the premotor areas, other frontal areas, the precuneus, the cingulate gyrus, and the cerebellum, all showed selectivity for musical notation compared with control visual stimuli. One characteristic of this multimodal network is that most of the areas were found bilaterally. (p. 710)

From neurological studies (e.g., Baumann et al., 2008; Brattico et al., 2008; Fujioka et al., 2005), researchers have indicated that musical training has long-lasting positive effects on brain structure and neural processing. Therefore, these effects have a potential impact on cognitive and affective processes.

In contrast to the positive cognitive effects of music, Tillman and Bigand (2004) presented an alternative view to the philosophy of the perceived benefits of music. They contended that the previous musical experiences of a listener of music work in context with the craft of a composer to create a musical experience. Tillman and Bigand (2004) posited that listener expectancies are a major contributing force to musical perception. Further, they stated, “implicit learning permits listeners to internalize the knowledge required to differentiate subtle changes in musical structures” (p. 218). Accordingly, non-musicians behaved “roughly in the same way as do musicians, the former being as musical as the latter” (Tillman & Bigand, 2004, p. 218). Thus, they argued that the potential for musical training to impact rich musical experiences is minimal. Although Tillman and Bigand’s assertion might be feasible, they did not address the cognitive, physiological or emotional benefits of musical training.

Music and Emotion

In addition to cognition, the interaction of music and emotion has been studied extensively. For instance, Reimer (2004) argued that the process of learning can be deeply impacted by music making, with cognitive and affective components working in a complementary fashion. Reimer proposed the following: (a) musical engagement promotes hemispheric laterality in the brain, as both sides are engaged, as well as the use of memory and retrieval systems within the brain; (b) the activities of the brain engaged in music are different for each type of musical event; (c) brain activity that occurs during music making is a learned response; (d) permanent physiological changes in brain structure and neural activity result from musical activity, and each activity produces unique results; and (e) the results of the changes following each activity can be linked to the unique nature of each activity (Reimer, 2004). Reimer summarized his thoughts about the interaction of musical experiences and the brain as he stated,

Every musical experience that we have changes who we are. Although musical experience occurs in the present

during which we are engaged in it, it also endures within us, in our brains and bodies. As brain research suggests, we are changed by each of our experiences. (p. 27)

Music's Capacity to Arouse Emotion

A philosophical divide exists between researchers (e.g., Kivy, 2006) who claim that emotional impact of music is primarily associated with the expectations of the listener and researchers (e.g., Carroll, 2003) who insist that music has its own emotional content, apart from the expectations of the listener. Kivy (2006) has been identified the proponent of the formalist viewpoint (Sizer, 2007). In the formalist view, "music (particularly instrumental or absolute music) cannot arouse emotions in us because music lacks the necessary representational content to do so" (Sizer, 2007, p. 307). To the contrary, Sizer characterized the arousalist viewpoint of music as she wrote that, "arousal theories hold that music is emotion expressive—is sad or happy sounding—in virtue of arousing those emotions in the listener" (p. 307).

Regardless of the merit of each well-constructed argument about the affective or emotional impact of music, numerous researchers (e.g., Kreutz, Bongard, Rohmann, Hodapp, & Grebe, 2004; Sammler, Grigutsch, Fritz, & Koelsch, 2007; Steinbis, Koelsch, & Sloboda, 2006; Webster & Weir, 2005) have demonstrated physiological effects of music on emotion. Zatorre and McGill (2004) eloquently stated,

One thing we do know is that music can elicit not only psychological mood changes, but also physiological changes in heart rate, respiration and so forth, that mirror the changes in mood. Indeed, music's anxiolytic effect is known not only to the specialist, but to anyone who listens to a favourite piece of music to relax after a trying day. (p. 314)

In the exploration of the complex relationship of music and emotion, several dissertations have been written (e.g., Babani, 2009; Bashwiner, 2010; Haghjoo, 2010; Kazee, 2010). Each author approached this complex relationship in a unique way. Babani (2009) utilized a case study design as he explored the peak emotional experiences of 21 participants. His qualitative approach to research gave voice to the participants as they described the emotional responses they experienced while listening to music of their own selection. Among the 22 categorically different responses noted by participants, physiological responses of listeners in the study were recorded as the most commonly experienced effect of listening to music (Babani, 2009). In his conclusion, Babani justified his use of Maslow's concept of peak experiences, as he stated "in order to grow, people must explore their capabilities for creation and destruction, their frightening intensities, and their exhilarating potentials: music is one way to achieve this" (p. 126).

In a dissertation that combined philosophical theory and the application of that theory to a piece of music, Haghjoo (2010) sought to develop an integrated aesthetic theory. Haghjoo drew heavily upon John Dewey's theory of art as an aesthetic experience, and the idea of dualism, characterized by the Cartesian split point of view. Descartes believed in both the existence of matter and of mind (Smith, 2010). For purposes of his philosophical argument, Haghjoo (2010) defined music as "any organized sound structure whose significance is perceived to lie in the sound structure itself" (p. 80). Haghjoo constructed five levels of meaning within music, embracing such diverse fields as mathematics, semiotics and philosophy. The rich and diverse complexity of his dissertation, as well as the inherent complexity of describing music and emotion, was summarized as Haghjoo stated, "there is always much that is distorted or lost in translation from aural experience into visual and linguistic experience" (p. 223).

Bashwiner (2010) conducted an exhaustive review of the literature, as he sought to develop a biologically grounded theory of musical emotion. Specifically, Bashwiner addressed the questions "(a) Does music arouse emotion?; (b) Which emotions does music arouse?; and (c) How does music arouse emotion?" (2010, p. 67). Drawing upon extensive neurological research, Bashwiner explored brain functioning from the structural, sonic, emotional and musical viewpoints. Bashwiner stated,

musical signalers have a real capacity to arouse and modulate the emotions of perceivers, irrespective of those listeners' past listening experience, i.e., unconditionally. Certainly the perceiver's experience will matter to *some* extent, no doubt to a *large* extent. But music of virtually any sort can be of interest, can be moving, to virtually any (human) listener. (2010, p. 414)

In summary, Bashwiner concluded that music has the power to arouse emotion, and that emotional responses to music by humans appeared to be a biological adaptation.

