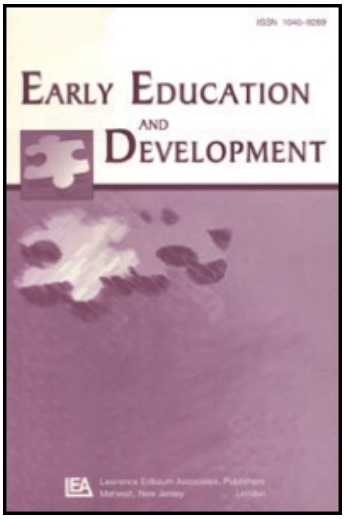

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Singing One's Way to Self-Regulation: The Role of Early Music and Movement Curricula and Private Speech

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Singing One's Way to Self-Regulation: The Role of Early Music and Movement Curricula and Private Speech

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Research Findings: Although the role of language and private speech in the development of behavioral self-regulation has been studied, relations between behavioral self-regulation and children's experiences with other symbolic systems, such as music, have not yet been explored. Eighty-nine 3- and 4-year-old children (42 of whom had been enrolled in Kindermusik music and movement classes, and 47 demographically similar children who had not experienced structured early childhood music classes) completed a battery of laboratory self-regulation tasks and a selective attention task during which their private speech was reliably transcribed and categorized. Children currently enrolled in Kindermusik classes showed better self-regulation than those who were not currently enrolled ($d = .41$), and they also used more relevant private speech during the selective attention task ($d = .57$), a verbal strategy that was positively related to performance. Children exposed to the music program were also more likely to engage in the facilitative strategy of singing/humming to themselves during a waiting period in which they had to inhibit their desire to examine a gift, and they were less likely to call out socially to the experimenter, a strategy negatively associated with performance and self-regulation. *Practice or Policy*: Implications for early childhood education are discussed.

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Behavioral self-regulation, a child's ability to plan, monitor, and guide his or her own goal-directed behavior in accordance with social and contextual norms, is one of the most important developmental outcomes of the preschool period (Blair, 2002; Bronson, 2000; Diaz, Neal, & Amaya-Williams, 1990; Kopp, 1982; McClelland, Cameron, Wanless, & Murray, 2007). Whether defined as delay of gratification (Mischel, Shoda, & Rodriguez, 1989), inhibitory or effortful control (Kochanska, Murray, & Harlan, 2000; Kochanska, Murray, Jacques, Koenig, & Vandegeest, 1996), or self-regulation (Kochanska, Coy, & Murray, 2001; Winsler, Fernyhough, & Montero, 2009), children's "executive" ability to organize, sustain, and guide their behavior during learning and problem-solving activities is not only critical for children's successful transition to school (Bodrova & Leong, 2006) but also important for children's long-term success in school and beyond (Baumeister & Vohs, 2004).

Longitudinal research examining children's self-regulatory skills during the preschool years and their success during elementary school supports what kindergarten teachers have been reporting for some time (Rimm-Kaufman, Pianta, & Cox, 2000), namely, that children's self-regulatory skills are critical for success in early school (Eisenberg, Smith, Sadovsky, & Spinrad, 2004; Kochanska, Murray, & Harlan, 2000; McClelland, Acock, & Morrison, 2006; Mischel, Shoda, & Peake, 1988). Youngsters who display age-appropriate self-regulatory skills tend to perform better in school, display fewer behavioral problems, and become more socially competent than children who have early difficulties with behavior regulation (Bronson, 2000). For example, Mischel et al. (1988) demonstrated that the number of seconds preschoolers were able to wait for a preferred but delayed outcome predicted their subsequent educational performance, social competence, and ability to cope with stress and frustration through adolescence. Conversely, difficulties with self-regulation are fairly stable and are indicative of future social and academic problems in elementary school and adolescence (Lengua, 2003; Olson & Hoza, 1993; Winsler, Diaz, Atencio, McCarthy, & Adams Chabay, 2000).

Contemporary scholars (Bodrova & Leong, 2006; Bronson, 2000; Diaz et al., 1990; Grolnick & Farkas, 2002; Kochanska et al., 2001; Kopp, 1982; Winsler, Diaz, & Montero, 1997) and classic theorists (Vygotsky, 1962, 1930–1935/1978) view parents and teachers as playing important roles in the socialization of children's self-regulation. From Vygotsky's perspective, self-regulation, as a uniquely human, higher order form of behavioral organization, gradually emerges from "other"-regulation provided by caregivers. Children's behavior is first primarily regulated through parental (i.e., external) control, initially through physical and then through verbal means. In time, children internalize parental rules and social demands, and they

gradually gain the ability to regulate their own behavior in the absence of caregivers (Kopp, 1982). A primary mechanism by which self-regulation emerges from social interaction, according to Vygotskian theory, is the internalization or appropriation of cultural tools or symbolic systems (i.e., language, literacy, mathematics, music, art, dance, logic) used during joint interactions with others (Vygotsky, 1930–1935/1978; Vygotsky & Luria, 1930/1993; Wertsch, 1985).

Language is the cultural tool that has been studied in most detail with regard to its role in self-regulation. Luria was one of the first to propose that language plays a pivotal role in the regulation of behavior. Luria (1928) referred to speech as a "functional barrier" between the child and environmental stimuli that serves to delay, inhibit, reorganize, and guide motor responses (Vocate, 1987). At first, it is the speech of caregivers that regulates children's behavior. Then children begin to talk to themselves in self-regulatory ways via overt private speech during the preschool years (Diaz & Berk, 1992; Vygotsky, 1930–1935/1978; Winsler et al., 2009). Eventually, overt private speech declines and is replaced with partially internalized speech (muttering, whispering) and then fully internalized speech (silent inner speech or inner verbal thinking; Winsler, De León, Wallace, Carlton, & Willson-Quayle, 2003; Winsler et al., 2009). Much research has been conducted demonstrating the important role of private speech in the development of children's self-regulation and executive functioning (Winsler, 2009).

Language is not the only sociocultural symbolic system of potential relevance to the emergence and maintenance of behavioral self-regulation, however. Music and movement/dance, as cultural systems, may also play a role. Music and movement activities have long been popular, predominant, and cross-culturally universal in the play and early educational and socialization experiences of young children (Chen-Hafteck, 1997; Mark, 2002; Mithen, 2005). However, the role of these activities in the development of self-regulation has not typically been a topic of research. The current study investigated the hypothesis that structured experience using cultural tools other than language (i.e., music and dance/movement) may be related to the development of self-regulation in young children.

It is clear, and early childhood music educators and advocates of arts education point out, that music is a source of much joy and interest for young children. Providing musical experiences and music education to young children is of intrinsic value both to the children themselves in terms of their own musical development but also to society as a whole. Engaging in musical activities transmits important cultural resources to the next generation (Bachmann, 1991; Chen-Hafteck, 1997; Cole & Nash, 2000). For this reason, music is seen by many as a central part of developmentally appropriate practice in early childhood education (Kenney, 1997). Thus,

numerous researchers and educators have explored potential positive effects that musical experiences may have on other domains of child development.