The fourth dissertation reviewed was Kazee's (2010) phenomenological study of how expressive qualities of music were valued by public school music teachers. She conducted interviews with current public school music teachers in South Carolina. She described her findings as "the importance of learning music through modeling, and that expression is defined through the personal experience of the performer or the receiver, rather than through words" (p. 121). Thus, she confirmed that expression of emotion in music is a vital and interactive part of the

educational process.

Experiences of students in music can range from the satisfaction of grasping a concept such as reading rhythm or pitch, to giving an inspired emotionally, fulfilling performance. At the highest level of performance, Cochrane (2008) described the central role of music in an emotional musical experience by saying:

Hence, overall, it seems that the music just more fully constitutes and dominates the development of the musician's emotion. And although the attention of the subject is not a necessary part of the emotional state, we may say that the musician's experience of the music more fully constitutes his or her experience of the emotion. (p. 339)

Stewart and Williamson (2008) highlighted a need for further music education research that involved interdisciplinary teams of musicians and scientists working in contact to provide ecological validity to claims about the impact of music on the brain. Following the assertion by Reimer (2004) that "every musical experience changes who we are" (p. 27), educators may carefully construct musical experiences that have impact on students' feelings in order to have a lasting, positive effect on their cognitive and aesthetic processes in the brain. In Reimer's concluding thoughts about the interaction of the brain and music, he summarized that these interactive activities "parallel the national standards for music education" (p. 27).

Music and Cognition

Having reviewed literature about the interaction between music and neuroscience, as well as music and emotion, the topic of music and cognition was also explored. Specifically, music and IQ, Gardner's (2006) *Multiple Intelligences: New Horizons*, and the concept of transfer between cognitive activities were discussed. Each of these three areas may inform academic achievement of students who study music.

Music has also been analyzed in regard to its potential effect on IQ. Rather than comparing standardized test scores, Schellenberg (2004) conducted two longitudinal studies in which he explored IQ development of students who had been involved in music lessons for extended periods of time (i.e., 56 months). Although he utilized a small ($n = 147$) sample size, Schellenberg's measure (i.e., Wechsler IQ test) was highly reliable. Schellenberg asserted that, "these results indicate that formal exposure to music in childhood is associated positively with IQ and with academic performance and that such associations are small but general and long lasting" (p. 457). Wetter, Koerner, and Schwaninger (2009) replicated Schellenberg's results, utilizing participants ages 9 - 12.

Howard Gardner originally introduced his theory of multiple intelligences in 1999, and subsequently revised his theory in 2006. As one of the set of intelligences listed by Gardner (2006), musical intelligence was generally defined as "having a core set of operations, triggered or activated by certain kinds of internal or external information, and susceptible to encoding in a symbol system" (p. 7). Gardner kept his definitions of musical intelligence broad. A problem with this broad definition of musical intelligence is the lack of a means of measurement. Given the subjective nature of music, and Gardner's broad definition, the existence of musical intelligence may be speculated.

Although the scientific rigor supporting Gardner's (2006) theory of musical intelligence seems primarily anecdotal, he postulated that intelligences work in tandem, not in isolation. This general theory has been supported by recent neurological studies. (e.g., Foregard et al., 2008; Schon & Besson, 2005; Schon et al., 2004). Specifically, Foregard et al. (2008) addressed the concept of transfer, defined as "the effect that training (or skill acquisition) in one domain might have on skills and cognitive performances in other domains" (p. 3566). The concept of transfer has formed the basis for the argument that musical training may have positive effects on academic achievement.

Brofenbrenner Ecological Systems Theory

Brofenbrenner (1979) theorized in *The Ecology Of Human Development* that development could be defined as "a lasting change in the way in which a person perceives and deals with his environment" (p. 3). Specifically, he stated that

The ecology of human development involves the scientific study of the progressive, mutual accommodation between an active, growing human being and the changing properties and the changing properties of the immediate settings in which the developing person lives, as this process is affected by the relations between these settings and by the larger context in which the settings are embedded. (p. 21)

In references to developmental settings, Brofenbrenner (1979) described various levels of influence each setting may have on development. The most proximal influence on a child came from dyad relationships. These relationships exist in closest proximity to the developing child, within a level Brofenbrenner termed "microsystem" (p. 22). A microsystem has elements that include "face-to face engagement" (p. 22) and "the way in which properties are perceived by persons in that environment" (p. 23). A teacher-student dyad is an example of a relationship that occurs within a microsystem, as are student-student relationships in learning environments.

A larger context of development is the mesosystem, which Bronfenbrenner (1979) described as “the interrelations among two or more settings in which the developing person actively participates” (p. 25). Thus, a mesosystem may be formed by the interactions of many microsystems. A classroom or school may function as a mesosystem.

In addition to considering the variety of settings in which human development occurs, Bronfenbrenner also posited that molar activities, joint activity dyads, and reciprocity relationships between levels of systems all contribute to development. Each of these concepts (i.e., molar activities, joint activity dyads, and reciprocity) in ecological systems theory inform this proposed study. Molar activities are activities “a behavior possessing a momentum of its own and perceived as having meaning or intent by the participants in the setting” (Bronfenbrenner, 1979, p. 45). Daily skill building activities present in academic and music classrooms appear to be examples of molar activities. Joint activity dyads are relationships “in which the two participants perceive themselves as doing something together” (p. 56). The dyadic relationship Bronfenbrenner described is one that is often present in musical groups, as each member contributes to the whole. The concept of reciprocity is applicable to the group music setting as well. Reciprocity, as articulated by Bronfenbrenner, results when “one member has to coordinate his activities with those of another” (p. 57). An outgrowth of reciprocity is “an acceleration in pace and an increase in complexity of learning processes” (p. 57).