The effects of passive exposure to music (e.g., simply listening to music, the so-called Mozart effect) are minor and limited to a slight and temporary increase in positive mood and optimal arousal, which happen to help somewhat with college students' performance on some spatial tasks (Husain, Thompson, & Schellenberg; 2002; Thompson, Schellenberg, & Husain, 2001). However, the positive effects of active participation in various forms of structured musical training are more pronounced (Schellenberg, 2006a). Research has shown that musical training, in the form of months or years of music lessons, for example, is linked with enhanced abilities in a variety of domains, including verbal memory (Ho, Cheung, & Chan, 2003); learning (Gardiner, Fox, Knowles, & Jeffrey, 1996); motor coordination, abstract thinking, and improvisation (Kalmar, 1982); spatial skills (Hetland, 2000; Rauscher et al., 1997); reading and phonological processing (Anvari, Trainor, Woodside, & Levy, 2002; Hurwitz, Wolff, Bortnick, & Kokas, 1975); selective attention (Hurwitz et al., 1975); math (Cheek & Smith, 1999); and even general intelligence (Costa-Giomi, 1999; Schellenberg, 2004, 2006b). Several of these investigations used well-controlled experimental designs involving the random assignment of children to music and comparison groups (Gardiner et al., 1996; Rauscher et al., 1997; Schellenberg, 2004), thereby providing evidence of causal, rather than just correlational, links between structured musical experiences and enhanced cognitive outcomes.

Indeed, the fact that researchers have found so many diverse domains of functioning to be enhanced by musical training has recently led to theorizing about the underlying neurological systems and processes that might be mechanisms responsible for such wide-reaching effects. Several researchers posit executive (self-regulatory) functions (mediated through language and symbol systems) as the central process that is strengthened by musical training (Bialystok & DePape, 2009; Hannon & Trainor, 2007; Schellenberg & Peretz, 2007). Bialystok and DePape showed that compared to monolinguals, well-trained monolingual musicians enjoy the same enhanced executive functioning skills that bilingual individuals have. Music has long been understood to be intimately linked with language skills/processing (Chen-Hafteck, 1997), but now the neurological substrates supporting the link between language and music are becoming apparent (Fujioka, Ross, Kakigi, Pantev, & Trainor, 2006; Jentschke, Koelsch, & Friederici, 2005; Moreno & Besson, 2006; Peretz & Zatorre, 2005; Shahin, Roberts, & Trainor, 2004; Wong, Skoe, Russo, Dees, & Kraus, 2007). Thus, researchers from very different backgrounds and traditions have been converging on potential links between music and children's behavioral self-regulation.

It is important to note, however, that most of the research on the nonmusical effects of musical training discussed earlier has been conducted with older children or adults and has focused on instrumental musical training in the form of private lessons. Another prominent form of active participation in music (and one that is distinct from taking private lessons on an instrument) that has yet to be studied, and one that is particularly relevant and common for young children, is participation in general music and movement programs and/or curricula. In addition to being a common feature of developmentally appropriate curricula in preschools (Kenney, 1997), structured music and movement programs for infants, toddlers, and preschoolers (such as Kindermusik, Musikgarten, and Music Together) are also frequently available and quite popular in the community as free-standing classes in which parents and children enroll. To date, no research has been conducted on the potential benefits of these programs that expose children to music during the early childhood years, a period critical for the development of self-regulation (Bronson, 2000). However, a few studies have examined other similar music and movement curricula or interventions with young children.

A scientifically rigorous demonstration of the positive benefits of movement and music on children's behavior comes from a study by Lobo and Winsler (2006). These investigators randomly assigned Head Start preschoolers to a dance (and music) intervention and an attention control group of children who received equivalent amounts of time with the interventionist in a separate room but only doing free play as usual. Teachers and parents, who were blind to the group to which children were assigned, independently rated children's social and behavioral competence before and after the 12-week intervention. Children in the creative dance and music program had significantly greater gains in social competence and larger improvements in behavior compared to those in the control group. Although the focus of the study was dance, the authors note that because music was used throughout the dance and movement activities, music may have played a role in the gains observed in children's behavior.

Another well-designed study was that of Zachopoulou, Tsapakidou, and Derri (2004), who randomly selected two classrooms of 4- and 5-year-olds from a large preschool center in Greece to participate in a music and movement program for 2 months ($n = 50$) and two other similar classrooms from the same center to participate in a standard physical education program that did not involve music ($n = 40$). These investigators were interested specifically in motor development and children's dynamic coordination and control over their motor behavior, and they cited the work of Carl Orff, whose long tradition in music education views music, movement, and verbal speech as all intimately interrelated and woven together through the common

element of rhythm (Cole & Nash, 2000; Keetman, 1974). These investigators found that only the music and movement program had a significant positive effect on children's motor skills and dynamic balance. This study replicated others that have explored the positive role of music and movement programs in fostering rhythmic and motor performance (Brown, Sherrill, & Gench, 1981; Painter, 1966; Weikart, Schweinhart, & Larner, 1987).

In addition to facilitating rhythmic and motor control, another way musical experience may have a positive effect on children' self-regulation is by aiding in emotion recognition, an important component of children's emotion regulation (Southam-Gerow & Kendall, 2002). Systematic exposure to different types of modes (i.e., major, minor, ''happy'' vs. ''sad'' sounding music) and different tempos in music has been found to facilitate not only children's ability to recognize such emotional expressions in music but also similar constructs in adults (Juslin & Laukka, 2003; Schellenberg, Peretz, & Vieillard, 2008). Finally, the literature on music therapy demonstrates ways of involving music in interventions to initiate, sustain, increase, or eliminate various behaviors in children with disabilities or disorders (Aldridge, Gustorff, & Neugebauer, 1995; Edgerton, 1994; Gold, Voracek, & Wigram, 2004; Hoskins, 1988; Humpal, 1991; Standley & Hughes, 1997). This is another source of evidence that music can have positive effects on children's self-regulation.

As an initial, exploratory, and correlational inquiry into this new area of research, the present study examined whether young children who have experience with an early childhood music and movement program commercially available in the community, namely, Kindermusik, differ from children who have not had these musical experiences on behavioral self-regulation and use of private speech for self-regulatory purposes during inhibitory control tasks. Kindermusik, the oldest of the publicly available early childhood music and movement programs, engages young children (newborn to age 7) in developmentally appropriate weekly music and movement classes. The classes are typically conducted in a small group (4–12 children per class with one teacher) and generally run 14 to 16 weeks. In these classes, children (and for those younger than age 3, parents together with the children) are led by a trained music educator in a series of activities that involve singing, moving, dancing, and playing instruments together (typically percussion, but also glockenspiels, recorders, and dulcimers). One relevant and particularly large part of the curriculum each week, especially for those in the 3–5 age group, involves songs that require children to guide and modulate their motor behavior through the music, rhythm, tempo, and style of the music (i.e., games involving stop/go, high/low, fast/slow, loud/soft, long/short). Stop-and-go tasks are featured prominently in measurements of children's executive and inhibitory control over behavior (Logan,

1994; Oosterlaan, Logan, & Sergeant, 1998). Also, students in these early childhood music classes acquire experience in inhibitory control by restraining themselves from playing when it is someone else's turn and by playing or marching along to the music when it is their turn. Another interesting aspect of the curriculum from a self-regulatory perspective is that typically each day, the teacher/group sings a clean-up song (i.e., *Bells Away* or *Sticks Away*) at the close of one activity when it is time to put the materials away and transition to the next activity. Indeed, the use of music/song to help children clean up or do other activities for which there is limited intrinsic interest (such as hand washing and teeth brushing) is common in homes, preschool classrooms, and the media (e.g., the clean-up song from the TV show *Barney*). Such songs are perceived to be useful for those who work with children, and they are another example of using music to regulate children's behavior (Kramer, 1980).

The central question asked in this study was whether extensive experience using music for self-regulation in the context of these music classes is related to children's self-regulatory skills as measured objectively in the laboratory and/or to their use of self-regulatory language in the form of private speech. We hypothesized that if, as suggested by Vygotskian theory and the private speech literature reviewed earlier, experience using the cultural tools of speech and music to guide behavior exercises children's self-regulatory system, and if children in Kindermusik classes get more of this experience with a second and new medium (music), then children exposed to such music classes would be better at behavioral self-regulation. Also of interest was whether a dosage effect would be observed, with children who had more structured musical experience displaying better self-regulation than those with less experience. Furthermore, to get at potential recency or fade-out effects, we also examined whether current participation in such classes mattered by comparing those currently enrolled and those not currently enrolled. Finally, we asked whether children's private speech during problem solving would be enhanced among those with musical experience.

METHOD

Participants

Eighty-nine children (53% female) between 36 and 64 months of age ($M = 48.11$ months, $SD = 7.4$) and their parents from a large mid-Atlantic urban/suburban metropolitan area participated in this study. Most of the children (80%) were Caucasian according to parental report, with African

American (3%), Asian American (3%), Latino/Hispanic (2%), and other/mixed-race children (12%) represented as well. Because the presence of two parents/guardians in the home was a criterion for participation in another concurrent study[1] with the same sample, most children (97%) came from two-parent families. Parents, on average, were in their mid-30s (mother age, $M = 36.6$ years, $SD = 4.3$; father age, $M = 38.4$ years, $SD = 5.1$), were generally reasonably educated (average was a college degree with some graduate/professional school), and were in the middle to upper-middle class (average income around $90,000, the median for the county).

Children were recruited in a number of ways, including (a) letters sent home to families that had appropriately aged (3–5) children enrolled in various participating preschools and Little Hands, Inc., a large Kindermusik-based music and movement education program for preschool children in the community; (b) flyers placed or posted on campuses and community health and women's centers; and (c) e-mails to families that had previously indicated interest in being contacted for participation in studies at the university. During a preliminary phone call, before scheduling the 1-hr visit to campus, parents were asked whether their child had any disabilities involving language, hearing, or motor skills. Only one child, who had autism, was excluded. There were no demographic or performance differences between the children recruited from the three different methods.

As part of the demographic questionnaire, parents indicated their history of child enrollment in Kindermusik classes specifically and in a variety of other music, dance, and fine arts programs available in the community (MusicTogether, Musikgarten, Gymboree, Wiggles & Giggles, music lessons/Suzuki, etc.). The salient names of the Kindermusik curricula were listed on the survey for parents to indicate whether and when they had taken those classes. A small number of parents reported difficulty remembering exactly when they had taken which classes, which prompted us to ask the participating organization, Little Hands, Inc., to look up in their records the child's registration history. Thus, we were able to verify (and decided to do so for each case for validation purposes) the number of months/courses/Kindermusik curricula in which the families had participated. From this, it was determined that 42 children (47%) had at least some experience attending Kindermusik classes, and 23 children (26%) were currently enrolled in Kindermusik at the time of the study. We were also able to

[1]This was a survey study having to do with marital relationship quality that only involved parents filling out additional questionnaires—participation in the concurrent study was unlikely to influence the results presented here.

calculate continuous measures of number of months or semesters that the child was enrolled in music classes.

It is important to note that analysis of variance (ANOVA) and chi-square analyses revealed that there were no differences on the family or child demographic variables (parent education, income, child ethnicity, gender, age) between those who had Kindermusik experience and those who did not. Furthermore, these background variables were not associated with length of time in Kindermusik. Finally, as part of the concurrent study, parents completed the Parenting Styles and Dimensions Questionnaire (Robinson, Mandleco, Frost Olsen, & Hart, 2001), which provided continuous subscales for authoritative ($k = 27$; $\alpha = .83$), authoritarian ($k = 20$; $\alpha = .83$), and permissive ($k = 15$; $\alpha = .70$) parenting. There were no differences between the music groups on parenting style.

Procedure

Overview. Parent and child arrived at the family data collection room on campus for a 1-hr visit, and they were greeted by two female graduate student experimenters (one interacted primarily with the child and one with the parent). After introductory activities during which rapport was built and parents gave consent, the child went into a large play room to be administered a battery of self-regulation tasks while the parent went into a nearby room. Here the parent completed surveys and viewed the child through a monitor. The entire session was videotaped. Each mother–child dyad was compensated for time/travel expenses with $25, and the children received a small gift for participating. After the self-regulation battery and a short snack break, children completed a selective attention task (SAT) to obtain a sample of their private speech.

Self-regulation task battery. A series of widely used, engaging, and developmentally appropriate inhibitory control tasks from the 33- and 45-month batteries of Kochanska and colleagues (1996, 2000) was administered to the children individually in fixed order as listed here. These tasks, which involve delay/waiting, slowing down motor activity, and initiating/suppressing one's activity to a signal, have been shown in previous work to be reliable and to be internally consistent and one-dimensional ($\alpha = .79$). Following the data reduction procedures of Kochanska and colleagues (1996, 2000), we standardized performance scores from each task and aggregated them into one overall self-regulation composite score, with higher numbers indicating greater self-regulatory skill. On one of the seven tasks that involved a waiting period while the child was alone (gift-in-bag), children's private speech was recorded.

Snack delay. Children were asked to wait for the experimenter to ring a bell before they could retrieve an M&M or other preferable snack (i.e., a goldfish or a raisin) from underneath a plastic cup that was placed in front of the child within reach on a small table. The experimenter showed the child the cup and snack and then covered the snack with the cup. The experimenter explained to the child that he or she was to wait until the experimenter rang the bell before retrieving the snack. The child was asked to keep his or her hands on the table until the bell rang. During two practice trials, if the child did not wait, the experimenter repeated the rules. Four trials were conducted (with randomly ordered delays of 10, 15, 20, and 30 s). The experimenter lifted the bell halfway through the time delay but did not ring it until the entire time had elapsed.

Performance on the snack delay was rated from the videotapes using a 5-point scale ranging from 0 to 4 (0 = eats M&M before bell is lifted, 1 = eats M&M before bell rings, 2 = touches bell or cup before bell is lifted, 3 = touches bell or cup after bell is lifted, 4 = waits for bell to ring before touching anything). An overall score was calculated by taking the mean across the four trials, with higher scores indicating better self-regulation. Interrater reliability was assessed by two independent coders who rated a random 20% sample of the videos. A significant interrater correlation ($r = .97$) was found when treating the value continuously, and the kappa, when coded as categorical with exact agreement, was .88.