Although individual effort is necessary, a group effort in a musical ensemble is the desired result. Bronfenbrenner (1979) also asserted that for developmental growth to occur, “substantive variety” must be present in a child’s learning environment (p. 55). Elective courses, specifically music, can be viewed as contributing to the substantive variety described by Bronfenbrenner. The nature of music in a public high school setting is one of group instruction. Assessment of learned musical skills, assignment of grades, and personal musical development may be considered on the individual student level, as part of a dyadic relationship or within a microsystem. However, the nature of public high school music performances are usually group oriented; thus, the interaction of musical groups can be considered a mesosystem. Bronfenbrenner’s Ecological Systems Theory (1979) was viewed as an appropriate fit for this proposed study.

Bandura Social Cognitive Theory

Bandura (1986) stated, “human functioning is explained in terms of a model of triadic reciprocity in which behavior, cognitive and other personal factors, and environmental events all operate as interacting determinants of each other” (p. 18). Specifically, Bandura sought to bridge the apparent gap between individuals who proposed that nature or inherent qualities were more influential on personal development and individuals who believed that nurture, or environment, was more influential on personal development. Bandura described the interactive nature of behavior, personal factors and environment reciprocal determinism and specifically used the term “triadic reciprocity” to define the interaction of these three areas (1986, pp. 22-23).

Elements within Social Cognitive Theory

Several elements of social cognitive theory (Bandura, 1986) inform this proposed study. Observational learning, motivational factors, personal efficacy, and social support are factors salient to academic achievement and music education. Each of these factors will be discussed as they pertain to academic achievement and music. Observational learning, according to Bandura (1986), is important because, “The capacity to learn by observation enables people to expand their knowledge and skills on the basis of information exhibited and authored by others” (p. 47). Bandura (1986) asserted that, “observational learning is attenuated by four processes; attentional processes, retention processes, production processes, and motivational processes” (p. 51). For purposes of this study, attentional processes, retention processes, and motivational processes will be considered.

Attentional processes “determine what is selectively observed...and what information is extracted from ongoing modeled events” (Bandura, 1986, p. 51). “Skill building and segmenting of complex activities, followed by times of subsequent practice” were activities described by Bandura (1986, p. 55) as means to bolster the efficacy of observational learning. These prescribed activities reflect the components of a music curriculum. “Retention processes” (p. 55) serve to reinforce concepts students have learned. Bandura elaborated, “the facilitative effects of rehearsal on long-term retention derive more from applying memory strategies to modeled information than from sheer repetition” (p. 61).

Motivation and its concomitant effects on observational learning were discussed by Bandura (1986). Specifically, he described outcome expectations and self-perceptions of efficacy. Bandura stated, “success by others raise observers’ outcome expectations and judgments of their own performance capabilities” (p. 301). The phenomenon Bandura described is a key element of music curriculum, specifically experienced by students in group settings such as choir, band, or orchestra.

Academic Achievement

For purposes of this article, academic achievement as measured by standardized testing was examined. Standardized testing has been utilized as a means of educational assessment for many years (Ravitch, 2010). Wolf (2007) described educational assessment as “any procedure for gauging the progress of a student in acquiring and mastering educational knowledge and skills” (p. 691). Factors including gender, race, and socioeconomic status, and the observed effects of these factors on academic achievement as measure by standardized testing will be briefly explored. Subsequently, high stakes testing and testing in Texas will be discussed.

Gender and Academic Achievement

Gender is a factor that is included frequently in studies of academic achievement. Marks (2008) investigated the relationship of gender and student achievement, as he analyzed data from 31 counties involved in the Programme for International Student Assessment (PISA). The PISA is an assessment administered by the Organisation for Economic Cooperation and Development (OECD). His examination yielded results that corroborated with previous gender-related achievement research. Specifically, Marks (2008) observed that, according to data from the 2000 PISA administration, girls outperformed boys in reading and boys outperformed girls in mathematics. One salient feature of the PISA is that it has been administered four times (2000, 2003, 2006, 2009) to 15-year olds in each participating country (OECD, 2011).

Chambers and Schreiber (2004) examined data from the National Educational Longitudinal Study of 1988 (NELS:88). They concluded that, on measures of reading achievement, girls outperformed boys. However, according to the National Center For Education Statistics (NCES) on mathematics tests, boys outperformed girls. As of the 2009 administration, boys had continued to outperform girls on mathematics tests and girls outperformed boys on reading tests (NCES, 2011).

Correlated to these results, some researchers (e.g. Anglin, Pirson, & Langer, 2008; Shapka, 2009) have investigated methods to narrow the gender gap for girls in mathematics. Shapka (2009) conducted a longitudinal study involving Canadian students to determine if single sex mathematics education affected mathematics achievement. Her results indicated that, for the participants in her study, girls who received mathematics instruction in an all-girls setting outperformed girls who learned math in a co-educational setting, and outperformed boys who learned mathematics in a co-educational setting. Specifically, she stated “It appears that the all-girl instruction acted as a protective factor by keeping average levels of math achievement relatively high throughout high school” (p. 537).

Anglin et al. (2008) analyzed the application of an instructional practice they termed mindful learning to address gender inequalities in mathematics performance. Mindfulness, as described by the authors was defined as a state of actively looking for novel perspectives” (p. 132). Based on their data, Anglin et al. (2008) were able to conclude that, “when mindful learning is encouraged through conditional instruction, female performance improves to a point where both genders perform equally well on novel math tasks” (p.137).

These two studies serve to illustrate the role research has recently played when the gender gap is examined. As with all studies, many factors may influence results. Although results from both researchers (i.e., Anglin et al., 2008; Shapka, 2009) indicated specific instructional strategies that may narrow the achievement gap, the gap is extant. In the next section, race and socioeconomic status are examined as factors that may affect academic achievement.

Race, Socioeconomic Status, and Academic Achievement

Race has long been considered a factor in academic achievement. Brown-Jeffy (2009) examined the interactive effects of school characteristics (i.e., racial make-up) and individual student achievement. After comparing data from the National Assessment of Educational Progress (NAEP), Brown-Jeffy (2009) confirmed findings of previous researchers (e.g., Bali & Alvarez, 2004; Jencks & Phillips, 1998; Stevens, Olivarez, Lan, & Tallant-Runnels, 2004) who documented that students of color have not scored as high as their White peers on standardized testing. Brown-Jeffy (2009) posited that students in schools who have a higher minority population (> 50%) score lower on standardized mathematics testing than their White counterparts. Brown-Jeffy also cited socioeconomic status as the single greatest influence on achievement, as defined by standardized testing.

Considering the academic achievement of Hispanic high school students, Capraro, Capraro, Yetkiner, Rangel-Chavez, and Lewis (2009), examined scores from over 3,000 students in Colorado. They noted that language acquisition and socioeconomic status might have been factors that contributed to the underperformance by Hispanic students. The results of their study confirmed the well-documented achievement gap between Hispanic students and their White and Asian counterparts as measured by standardized tests.

The findings of Capraro et al. (2009) are similar to the findings of Tanner (2006), who examined data on

students from a school district with 80.9% Hispanic population and 70.4% economically disadvantaged. Tanner examined 4,570 10th grade student scores on the 2006 administration of the TAKS test, to determine if score differences existed between students enrolled in music, and those students who were not enrolled in music. Students enrolled in music outscored their non-music peers on TAKS Reading and TAKS Mathematics tests. Tanner (2006) also noted that, as a group, 10th grade non-music students had an average mean score that was below the passing standard for TAKS.

Although Tanner (2006) did not find a statistically significant difference based on ethnicity or socioeconomic status, the lack of difference might have been the result of a largely homogenous sample, in which the high percentage of Hispanic (80.9%) and low socioeconomic status (70.4%) may have confounded the statistical model (Field, 2009). However, when scale scores from Tanner's results were examined, an achievement gap between White and Hispanic students was evident, regardless of music enrollment. On the TAKS Reading test, White students in Tanner's sample averaged 2273, versus 2160 for Hispanic students. On the TAKS Mathematics test, results were similar as White students in Tanner's sample averaged 2195, versus 2079 for Hispanic students.

Lorence (2008) investigated the effect of socioeconomic status on the 1999 Texas Assessment of Academic Skills (TAAS) test and compared scores to the Stanford-9 test. He determined that the SES of a student, as well as that of the school had a statistically significant effect on standardized testing. Students from lower SES family backgrounds and from lower SES schools, scored lower on both types of testing. These results appeared to corroborate the findings of Brown-Jeffy (2009).

Another aspect of Lorence's (2008) study was to compare score increases reported on the TAAS test with increases from National Assessment of Educational Progress (NAEP) test results. He concluded that gains in scores by White and Black Texas students on the TAAS test were not reflected equally by gains in NAEP test scores. However, in the time period he examined (i.e., 1996-2000) scoring increases by Hispanic students were noted on both TAAS and NAEP (2008).

Darling-Hammond (2007) also noted that the scoring gains reported in Texas had not been substantiated by other means of measurement, such as NAEP scores. Additionally, she speculated that the reported gains might have been due to the increased dropout rates by students of color, or that students of color simply were not tested. She further lamented that as achievement gaps had increased, curriculum offerings for non-tested subjects had decreased. Thus, enrichment opportunities such as fine arts were offered less frequently. This sentiment was echoed by Gullatt (2007), who asserted "NCLB identified arts as core academic content. Nevertheless, the core seems to be getting reduced to only those content areas that are tested, and the study of arts has become a victim of the present political environment" (p. 218).

High Stakes Testing

Recently, standardized testing has been reconceptualized as high-stakes testing (e.g., Caine & Caine, 2001; Koretz, 2008; Nichols & Berliner, 2007). The impact of high stakes testing on academic achievement has been examined (Caine & Caine, 2001; Gay, 2007; Hursh, 2005, 2007; Koretz, 2008; Nichols & Berliner, 2007; Ravitch, 2010). As prescribed by the NCLB Act, students must achieve adequate yearly progress (AYP) in order for schools to maintain acceptable ratings. When schools do not meet AYP requirements, penalties are imposed. Thus, schools have begun to teach primarily what is tested in order to satisfy the NCLB Act, and to avoid penalties for not achieving standards. Consequently, a narrowed scope of curriculum has resulted from the NCLB requirements (Caine & Caine, 2001; Gay, 2007; Hursh, 2005, 2007; Koretz, 2008; Nichols & Berliner, 2007; Ravitch, 2010). Specific to this review, the impact of high stakes testing on the arts in schools, as prescribed by the NCLB Act, has been examined (Beveridge, 2010; Gay, 2007; Hursh, 2005, 2007; Spohn, 2008).

Testing in Texas

In Texas, accountability through testing has been a part of the Texas Education Code since 1979 (TEA, 2004b). Although testing in Texas began as an assessment of minimum skills, the national trend toward mastery of skills resulted in the development of the TAKS test in 2003 (TEA, 2004b). The Texas model of accountability was a strong influencing force on the development of the NCLB Act testing regulations (Ravitch, 2010; Wolf, 2007). A major component of the NCLB Act has been AYP and exit level requirements. To address these required NCLB standards, Texas education code prescribes that students must pass all four sections of the TAKS test in grade 11 to graduate from high school. Thus, extensive data have been collected since 2003 on student achievement, as measured by the TAKS test.

Wolf (2007) extolled the benefits of frequent testing, along with the narrowing of curriculum that has resulted from the accountability sanctions prescribed by the NCLB act. However, students and teachers in the arts subjects have often decried the loss of available instructional time due to increased focus on testing. In response to the loss of

what is perceived as opportunities for academic enrichment, and decreased arts instructional time, researchers have attempted to show the concept of transfer between musical experiences and academic achievement (e.g., Andrews, 1997; Bahr & Christensen, 2000; Butzlaff, 2000; Standley, 2008; Vaughn, 2000).

Music in Schools

In his seminal work, *History of Public School Music in America*, Birge (1953) traced the origins of public school music instruction. He focused on the work of Lowell Mason in Boston who in 1834, "issued his famous *Manual of Instruction*, which became the handbook of every singing-school teacher" (p. 27). Following several years of petition and demonstration of skills by students, music was formally approved as a part of Boston public school music curriculum on August 28, 1838 (Birge, 1953). The addition of music to public school curriculum soon spread across the United States. By 1910, several extant methods were published to promote musical literacy (Birge, 1953; Branscome, 2005). Throughout the ensuing 84 years, many different music education method books were published. These varied books had an impact on the development of nine national standards for music education, as developed by the Music Educators National Conference (MENC) (Branscome, 2005).