Telephone poles. To measure older children's (41 + months) ability to slow down fine motor activity, children were shown a piece of paper with two telephone poles and squirrels drawn on them. Children were asked to draw the telephone wires between the poles for the squirrels to play on. A baseline trial, a fast-as-possible trial, and a slow-as-possible trial were conducted. The experimenter showed the child how to draw a line on a blank piece of paper before the baseline trial. For the fast trial, the child was instructed to draw a straight line as quickly as possible using a fast "bunny" pencil. For the slow trial, the child was to draw a straight line as slowly as possible using a "turtle" pencil. Performance was measured as the difference in milliseconds between the time it took on the fast and the slow trial. For accuracy, the duration of each trial was recorded three times from the videos and then averaged. Interrater reliability for the calculation of the duration between two independent coders was high ($r = .99$).

Turtle and rabbit. Younger children's (less than 41 months) ability to slow down their motor behavior was assessed with the turtle and rabbit task rather than the telephone pole task, which required facility holding a pencil. In this task, there is a drawing of a curvy path with a barn placed at the end.

The experimenter showed the child a little doll boy or girl (matched to the child's gender) and asked the child to help the little boy/girl get home to the barn. The child was instructed to start at the beginning of the path and to be sure to stay on the path. The experimenter modeled with the little boy/girl while saying, "Try not to step on the grass, stay on the path, and be careful not to fall in the river." The child did two trials with the little boy/girl. The experimenter then showed a toy rabbit and instructed the child to help the rabbit get home "as fast as possible" on the same trail without trampling on the grass or falling into the water. The child was instructed to conduct two trials with the rabbit. Finally, the experimenter showed a turtle to the child and instructed the child to help the turtle get home "as slowly as possible" with the same rules as above. Performance was defined similarly to the telephone poles task by having coders time each trial for duration in milliseconds. The average for each trial was calculated using three independent timing trials for each trial (i.e., two trials for little boy/girl, two trials for rabbit, two trials for turtle). The final score was calculated by subtracting the average of the two rabbit trials from the average of the two turtle trials, with a higher score indicating better self-regulation. Interrater reliability was established by two independent coders through correlations (rs = .92–.99).

Bear and Dragon. One puppet (Bear) asked the child to perform five different activities (e.g., stick out your tongue), and another puppet (Dragon) asked the child to perform other activities (e.g., touch your nose). Both puppets were held at the same level, moved only their mouths, and gave the commands quickly without changing voice. The experimenter instructed the child as follows: "I have a game we can play with these puppets. This is a nice bear. When he talks to us, we will do what he tells us to do. This dragon is mean. So when he talks to us, we're not going to listen to him. We don't do what he says." Following Kochanska and colleagues (1996, 2000) children's performance was coded using a 4-point scale ranging from 0 to 3. For Bear's (i.e., do) requests, children's responses were coded as 0 = no movement, 1 = wrong movement, 2 = partial movement, 3 = full correct movement. For Dragon's (i.e., don't) requests, children's responses were coded as 0 = full movement, 1 = wrong movement, 2 = partial movement, 3 = no movement. An average of the scores across the six trials was computed, with a score ranging from 0 to 3 corresponding to Bear's commands, and another score corresponding to Dragon's inhibition of movement. These scores were summed, with higher numbers indicating greater self-regulatory skills. Interrater reliability was established using Spearman's correlation and resulted in $r = .94$ for Bear and $r = .94$ for Dragon scores.

Lowering voice. The experimenter showed the child, in an excited manner, 12 cards depicting popular cartoon characters and asked the child to whisper the name of each character. The characters consisted of 12 relatively familiar characters (Elmo, Nemo, Ariel, Bambi, SpongeBob, Scooby Doo, Blue from *Blue's Clues*, Barney, Big Bird, Mickey Mouse, Winnie the Pooh, and Arthur) presented in random order. The experimenter first asked the child to whisper his or her name (all could whisper). The experimenter presented the first card and asked, "Can you whisper to me his/her name?" Children's responses were scored on a scale ranging from 0 to 3 (0 = shout; shout; 1 = loud or part loud, part whisper; 2 = no response; 3 = whisper). All codes for this task were summed and averaged across the 10 cards with greater numbers indicating greater skill. Interrater reliability was 94% agreement ($\kappa = .90$).

Walk-a-line. For this task, participants were instructed to walk across a "path" (a 2.5-in × 12-ft strip of floral fabric taped to the floor) a total of three times. The first trial established the child's baseline motor activity. For the next two trials, the child was instructed to pretend that he or she was the slowest person in the world and to walk very slowly and cautiously along the path without stepping over the sides. The duration (in milliseconds) of each trial was recorded live using a stopwatch (the location of the walking path was outside the range of the video camera). The final score was computed by calculating the average duration of the two slow trials, with higher scores (longer times) indicating greater self-regulatory skills.

Gift-in-bag (GIB) task. The experimenter brought a colorful paper bag containing a gift and said, "I have a present for you in this bag, but I want to wrap it for you so it will be a surprise. You have to help me. Can you sit in this chair and try not to look so that I can wrap your surprise for you?" The experimenter then wrapped the gift noisily for 60 s. If the child looked, the experimenter reminded the child not to peek. Once the gift was wrapped (after exactly 60 s), the experimenter informed the child that she had forgotten the bow in the other room. The child was told that he or she could turn around now but that he or she had to stay put and not peek into or touch the bag. The experimenter turned the child's chair so that the child was facing the table and the bag. The experimenter left the room for exactly 3 min. Upon returning, the experimenter attached the bow to the gift and gave it to the child, who was allowed to open the present.

Performance on this task involved a combination of latency scores for peeking or touching the gift as well as tabulations of the number and magnitude of behavioral infractions (peeks and touches). A "big peek" was coded when the child turned his head or his torso 90 degrees or more from

his initial position (i.e., the child's back was turned to the experimenter who was wrapping the gift). A "little peek" was coded when the child turned his head or torso less than 90 degrees from his initial position. Coders recorded the latency to both big and little peeks. The child's self-regulation while the adult was out of the room was rated on a 5-point scale ranging from 1 to 5 (1 = takes gift out of the bag, 2 = touches gift inside the bag, 3 = opens bag to peek, 4 = touches bag but does not peek, 5 = does not touch or peek). Interrater reliability was established by percent agreement for the presence of peeking strategies (90%), through correlations for latency to little and big peeks during wrapping (rs = .87 and 1.00, respectively) and latency to peek in the bag while the experimenter was gone (r = 1.00).