Developed by the MENC (1994), the nine standards for music education are: (a) singing, alone and with others, a varied repertoire of music; (b) performing on instruments, alone and with others, a varied repertoire of music; (c) improvising melodies, variations, and accompaniments; (d) composing and arranging music within specified guidelines; (e) reading and notating music; (f) listening to, analyzing, and describing music; (g) evaluating music and music performances; (h) understanding relationships between music, the other arts, and disciplines outside the arts; and (i) understanding music in relation to history and culture. The national standards have provided a framework for music instruction across the United States (Conway, 2008; MENC, 1994). However, these standards have not been subjected to uniform measurement. Further, they encompass a broad perspective of music education, and have not been disaggregated to specific grade levels or a scope and sequence format.

Texas Music Curriculum

The State of Texas has curriculum standards for music education as well (TEA, 1997). Published as Chapter 117 of the Texas Education Code, the Texas standards closely resemble the national standards (TEA, 1997). However, the TEKS have been organized into four large strands (TEA, 1997). The Texas Education Code contains a description of the four strands:

Four basic strands--perception, creative expression/performance, historical and cultural heritage, and critical evaluation--provide broad, unifying structures for organizing the knowledge and skills students are expected to acquire. In music, students develop their intellect and refine their emotions, understanding the cultural and creative nature of musical artistry and making connections among music, the other arts, technology, and other aspects of social life. Through creative performance, students apply the expressive technical skills of music and critical-thinking skills to evaluate multiple forms of problem solving. (TEC, 2001, Ch. 117)

Another distinguishing feature of the TEKS for music is that they are organized by grade level. Whereas the nine national standards are broad in scope, the TEKS for music are specific and gradually increase in specificity and complexity. Each set of essential knowledge and skills is divided into elementary, middle school, and high school. For example, the TEKS for a student in high school music level IV are different than the TEKS for a student in elementary music (i.e., Grades 1-5).

To address the teaching of the TEKS for music in high school, several courses are offered in Texas. Among the courses approved by the TEA to address music TEKS are choir, band, and orchestra. The TEKS provide a broad framework for school districts to develop sequenced curriculum.

Band, Choir, and Orchestra in Texas

In the State of Texas, band, choir, and orchestra are among the approved high school courses that fulfill the requirements of the fine arts TEKS (TEC, 2001, Ch. 117). According to the TEA website, courses in each subject (i.e., band, choir, and orchestra) may be taken in four consecutive levels. For students enrolled in band, 12 course numbers are available, for students enrolled in choir eight course numbers are available, and orchestra has eight course numbers available. Instrumental students may enroll in instrumental ensemble as either a band or orchestra student. Also, a student may be enrolled in more than one musical ensemble concurrently, or consecutively. Table 1 contains these course offerings.

Table 1

Course Offerings for High School Music in Texas

Music Offering	Level 1	Level 2	Level 3	Level 4
Band				
Band	Y	Y	Y	Y
Jazz Band	Y	Y	Y	Y
Instrumental Ensemble	Y	Y	Y	Y
Choir				
Choir	Y	Y	Y	Y
Vocal Ensemble	Y	Y	Y	Y
Orchestra				
Orchestra	Y	Y	Y	Y
Instrumental Ensemble	Y	Y	Y	Y

A way in which competency in the music TEKS is demonstrated annually is participation by choirs, bands and orchestras in University Interscholastic League (UIL) music contests. These contests provide specific ways in which students may demonstrate mastery of TEKS concepts in an adjudicated format. In the 2009-10 school year, more than 500,00 students participated in UIL music contests (UIL, 2011). According to the UIL website, 849 marching bands, 3,208 concert bands, 1,152 orchestras, 2,750 choirs, 109,699 solo entries, and 16,846 ensemble entries competed in UIL contests during the 2009-2010 school year (UIL, 2011). Similarly, 35,882 students entered the all-state audition process in band, orchestra and choir (TMEA, 2011).

Music and Academic Achievement

The notion that studying one discipline (e.g., music) may improve another set of cognitive skills has been defined as transfer (Foregard et al., 2008) that may enhance cognitive functioning. As previously discussed, neurological changes have been documented for individuals with musical training. Similarly, the effect of music on emotion has been discussed (Kreutz et al., 2004; Sammler et al., 2007; Steinbis et al., 2006; Webster & Weir, 2005). The remainder of this review of literature contains critiques of dissertations, meta-analyses, and individual studies that have been conducted to demonstrate correlational relationships or imply causality for the positive effect of music study on academic achievement. Finally, the review will include those articles in which the benefits of music participation are acknowledged, but for reasons other than academic achievement.

Studies Published in Academic Journals

A keyword search for music and academic achievement yielded results that included quantitative studies and literature reviews. The majority of the searches (14 of 22 articles) indicated the positive relationships between music and academic achievement. In other articles, authors (e.g., Cox & Stephens, 2006; McKelvie & Low, 2002; Pietschnig, Voracek, & Formann, 2010) chose not to endorse claims that music instruction or listening can have positive academic benefits. Several authors (e.g., Graziano, Peterson, & Shaw, 1999; Kinney, 2008; Schellenberg, 2004; Schneider & Klotz, 2000) ascribed positive benefits to students that came from music participation, but acknowledged that other factors such as motivation, SES, and family background may have confounded their study results.

Music and Academic Achievement Dissertations

Several keyword searches were conducted to find dissertations written about music and academic achievement. Using Academic Search Complete, eight dissertations, which had been written since 2006, were located. Of these eight dissertations, four were specifically targeted studies about the relationship of middle school music students with academic achievement.

Middle School Music Students and Academic Achievement

Huber (2009) examined relationships between instrumental music instruction and reading achievements. Although her literature review was scant, she was highly critical of Howard Gardner's (2006) multiple intelligence theory. Huber's study was weakened by a small ($n = 267$) sample size. The result of her study did show a "positive but weak relationship between the study of music and reading development among middle school students" (p. 79). This finding was echoed in her acceptance and rejection of null hypotheses, as only four were rejected. Additionally, no mention of statistical adjustments (e.g., Bonferroni) was made, although multiple instances of data analyses were described. Thus, the statistical significance of her results might be questionable.

Helmrich (2009) examined ways in which music instruction may have positively affected algebra achievement scores during a three year period in Maryland. She gave extensive review of brain functioning and neurology as associated with music and with mathematics. For her study, she utilized a sample size of 6,076 participants, which bolstered the credibility of her findings. Interestingly, she noted that students who received instrumental music instruction appeared to achieve at a higher academic level than students who received choral music instruction or no music instruction. However, Helmrich also demonstrated that students who received choral instruction achieved at a higher academic level than students who received no musical instruction. In her concluding chapters, she gave attention the cognitive, neurological, and developmental benefits that may be gained for adolescents who receive formal musical instruction.

Similar to Huber (2009), Deere (2010) analyzed the relationship of musical participation to academic achievement in middle school students. Deere (2010) utilized two quantitative data gathering methods in her study; namely, surveys completed by 215 adults in two school districts, and a comparison of 271 students' test scores between 4th grade music and non-music students and 8th grade music and non-music students. In her study, Deere, replicating a 2006 study by Linan, surveyed teachers, administrators and principals in two school districts in western Tennessee. Results from 215 respondents indicated "93.9% of School System A and 90.6% of School System B agree or strongly agree that music education does influence the learning environment" (Deere, 2010, p. 77). In the second part of her study, Deere examined differences in reading and mathematics scores on the Tennessee Comprehensive Assessment Program test (TCAP). Although statistically significant differences were shown for the 4th grade students (music students scored higher on the TCAP reading and mathematics tests), the results were not similar for 8th grade students. On the TCAP reading tests, music students scored higher than their non-music counterparts, but did not score statistically significantly higher on mathematics tests. The results for 8th grade students appear to contrast to the results of Helmrich (2009), who revealed that students who had received three years of musical instruction exhibited higher mathematical achievement on Maryland standardized testing than students who received less musical instruction.

Kurt (2010) demonstrated positive associations between instrumental study and literacy achievement as defined by the Iowa Test of Basic Skills, and the Reading Measures of Academic Progress developed by the Northwest Evaluation Association. Utilizing a pairwise comparison design, Kurt compared high SES versus low SES students. Additionally, he compared students who had received instrumental instruction for a short time, versus those students who had received instrumental instruction for a long time. However, his use of a small sample size ($n = 38$), and no mention of statistical adjustments he used for repeated measures of testing, made his conclusions statistically questionable.

In sum, four dissertations regarding middle school music students and academic achievement were examined. Due to methodological weaknesses that were present in two of the four dissertations, two dissertations (Deere, 2010; Helmrich, 2009) provided useable information regarding the positive association of music instruction and academic achievement in middle school.

High School Music Students and Academic Achievement

Dissertations in which the relationship of studying music in high school and academic benefits associated with studying music were located in Academic Search Complete and ERIC. The three dissertations were published in a period of five years from 2006 to 2011. Of the three extant dissertations, one (Allen, 2006) was a qualitative study, and two (Davenport, 2010; Tanner, 2006) were quantitative.

Allen (2006) surveyed 187 high school students, as well as 18 counselors about the perceived academic benefits of fine arts instruction. He also analyzed data from standardized tests (i.e., SAT, ACT, and TAKS) to determine whether music students outperformed non-music students. The qualitative inquiry yielded strong indications that students in the arts, as well as high school counselors who participated in the surveys, perceived that the arts had a positive effect on academic achievement. Data from the standardized tests indicated that, for the sample ($n = 187$) examined, students in the arts outperformed their campus averages and state averages. Although Allen's sample size may not allow for generalization, his results did concur with Davenport (2010), who compared English and

mathematics scores of students enrolled in instrumental music programs versus students not enrolled instrumental music programs in Maryland.

Davenport (2010) compared two groups of 90 students each; students enrolled in instrumental music programs versus students not enrolled instrumental music programs. His quantitative study participants were drawn from a sample population of over 121,000 students (Davenport, 2010). He divided the sample evenly between students who were not enrolled in music and students who were enrolled in music. A unique feature of Davenport's (2010) study was that he compared both middle school students and high school students. Within each comparison group (i.e., middle school and high school), standardized English and mathematics test scores from Maryland School Assessments (MSA) were examined. Davenport concluded that music enrollment had no statistically significant effect for middle school students. However, high school instrumental music students outperformed non-instrumental music students on the MSA English and Mathematics tests (Davenport, 2010). Davenport's conclusions provided a general sense of the influence high school instrumental music instruction may have had on academic achievement, as defined by standardized testing. However, he chose not to analyze the potential mediating effect of gender, ethnicity, or SES on his research findings. Further, his results are in contrast to Deere (2010) and Helmrich (2009), who each concluded that instrumental instruction contributed to academic achievement in middle school students.

Similar to Allen's (2006) research, Tanner (2006) explored how high school music enrollment may have contributed to academic achievement on the 2006 administration of the TAKS test. Tanner, however, chose to focus his research on a sample of 4,570 students in a large (63,000 students) school district on the border of Texas and Mexico. Tanner's results revealed that grade 10 students enrolled in music (i.e., band, choir, or orchestra) did outperform their non-music counterparts on the TAKS English and TAKS Mathematics test (Tanner, 2006). According to the data examined, Tanner concluded that music enrollment produced a small effect size ($d = 0.06$) when gender and ethnicity were considered (Tanner, 2006). Potentially, the large percentage of minority students (87%) and of economically disadvantaged (70%) in the sample of 4,570 students may have contributed to Tanner's finding that SES and ethnicity were not statistically significant factors in academic achievement. However, Tanner did posit that gender was a statistically significant factor, in the academic achievement of music students who outperformed non-music students on TAKS English and Mathematics tests. Specifically, "Female students who participated in a music program outscored all other groups" (Tanner, 2006, p. 57). Gender, although statistically significant, had a small ($d = 0.05$) effect size, according to Cohen's (1988) criteria. Another interesting result of Tanner's study was that music students, on average, passed both TAKS English and Mathematics tests, whereas non-music students, on average did not pass the TAKS Mathematics tests (Tanner, 2006).