SAT. Finally, an additional executive functioning task that was not part of the self-regulation battery was given to the children to elicit/record private speech during problem solving (Manfra & Winsler, 2006). This task required the children to examine two pictures (attached to 4-in × 8-in cards) that shared a common feature (color or shape/form) and to determine what the two pictures had in common. Children were instructed to match/place a third picture/response card that indicated color or picture/form on each of the 12 item cards with Velcro. For example, one card showed a blue car and an orange car, and the child had to select and attach the uncolored answer card of a car (from a group of 20 cards). Another item had a red house and a red flower, with the correct answer being "red." After two practice rounds with experimenter demonstrations, the child did the remaining items alone while the experimenter completed paperwork in the back of the room. Attempts by the child to talk to the experimenter were ignored, and persistent attempts were met with the experimenter encouraging the child to continue his or her work independently (e.g., "You're doing well," "You know how to do it," "Please finish it up by yourself").

Private Speech Coding

SAT. Children's private speech during the SAT was transcribed from the videotapes by assistants blind to children's musical group status and the hypotheses of the study. Speech utterances were first coded as being either social or private speech. Speech was considered private unless one or more explicit markers of social intent were present, such as gaze to the experimenter during or immediately surrounding the utterance, use of a name or pronoun for the experimenter, an immediate conversational reply, or a touch (Winsler, Fernyhough, McClaren, & Way, 2005). Following procedures outlined by Winsler et al. (2005) and used before in previous research with this task (Winsler et al., 1997; Winsler Diaz et al., 2000), each

of the SAT items was coded for both performance (correct or incorrect) and the presence of different types of private speech. An item contained item-relevant private speech (yes/no) if the child mentioned the correct dimension required for the answer to that item (e.g., "blue" or "color") at any time while working on that item. Items were classified as containing item-irrelevant speech if private speech was used by the child during that item but the correct perceptual dimension or answer was never mentioned. Items were also coded for containing partially internalized speech that was either unintelligible, whispered too quietly to be understood, or inaudible muttering. If the child produced no speech at all while working on an item, the item was coded as containing silence.

Thus, six different types of speech–performance relations were possible for each item: (a) silence/fail, (b) irrelevant private speech/fail, (c) relevant private speech/fail, (d) silence/success, (e) irrelevant private speech/success, and (f) relevant private speech/success. The total number of items that contained each of the types of speech, and the total number of items completed correctly, were calculated and used in the analyses. Also, the probability of getting an item correct given that it contained either relevant speech, irrelevant speech, partially internalized speech, or silence was calculated for each child. Reliability across two coders for the distinction between private and social speech on a subsample of 20 transcripts was 92%, with a kappa of .84. Reliability for the item/speech type coding was 90.6% ($\kappa = .80$).

GIB task. Speech produced by the child during the experimenter-absent "waiting" part of the GIB task was transcribed from the videotapes and coded by a naïve but trained student assistant. Following Winsler et al. (2005), the unit of analysis here was the *utterance*, defined as a string of words spoken together as a clause with intentional markers of termination, a complete or incomplete sentence, a conversational turn, or any string of speech separated from another by at least 2 s. If there was a semantic discontinuity (a notable change in the content of speech or a new thought) in a rapid, continuous string of words with no pause (i.e., "Where is . . .—Here it is!"), it was coded as two utterances.

Speech utterances were categorized into the following six categories based on the content of the speech: (1) Speech about the rules and task: any words/phrases that were designed to keep the child focused on the rules (i.e., not to touch/peek or leave the chair). This included any mention of time passage or waiting (e.g., "This is a long time," "Don't touch," "Wait until the teacher gets back"); (2) Speech focused on the bag/gift itself that did not focus on the goal of not looking or touching (e.g., "I wonder what's in that big bag"); (3) Non-task-related/irrelevant utterances that were unrelated to the bag, gift, or rules (e.g., "I like gummi bears," "I'm all alone in

here"); (4) Unintelligible/unclear speech: whispers, inaudible muttering, or utterances that could not be understood by the transcriber; (5) Humming/noises/singing: this included instances in which the child was humming, singing, or making noises. If the words of the song had task-relevant content (i.e., the song was about the rules, bag, or gift), the utterance was coded for content using Categories 1–3; and (6) Social speech: loud speech directed at the door that was clearly intended for the experimenter, as indicated by name or pronoun, by repetition and increased volume of the same utterance (e.g., "Where are you?" spoken while facing the door). Two naïve coders coded speech utterances for interrater reliability. Each coder was required to code the utterances of 10 randomly selected children (a total of 37 utterances). Interrater reliability (κ) was determined to be .89. The total number of utterances in each category was calculated and used in the analyses.

RESULTS

Preliminary Analyses

Preliminary analyses were conducted to examine data for outliers or distributional properties that might have affected the data analysis. No problems were found except that the number of private speech utterances during the GIB task was positively skewed. In addition, age and gender differences in self-regulation and private speech were explored. Age in months was positively correlated ($r = .43$, $p < .001$) with self-regulation, as is to be expected, with older children being better than younger children. On a related note, age was also positively associated ($r = .29$, $p < .01$) with performance on the SAT. There were no gender differences in SAT performance or self-regulation. Self-regulation and children's SAT performance were positively associated ($r = .23$, $p < .05$).

In terms of private speech usage, there were no age differences in the number of utterances during the GIB task or the number of SAT items with speech, but older children were more likely than younger children to get items correct on the SAT while being silent (age and percentage of items correct with silence, $r = .35$, $p < .01$; age and probability of getting an item correct with silence, $r = .29$, $p < .05$). Boys used more private speech during the GIB ($M = 9.85$, $SD = 13.3$) than girls ($M = 4.95$, $SD = 6.02$), $t(85) = -2.15$, $p < .05$, but there were no gender differences in speech during the SAT. Given the presence of age and gender differences, the following analyses often included these variables. Because of the exploratory and small-sample nature of this first investigation of relations between structured music classes and self-regulation in early childhood, an alpha value

of $p < .10$ was selected, and effect size estimates were interpreted to determine whether effects were notable.

The analyses appear in the following order. First, we examine differences in children's self-regulation between the music groups. Second, we report on the private speech used by the children during the GIB and SATs and relate speech use to performance on the tasks. Third, we examine music group differences in children's private speech usage.

Self-Regulation and Musical Exposure

Kindermusik. To investigate whether experience with Kindermusik was related to children's behavioral self-regulation, we conducted ANOVAs with the overall composite self-regulation score as the dependent variable and the two independent variables (in turn) being whether the child had ever been enrolled in Kindermusik (yes: $N = 42$, no: $N = 47$) and whether he or she was currently enrolled in Kindermusik (yes: $N = 23$, no: $N = 66$). The mean length of involvement in Kindermusik was approximately 10 months ($SD = 14.54$). To explore the role of gender and age as potential moderators, each was added individually as additional independent variables. Consistent with prior research that has found differences between 3- and 4-year-olds in terms of the role of private speech in self-regulation (Müller, Zelazo, Hood, Leone, & Rohrer, 2004; Winsler, Carlton, & Barry, 2000), children were classified into two age groups for the purposes of these analyses: those 48 months and younger ($n = 43$) and those older than 48 months ($n = 46$).