Similarities existed in the three dissertations written about academic achievement differences for high school music versus non-music students. Each author (Allen, 2006; Davenport, 2010; Tanner, 2006) concluded that students enrolled in high school music classes outperformed their colleagues who were not enrolled in music classes. Although Tanner (2006) was the only author to include effect sizes in his presentation of findings, each author considered a different sample size, with similar conclusions. Tanner's sample ($n = 4,570$) was sufficiently large to have statistical power (Faul et al., 2007). Allen's sample ($n = 187$) and Davenport's sample ($n = 180$) were both considerably smaller. However, Allen (2006) and Davenport (2010) each employed criterion and purposive sampling in different ways. Allen began his mixed method study with a survey and focus groups, and followed the survey results with quantitative analysis of the academic achievement of the students in his sample versus campus and state averages. Davenport utilized stratified random sampling to create two comparison groups for middle school students and high school students. Although each author employed different research methods and sampling strategies, in all three studies, academic achievement was compared for music students versus non-music students, as measured by standardized testing. Specifically, Allen (2006) and Tanner (2006) examined TAKS data; Davenport (2010) examined MSA data. All three researchers indicated, although utilizing vastly different samples, that students enrolled in music outperformed their non-music counterparts on standardized tests. In addition to dissertations written about the potential of music instruction to positively affect academic achievement, journal articles were located through use of Academic Search Complete and ERIC.

Meta-Analyses of Music's Effect on Academic Achievement

Searching for meta-analyses that reviewed studies of the potential for music to impact academic achievement yielded five results. The meta-analyses were conducted from 2000-2008. A comparison of the meta-analyses is presented in Table 2. Of the five studies, two were by the same author (Hetland, 2000a, 2000b). In her first analysis, Hetland (2000a) reviewed studies that had been conducted whose participants were children ages 3-15. Specifically, she examined studies in which music instruction preceded spatial-temporal tasks, such as object assembly. In her second analysis, Hetland (2000b) compared studies in which listening to music prior to spatial-temporal tasks enhanced the participants' success on spatial-temporal tasks. She concluded that modest effects were present which indicated that spatial-temporal task performance increased after participants listened to music (Hetland, 2000b).

Butzlaff (2000) compared 30 studies about the effect of music on academic achievement. Participants whose data he examined were primarily high-school students who had taken the SAT (10 studies), and the remaining participants ranged from kindergarten to 12th grade (Butzlaff, 2000). He concluded that, of the 24 correlational studies he examined, all showed strong correlations between academic success in reading achievement and music instruction. However, he also posited that the six experimental studies he examined showed little or no evidence of causality (Butzlaff, 2000). Much of the data examined by Butzlaff came from College Board SAT information. Vaughn (2000) analyzed the relationship of mathematics achievement to musical instruction in high school students. Similar to Butzlaff (2000), Vaughn examined 10 years of SAT data. Her conclusion was that there existed “a modest positive association between the voluntary study of music, on the one hand, and mathematical achievement, on the other hand” (2000, p. 154).

A compendium, commissioned by the Arts Education Partnership, titled *Critical Links*, (2002) compiled 15 studies, including meta-analyses (Butzlaff, 2000; Hetland, 2000a, 2000b; Vaughn, 2000), as well as 11 other studies, and one additional meta-analysis by Standley (1996) about the effect of music to achieve therapy objectives. Deasy cited the previously mentioned meta-analyses by Hetland (2000a, 2000b), as well as Butzlaff (2000) in support of the concept of transfer. Deasy also included two studies (i.e. Bilhartz, Bruhn, & Olson, 2000; Costa-Giomi, 1999) that investigated links between private piano instruction and cognitive development. Although none of the results from studies in the music section of *Critical Links* allowed readers to imply causation, correlation between music and improved academic functioning was present.

In 2008, Standley conducted a meta-analysis of 30 studies that investigated the relationship of music instruction to developing reading skills. Her analysis involved studies whose participants ranged from pre-Kindergarten to 8th grade. Although the sample sizes were relatively small (average $n = 64.7$), Standley did note an overall effect size of Cohen’s $d = 0.32$ (2008, p. 22). Standley observed that music instruction appeared to have a greater effect on reading skills than she observed in studies about other reading strategies. A comparison of the five meta-analyses is presented in Table 2.

Table 2

Meta-Analyses of Music and Academic Achievement

Author	Year	Studies	Mean Effect Size	Participant Ages
Butzlaff	2000	30	$r = .10$	9-12 grade
Hetland	2000	15	$r = .21$	PreK-9
Hetland	2000	26	$r = .23$	PreK-9th
Standley	2008	20	$d = 0.32$	PreK-8th
Vaughn	2000	30	$r = .23$	9-12 grade

In his concluding essay following the music section of the compendium *Critical Links*, Scripp (2002) suggested that, “music functions as a catalyst for cognitive skills and aspects of social-emotional development across disciplines especially when conditions for transfer are optimized through teaching to principles and processes that engage and deepen learning across disciplines” (p. 132).

Considering the aforementioned meta-analyses, two trends emerged: the methods of researchers and participant characteristics. Specifically, younger students were often studied in interdisciplinary settings. Although studies were conducted in which children were assigned to control groups and condition groups, as in experimental design research, the majority of the studies were correlational or causal-comparative in design. In studies that involved older students, researchers relied heavily on self-reported data, such as SAT demographic data. The correlation was often asserted that academic functioning was improved by music instruction, or even simply by listening to music. However, given the complex nature of any educational setting, readers are cautioned about implied causality from these meta-analyses. The quest to ascribe improved academic functioning to music participation has also been explored in journal articles.