Table 1 shows the means and standard deviations for children's self-regulation and selective attention by Kindermusik group (ever/never) and by age group. There was the expected main effect for age group,

TABLE 1
Self-Regulation and Selective Attention Performance as a Function of Ever Having Been Enrolled in Kindermusik and Age Group

	Kindermusik (Ever)			*No Kindermusik*		
Variable	*Younger (n = 21)*	*Older (n = 21)*	*Total (n = 42)*	*Younger (n = 22)*	*Older (n = 25)*	*Total (n = 47)*
Self-regulation composite[a,b]						
M	−.374	.300	−.04	−.148	.165	.020
SD	.49	.45	.58	.42	.51	.49
Selective attention						
M	6.89	7.10	7.00	5.75	7.39	6.72
SD	2.9	2.7	2.8	2.9	2.8	2.9

[a]Significant Kindermusik × Age Group interaction ($p = .07$).
[b]Significant age effect ($p < .001$).

$F(1, 85) = 23.91$, $p < .001$, with the older age group doing better, and no main effect for having ever attended Kindermusik. However, there was a significant Age × Kindermusik group interaction, $F(1, 85) = 3.26$, $p = .07$, revealing that whereas within the younger age group, children without Kindermusik experience had higher self-regulation skills, among the older (4+) age group, those with Kindermusik experience had greater self-regulatory skills than those without (Cohen's $d = .28$). Also listed in Table 1 is children's performance on the SAT. There were no significant age effects, Kindermusik effects, or interaction. When the same models were run with gender as the second independent variable, gender was never significant, nor did it interact with music group.

Table 2 displays the means and standard deviations for children's self-regulation and selective attention as a function of being currently enrolled in Kindermusik (current/not) and age group. There was a significant effect for current Kindermusik enrollment, $F(1, 85) = 3.19$, $p = .07$, indicating that those children who were currently enrolled in Kindermusik (regardless of age) showed better self-regulation than those who were not currently enrolled ($d = .41$). There was the already-known significant age effect in this ANOVA as well, $F(1, 85) = 17.06$, $p < .001$, and no interaction. For SAT performance, there were no age group or current Kindermusik effects.

In addition to these main analyses, we also analyzed other information received about the quantity of Kindermusik to which children had been exposed. The total number of classes for which the child was enrolled in Kindermusik and the proportion of the child's life that he or she had been in a Kindermusik class (total number of months in Kindermusik divided by

TABLE 2
Self-Regulation and Selective Attention Performance as a Function of Being Currently Enrolled in Kindermusik and Age Group

	Kindermusik (Current)			*No Kindermusik*		
Variable	*Younger (n = 9)*	*Older (n = 14)*	*Total (n = 23)*	*Younger (n = 34)*	*Older (n = 32)*	*Total (n = 66)*
Self-regulation composite[a,b]						
M	−.170	.352	.15	−.280	.172	−.06
SD	.44	.34	.45	.47	.53	.55
Selective attention						
M	6.50	7.86	7.36	6.33	6.97	6.66
SD	2.7	2.4	2.6	3.1	2.8	2.9

[a]Significant Kindermusik effect ($p = .07$).
[b]Significant age group effect ($p < .001$).

current child age in months) were correlated with overall self-regulation and SAT performance for those with Kindermusik experience. A partial correlation, controlling for age, was used in the case of total number of semesters. Furthermore, because age was found to interact with Kindermusik experience (above), these correlations were run separately for those in the younger and older age groups. There was some evidence of a dosage effect for quantity of Kindermusik exposure, especially for those 4 years of age or older. The proportion of life measure was correlated ($r = .38$, $p = .09$) with self-regulation among the subsample of 4-year-olds, and the total number of semesters in Kindermusik was associated ($r = .27$, $p = .09$) with self-regulatory competence after we controlled for child age when all ages were included and when just 4-year-olds were included ($r = .43$, $p = .059$).

Other musical experience. We were also interested in examining associations between self-regulation and participation in other organized music and movement activities. A total of 19 parents (7 of whom had also done Kindermusik) indicated on the survey that their child had participated in some other organized, structured music program (i.e., Music Together, Wiggles & Giggles, church choir, group piano lessons, library or other community center music program). There were no differences in self-regulation between those who had participated in some other type of musical program ($M = -.017$, $SD = .48$) and those children who had not ($M = -.004$, $SD = .55$) according to an ANOVA, $F(1, 87) = .008$, *ns*. The same was true after we removed the seven children who had been in Kindermusik as well and reran the analysis.

Private Speech on the GIB and SAT

Speech during the GIB. Table 3 shows children's private speech use for the overall group of children in terms of both the percentage of children who engaged in the various categories of speech and the mean number of utterances. Overall, 81.6% of the children used some form of private speech while waiting for the experimenter to return during the GIB task, with the average number of utterances during the 3-min period being 7.3 ($SD = 10.4$). In terms of subcategories of private speech, almost 20% of the children said something to themselves about the rules of the task, and a quarter of the children talked about issues irrelevant to the task. More than half of the children engaged in partially internalized muttering and unintelligible speech, and about half of the children sang or hummed to themselves or made various noises while waiting for the experimenter to return. Also, about 12% of children used social speech in the form of calling out to the experimenter through the door.

TABLE 3
Private Speech Use in the Gift-in-Bag Task, Overall and by Music Group

		Ever Kindermusik		*Current Kindermusik*	
Private Speech Type	*Total Sample (n = 89)*	*Yes (n = 42)*	*No (n = 45)*	*Yes (n = 23)*	*No (n = 64)*
About rules and task					
% who used	18.4	16.7	20	21.7	17.2
M	0.93	1.43	0.47	0.52	1.08
SD	5.11	7.3	1.2	1.2	5.9
About bag/gift					
% who used	1.1	0	2.2	0	1.6
M	.02	0	.04	0	.03
SD	.21	0	.3	0	.25
Task irrelevant					
% who used	26.4	26.2	26.7	26.1	26.6
M	1.17	1.02	1.31	1.13	1.19
SD	3.24	2.6	3.8	2.9	3.4
Muttering/unintelligible					
% who used	59.8	67.3	55.6	47.8	64.1
M	2.90	3.79	2.07	4.91	2.17
SD	7.21	9.8	3.3	12.9	3.2
Humming/singing/noise					
% who used*	50.6	62^a	40^b	60.9	46.9
M	2.24	2.5	2.00	3.22	1.89
SD	(4.63)	5.2	4.03	6.7	3.6
Total private speech					
% who used*	81.6	92.9^a	71.1^b	87	79.7
M	7.26	8.74	5.89	9.78	6.36
SD	(10.43)	13.0	7.1	14.2	8.7
Social speech					
% who used*	11.5	4.8^a	17.8^b	4.3	14.1
*M**	.37	$.05^a$	$.67^b$	$.04^a$	$.48^b$
SD	1.29	0.2	1.7	0.2	1.5

Note. Numbers with different superscripts are significantly different from one another, $^*p < .05$.