Academic Achievement and Music Participation

Several studies (i.e., Fitzpatrick, 2006; Gouzouasis et al., 2007; Miksza, 2007; Southgate & Roscigno, 2009) were

examined in which the academic achievement of a large sample of students who studied music was compared to students who did not study music. Fitzpatrick (2006) examined Ohio standardized test scores, and concluded that students who studied instrumental music in grades 9 through 12 outscored their cohorts who did not study instrumental music. In the sample of over 15,000 students, Fitzpatrick noted that, for the 2003-04 school year, students who studied instrumental music outscored their non-music counterparts on all tests. Specifically, Fitzpatrick observed that students who studied instrumental music “outperformed non-instrumental students of like socioeconomic status in every subject and at every grade level” (p. 77).

Although Fitzpatrick’s study was limited to one school district in Ohio, other researchers (i.e., Gouzouasis et al., 2007; Miksza, 2007; Southgate & Roscigno, 2009) have compared, at the national level, test score differences for students who studied music versus those students who did not study music. In each of these studies, researchers noted positive associations between music enrollment and academic achievement. Moreover, each of these studies yielded similar results, namely, that students enrolled in choir, band, or orchestra outscored their non-music counterparts on various measures of academic achievement. A summary of these studies is presented in Table 3.

Table 3

Large Scale Studies of Test Scores for Music Students Versus Non-Music Students

Year	Author	Location	n	Data Source	Major Finding
2007	Gouzouasis et al.	Canada	61,431 ^a	British Columbia Standardized test	Music students in grades 11 and 12 outscored non-music students in math and English
2007	Miksza	United States	5,335	NELS:88	Music students’ scores were consistently higher than non-music students
2009	Southgate & Roscigno	United States	7,781 4,736	NELS:88, ECLS:K	For both ages, music students achieved at higher levels in English, math

^a This figure is a 3 year average

Additional Benefits of Music

Many researchers have espoused the correlations between music participation and academic achievement. However, the role of music has been examined in ways other than as a means to improve academic achievement. The topics explored by these authors included music in life, motivation, and engagement.

Importance of Music in Life and School

Music was examined in light of its importance in the life of adolescents (Campbell et al., 2007). Music was viewed as an integral part of the life of adolescents. Specifically, overwhelming support was expressed for music as a necessary component of adolescent life, with support for and comments to probe concerning the work of music educators (Campbell et al., 2007).

The role of music in high school life was explored by Abril and Gault (2008) as they surveyed 541 principals from various areas of the United States. Their results indicated that principals, while not viewing improved academic function as a result of music participation, did acknowledge the importance of music in schools. Abril and Gault (2007) noted that aspects of music the principals most valued were,

broad educational outcomes that were thought to be most effectively met through participation in music included cooperation/teamwork and self-esteem. Cooperation is a skill necessary for ensembles to be successful in performance, and self-esteem is likely to be observed through the students’ various performances throughout a school year. (p. 65)

Motivation and Engagement

Academic achievement has been associated with engagement and motivation (Walker & Greene, 2009). Specifically, student membership in a school group has been associated with engagement and motivation. Schmidt (2005) surveyed 300 band students in grades 7-12, and concluded that motivation and inclusion in a group was a key factor in their academic success. Similarly, Walker and Greene (2009) queried 249 high school students to ascertain

factors involved in academic success. Although the focus of their study was not specifically music participation, they examined academic motivation in the high school setting. Based on the responses of their participants, Walker and Greene reported, "high school students who report a sense of belonging are more likely to focus on the development of understanding and then use cognitive effort to make that understanding possible" (2009, p. 469). This study has applicability to the notion that being in a musical group (i.e., band, choir, or orchestra) may serve as a motivational force for those students. Schmidt (2005) posited that participants in his study expressed their belief that being in a group positively affected their work outcomes. Eady and Wilson (2004) expressed similar thoughts about the interdisciplinary aspects of music and the benefits of integrating music across various areas of curriculum.

In a related manner, Črnčec et al. (2006) explored the "potential cognitive and academic benefits of music to children" (p. 579). A thorough review of literature (107 references) was provided as the authors explored the potential effect of music listening on tasks, music instruction on academic achievement, and effect of music on cognitive arousal (Črnčec et al., 2006). They concluded that, "the narrow focus on children's cognitive development inherent in the literature serves to exclude other important domains, including socio-emotional and physical development" (2006, p. 589). The focus of this review is on the extant literature written to address the relationship of music instruction and academic achievement.

Summary

In sum, studies have been conducted in which music enrollment appeared to be positively correlated to academic achievement (i.e., Catterall, 1998; Fitzpatrick, 2006; Gouzouasis et al., 2007; Miksza, 2007; Southgate & Roscigno, 2009). However, each of the authors cautioned that other factors (e.g., SES, race, and gender) may have influenced their results. Considering the literature in this review, gaps have become evident. Several studies involved younger children (e.g., Bahr & Christensen, 2000; Deere, 2010; Helmrich, 2009; Huber, 2009; Johnson & Memmott, 2006; Kinney, 2008; Kurt, 2010; McKelvie & Low, 2002; Rauscher & Shaw, 1998; Schellenberg, 2004), but few researchers (e.g., Allen, 2006; Cox & Stephens, 2006; Fitzpatrick, 2006; Gouzouasis et al., 2007; Schneider & Klotz, 2000;) specifically considered high school students. Researchers have utilized standardized test scores from large sample in Canada (Gouzouasis et al., 2007). However, no other studies of this magnitude, in which scores on state standardized tests were examined, have been conducted in the United States. Several studies have been conducted in the United States in which researchers utilized small sample sizes (e.g., Davenport, 2010; Deere, 2010; Kurt, 2010). Davenport (2010) considered a stratified sample of 180 students from a population of over 121,000 students (p. 47). Tanner (2006) examined 17,904 10th grade student scores from one school district of over 63,000 students. Kurt (2010) utilized a small sample size ($n = 38$), as did Deere ($n = 271$). As the No Child Left Behind Act has mandated Annual Yearly Progress on state standardized tests, research has been scant in which the academic achievement of music students has been compared to the academic achievement of non-music students and utilized state standardized testing as a measure of academic achievement.

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