Use of the speech categories in the GIB task was linked with performance. Children who used private speech that was unrelated to the task during the waiting period received poorer performance scores on the GIB task ($M = 3.5$, $SD = 0.67$) and a lower overall self-regulation score on the full battery of tasks ($M = -.21$, $SD = .64$) than those who did not use irrelevant private speech: GIB, $M = 3.78$, $SD = 0.49$, $t(83) = 2.07$, $p < .05$; self-regulation total, $M = .08$, $SD = .47$, $t(85) = 2.32$, $p < .05$. Children who mentioned the task rules or goals to themselves during the waiting period did a better job of waiting for the experimenter ($M = 3.87$, $SD = 0.35$) than

did those who did not ($M = 3.67$, $SD = 0.58$), $t(32.9) = 1.7$, $p = .09$. Finally, children who tried to engage in social speech with the experimenter through the closed door did poorer on the overall self-regulation battery ($M = -.44$, $SD = .41$) than those who did not ($M = .06$, $SD = .52$), $t(85) = 2.94$, $p < .01$.

Speech during the SAT. Most of the children used at least some private speech during the SAT (73%). Table 4 shows the percentage of SAT items that contained different types of private speech for the entire sample, as well as the average within-child probability that he or she would get an item correct given silence or the use of speech. Children on average used some type of private speech on 38% of the task items and thus were silent on the other 62%. Item-relevant private speech was most common (occurring on 21% of the items) followed by item-irrelevant speech (13% of items). Whispers/inaudible muttering was rare (only about 5% of the items). Children were more likely to get SAT items correct when they mentioned the relevant dimension to themselves (probability of success given relevant private speech = .84) than when they said the wrong dimension (probability of success given irrelevant private speech = .65) or when they were silent (probability of success given silence = .65).

Kindermusik experience and private speech. To investigate whether experience with Kindermusik was related to children's private speech use during the GIB task and the SAT, we conducted similar ANOVAs as those already discussed with the ever enrolled and the currently enrolled Kindermusik variables as the between-subjects independent variable and the private speech variables in turn as the dependent measures. For the categorical (yes/no) variables pertaining to whether or not a speech category was used, two-way chi-square analyses were conducted. Table 3 shows the results of children's speech use during the GIB task as a function of music group. It is interesting that children who had been in Kindermusik were more likely to hum or sing (62%) while waiting for the experimenter than those who had not experienced the music class (40%), $\chi^2(1) = 4.17$, $p < .05$. This increased likelihood of humming, singing, or making noises (which was counted as private speech) contributed to the finding that a greater percentage of the children who had experienced Kindermusik talked to themselves (93%) in general during this task compared to children who had not been in the music classes (71%), $\chi^2(1) = 6.85$, $p < .01$. Furthermore, it was the children who had never had a Kindermusik class who were significantly more likely (18%, compared to 5% for the Kindermusik group) to try to engage the experimenter with social speech through the door during the waiting period, $\chi^2(1) = 3.6$, $p = .057$. As previously discussed, this verbal behavior was characteristic of those with poorer overall self-regulatory

TABLE 4
Private Speech (PS) and Performance in the Selective Attention Task, Overall and by Music Group

Variable	Total Sample ($n = 78$)	Ever Kindermusik: Yes ($n = 39$)	Ever Kindermusik: No ($n = 39$)	Current Kindermusik: Yes ($n = 22$)	Current Kindermusik: No ($n = 56$)
% Items with relevant PS					
M	.207	.228	.185	.309*	.166*
SD	.26	.30	.22	.34	.21
% Items with irrelevant PS					
M	.128	.109	.146	.141	.123
SD	.18	.17	.19	.18	.18
% Items with partially internalized PS					
M	.045	.026	.065	.023	.054
SD	.10	.05	.14	.04	.12
% Items with any PS					
M	.380	.363	.397	.473†	.343†
SD	.35	.36	.34	.40	.32
% Items with silence					
M	.620	.637	.603	.527†	.657†
SD	.35	.36	.34	.40	.32
Probability of item success given relevant PS					
M	.836	.856	.815	.801	.853
SD	.28	.29	.29	.33	.26
Probability of item success given irrelevant PS					
M	.652	.764	.571	.767	.608
SD	.41	.31	.45	.25	.45
Probability of item success given silence					
M	.650	.637	.662	.663	.645
SD	.34	.34	.35	.35	.34

†$p < .10$. *$p < .05$.

abilities. The only significant difference in speech use between those who were currently enrolled in Kindermusik and those who were not (last two columns of Table 3) was that those who were not used more social speech, $t(69.5) = 2.32$, $p < .05$.

Table 4 shows how children's speech used on the SAT varied by music group. There were never significant differences in children's speech use or probability of success on the SAT as a function of whether the child had been in Kindermusik, but significant effects were observed when contrasting those who were currently enrolled with those who were not. Children who were currently enrolled in Kindermusik were more likely to use relevant

private speech during the SAT than those who were not enrolled, $F(1, 74) = 7.01$, $p < .01$, $d = .57$. Also, children currently enrolled used private speech on more items (and thus had fewer items completed with silence) than children who were not in Kindermusik at the time, $F(1, 74) = 3.36$, $p = .07$. The probability of getting items correct given speech use did not vary significantly as a function of music group.

As before, age group and child gender were also included as additional factors in the ANOVAs. There was one significant interaction involving gender. For those who had never experienced Kindermusik, there was a gender difference on the percentage of items in which item-irrelevant private speech occurred, with boys more likely to use irrelevant speech (on 25% of the items) than girls (8% of the items). However, for those who had experienced Kindermusik, this gender difference was not present, with girls (14% of the items) being more similar to boys (9% of the items) on the likelihood of using irrelevant private speech, $F(1, 74) = 7.53$, $p < .01$.

DISCUSSION

Although much prior work has examined the role of private speech as a tool for children to guide their behavior and problem solving (Berk, 1992; Winsler, 2009), little is known about the role of other cultural tools and symbol systems in the development of children's self-regulation. The goal of this preliminary investigation within this nascent area of inquiry was to explore potential links between children's early experiences with structured music and movement programs (in the form of Kindermusik), use of private speech, and behavioral self-regulation. It stands to reason that young children who have considerable experience modulating their motor behavior via songs and musical activities that involve starting and stopping, going fast or slow, moving sharply or smoothly, or reaching high or low according to the music and singing clean-up songs while putting away musical instruments may have stronger skills in terms of controlling their behavior than those who do not have these experiences. This may be because in addition to language in the form of private speech, children who experience Kindermusik, and perhaps other similar music and movement programs, might also have at their disposal song, music, and dance as cultural tools to use for directing their own behavior. Thus, the goal was to see whether singing songs and engaging young children in music and movement activities, in addition to simply being rewarding and intrinsically valuable for cultural and recreational reasons, may also have added benefits for children's self-regulation. The answer to this question not only has practical significance for early childhood education, music education, and intervention but is also

of theoretical significance, as it expands our understanding of the role of a more diverse set of cultural and meta-cognitive tools in the regulation of children's behavior.

Indeed, the results of this first investigation in this area suggest that something interesting is occurring in terms of the interplay between music, private speech, and self-regulation in the early childhood years. Children 4 years of age or older who had attended Kindermusik classes showed greater skills in behavioral self-regulation than the demographically similar group of children who had never been enrolled. Furthermore, children, regardless of age, who were currently enrolled in Kindermusik at the time of assessment did better on the self-regulation tasks than those who were not taking such classes. The size of these effects was moderate and notable ($ds = .28–.41$). Differences observed between those currently enrolled in such classes and those not enrolled suggest that potential influences of early childhood music classes on self-regulation may fade out over time, and thus it may be important for children to be recently or continuously receiving such experiences in order for such benefits to be observed. Furthermore, there was some evidence of a dosage effect. Among those who had experienced Kindermusik, those who had taken more semesters of the class (controlling for age) and those who had been in Kindermusik classes for a larger proportion of their lives had stronger self-regulation, especially among the 4-year-olds. Although this study was not designed to directly test this, and we did not have many children with other early childhood musical experiences, it is worth pointing out that other types of structured musical activities (i.e., piano lessons, church choir) at this age were not associated with self-regulatory skills in this study. Perhaps there is something specifically about Kindermusik and other similar early childhood music and movement programs, likely their frequent use of music and movement activities that require children to modulate their motor behavior (i.e., up/down, fast/slow) as a function of characteristics of the music, that is linked to children's self-regulatory skills.

The vast majority of children in this study used at least some private speech while their self-regulatory or executive capacities were being challenged in this study, either in the form of inhibiting their desire to look at the gift in the bag while waiting for the experimenter to return (82% used private speech) or having to refocus their attention to the relevant shifting dimension on the cards during the SAT (73% used speech). This is additional evidence that private speech is a common strategy that preschool-age children use when engaged in problem-solving activities or when called upon to regulate their behavior (Winsler, 2009). Indeed, speech use was related to task performance and self-regulation. Children who called out to the experimenter or used irrelevant speech during the waiting task had poorer

self-regulatory skills. Children who mentioned the rules and/or discussed the waiting task/goals did a better job of inhibiting their behavior while waiting. Finally, and most important, on the SAT, children were more likely to get items correct if they said the relevant dimension out loud to themselves than if they said something irrelevant or nothing at all.

Children's use of verbal strategies that were associated with performance did vary somewhat by their structured musical experiences. Children who were currently taking Kindermusik classes were more likely to use item-relevant private speech (a positive strategy), and they did so on more task items, than those who were not currently having such musical experience. Also, those with a music background were more likely to hum and sing while waiting for the experimenter to return. Those without such experience were instead more likely to call out to the experimenter (an ineffective strategy) when they were supposed to wait, and they did so more often than those with a Kindermusik history. This suggests that structured musical experience may be associated not only with an increased use of verbal self-regulatory strategies in the form of private speech but also with the introduction of a musical medium or tool through which children can think, guide their behavior, or indeed bide their time, depending on what the situation calls for. Also of note is that for those with the musical experience, no gender difference was found in the use of irrelevant speech. For those without the structured musical experience, boys were more likely to use irrelevant private speech during the SAT, but this gender difference was not found among those who had Kindermusik experience.

One limitation of the study is that the sample was fairly advantaged and homogenous in terms of family income and marital status, and the sample was predominantly Caucasian. Also, the children were generally well behaved with relatively strong self-regulatory skills. Clearly, an important goal for future research in this area would be to replicate these findings with a more socioeconomically and ethnically diverse sample and with children who are having more behavior regulation difficulties. It is impressive, however, that effects were observed in the present sample even though there was a restricted range of both family income and behavior problems. It is likely that the effects of a structured musical experience such as Kindermusik are even stronger if examined among a more diverse group of children, including families in poverty and children with self-regulatory difficulties. Children in poverty generally have more behavior problems and greater trouble with behavioral self-regulation than children with greater economic resources (Allhusen, Belsky, & Booth-LaForce, 2005; Qi, Kaiser, & Milan, 2006) and can perhaps benefit from interventions emphasizing music and movement. Indeed, Lobo and Winsler (2006) documented impressive pre- to postintervention gains in children's behavior and social skills (as

reported by teachers and parents) from a creative dance/music and movement curriculum offered to at-risk Head Start preschoolers. It would appear that early childhood music and movement programs may have consequences for young children of all socioeconomic groups, and they represent a ripe and promising area for expansion and future research. Another limitation is that the study was underpowered because of relatively small sample sizes. Thus, some of the effects that were observed, even though they were medium to large in size, did not reach conventional ($p < .05$) levels of statistical significance.

The final limitation of this preliminary study is that it was quasi-experimental in design rather than a controlled experiment. Thus, there may have been unmeasured preexisting differences in the families or children who chose to attend Kindermusik classes in the first place. However, recall that there were no differences between the music exposure groups on any of the demographic variables that we examined, including parenting style, maternal and paternal age and education, marital status, income, ethnicity, child disability status, and other musical activities (other than Kindermusik) going on in the home. So, selection effects seem unlikely, and, if they are present, it is hard to imagine on what relevant dimension the families might have differed. Another possibility, of course, that cannot be ruled out with the present study design is that the children participating in the group music classes had better self-regulatory skills to begin with. Clearly, the next step for this new area of research is to randomly assign children to musical groups and see whether the effects observed here are replicated. Another important next step would be to manipulate the amount of experience children receive specifically in modulating their motor behavior according to the music to help discover the particular mechanisms or processes that occur in music and movement classes that may be responsible for such effects.

The experiences that children have in structured music and movement classes such as Kindermusik can and do take place in other early childhood settings, such as preschools, kindergartens, and child care centers. Therefore, this work has important implications for early childhood education. Although many educators are convinced of the value of music and movement during early childhood (Kenney, 1997; Nardo, Custodero, Persellin, & Fox, 2006), there are several challenges to high-quality music programs in schools. First, in the current climate of high-stakes testing, accountability, budget pressures, and increased demands on early childhood curricula for school readiness, literacy, and math, it is often music and arts programs and curricula that are either cut back or removed (Abril & Gault, 2006). Second, early childhood teachers report feeling unqualified and ineffective at teaching music and are in need of better training in this area (Nardo et al., 2006). The results of the present study suggest that we should preserve

and perhaps even intensify early childhood music and movement programs in schools and ensure that there are qualified teachers to run high-quality music and movement programs for young children.

In summary, this study finds preliminary support for the notion that structured musical experience during the early childhood years in the form of Kindermusik is related to increased behavioral self-regulation and the use of self-regulatory speech in young children. Providing children with repeated experiences modulating their movements with the aid of music and song (i.e., stop/go, high/low, fast/slow, short/long, and loud/soft songs whereby children's motor behavior is guided by the music) may be good exercise for young children's emerging self-regulatory system. Increased use of task-relevant private speech in addition to private singing and humming appear to be other potential correlates of such early musical exposure and may be the mediational mechanism through which music and movement activities influence children's emerging self-regulation. In the end, it is important to keep in mind that early childhood music programs likely have intrinsic benefits for young children in that they foster musical development and appear to be enjoyable activities for the participants. However, if these results were to be replicated with an experimental design, it would appear that such musical experience may have other benefits in terms of children's capacity to plan, guide, and control their own behavior—skills that are important for children's future academic and life success.

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