Vocal Accuracy in Preschool Children: Are The Curwen Hand Signs Really Useful?

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Abstract

The effects of learning to sing with and without Curwen hand signs on singing accuracy in kindergarten-age children were compared. Participants comprised an experimental group (Curwen signs) and a control group (without signs), each containing 33 children aged 5 to 6 years. All participants took 30 music lessons centered on learning songs. The experimental group learned songs using Curwen signs and the control group learned the same songs without signs. Before and after instruction, all participants were tested on singing accuracy and melodic perception. Short-term memory was assessed to ensure between-group equivalence. Complementary data were gathered from a parent-completed questionnaire on the home music environment. Results showed significantly improved singing accuracy and melodic perception from pretest to post-test for all participants. However, no significant difference in singing accuracy was found between the Curwen group compared with controls, or between boys and girls. In addition, the home music environment appeared to foster melodic perception, more specifically, recognition of a four-note melody, but with no significant effect on singing accuracy.

Introduction

Despite the importance placed on singing in elementary schools, many children continue to sing out of tune (Burton & Taggart, 2011; Flohr, 2005). Singing accuracy, also called pitch-matching accuracy or vocal accuracy, is defined as the ability to match musical sounds of a certain highness or lowness (Kim, 2000), and is generally held to be one of the most important components

of singing education (Hutchins & Peretz, 2012; Jacobi-Karna, 1996; Mang, 2006). Moreover, in addition to recognized music education approaches, factors such as age, gender, and home music environment are believed to influence singing accuracy in children.

First, singing accuracy improves with age, and more specifically from kindergarten through the school grades: second grade (Hornbach & Taggart, 2005), third grade (Hornbach & Taggart, 2005), fourth grade (Geringer, 1983), sixth grade (Demorest & Pfordresher, 2015), and eighth grade (Yarbrough, Green, Benson, & Bowers, 1991). This progression should be considered with caution, however, as Demorest and Pfordresher (2015) argue that accuracy can be influenced by singing practice, and that the improvement is not linear, in that the progress is not necessarily steady.

Second, with respect to gender, although some authors argue that boys achieve lower singing accuracy than girls (Trollinger, 2003), the results on specific tasks are more homogeneous. For example, studies show that kindergarten-age boys perform as well as girls on melody imitation tasks (Cooper, 1995; Goetze, 1985; Leighton & Lamont, 2006; Smale, 1987; Welch, Sergeant, & White, 1997), except for Trollinger's (2003) study, in which girls were better at reproducing high notes, albeit in a younger population (age 3–5 years). Still, certain evaluative tasks or conditions (e.g., singing with other children) would negatively impact vocal performance in boys versus girls. Indeed, Welch et al. (1997) noted that when the assessment item was a learned song containing lyrics, boys performed significantly lower than girls. Mang (2006) attributed this difference to boys' word-learning difficulties. In contrast, Apfelstadt (1984) found no gender differences when using a song with lyrics that the participant chose. Moreover, in a group singing assessment, boys showed lower performance (Goetze, 1985; Leighton & Lamont, 2006). However, when the assessor sang along with the children, no difference in vocal accuracy was found between girls and boys (Cooper, 1995).

The home environment also influences singing accuracy in kindergarten children. Two

studies found better singing by kindergarten children from homes where music was emphasized (Apfelstadt, 1984; Persellin, 2006), as assessed by parent-completed questionnaires.

In addition to these three factors (age, gender, home music environment), studies have addressed various music education approaches. The findings contribute to the repository of music education practices and provide music educators with the most effective approaches to develop singing accuracy (Atterbury & Silcox, 1993). The literature describes three pedagogical approaches to explicit teaching of songs: i) the phrase-by-phrase approach versus the holistic or immersion approach (the whole song); ii) teaching songs with and without words; and iii) "singing for" or "singing with" children. Gault (2000) compared the effect of phrase-by-phrase versus holistic learning (the teacher sings the entire song before the child joins in) on 5- to 7-year-olds and found that the results depended on a number of things. For instance, the first song was learned better using the phrase-by-phrase approach, but no difference was found for the second song. The author surmised that the second song was more difficult to learn. Although further studies are needed on this topic, we may cautiously conclude that neither phrase-by-phrase song nor holistic song learning would negatively influence singing accuracy.

Other authors have examined the effect of simultaneous learning of lyrics and melody (compared with melody alone using a neutral syllable) on singing accuracy in kindergarten children (Goetze, 1985; Jacobi-Karna, 1996; Lange, 1999; Levinowitz, 1987, 1989; Rutkowski, 1993; Smale, 1987). Using correlational analysis, Goetze (1985) and Smale (1987) obtained contradictory results. Goetze (1985) proposes that kindergarten-age children achieve better singing accuracy when they learn without words, whereas Smale (1987) found no difference between the two approaches (with and without words) for same-age children. This disparity could be explained by the different assessment methods. Goetze (1985) used a song that the children imitated phrase-by-phrase, whereas Smale (1987) used a complete song that the children practiced four times more

often with words than with the syllable "loo." Levinowitz (1989) obtained similar results to Goetze (1985). All her participants learned songs with words as well as a neutral syllable. Tonal performance was measured with two different songs having similar characteristics (melodic development and harmonic structure), showing significantly better learning without than with words. She concluded that words might have distracted the children from learning. However, she assessed tonal performance, or the ability to stay in tune throughout the song. The findings of other quasi-experimental studies on this topic are more homogeneous. Levinowitz (1987), Jacobi-Karna (1996), and Lange (1999) found no significant differences between vocal performance (tonal performance and vocal accuracy) in 5-year-old kindergarten children who learned to sing with vs. without words. In all three studies, the experimental group learned to sing with words while controls learned without. In sum, use of words to learn to sing does not appear to impede tonal performance or singing accuracy.

We also considered the effect of "singing for" versus "singing with" children. In a quasi-experimental study, Persellin (2006) divided 134 kindergarten children (age 5 years) into three groups. Group 1 sang after the teacher, group 2 sang with the teacher, and group 3 sang both after and with the teacher. Although performance improved from pretest to post-test, no significant between-group differences were found. Of the various studies cited above, none was able to determine a significant effect on singing accuracy or tonal performance. Thus, these approaches, whether phrase-by-phrase, holistic, using words or not, singing after or at the same time, do not appear to either foster or hinder singing accuracy.

Besides explicit song teaching, studies have examined the impact on singing accuracy of other approaches such as small-group teaching, use of accompaniment, and use of gestures. Rutkowski (1996) compared the effects of whole-class versus small-group and individual traditional classroom singing instruction in kindergarten and found that small-group and individual teaching

improved the singing voice. The singing voice requires access to a wide vocal range, and children who sing in small groups can expand their vocal range better than children who consistently sing in large groups.

Turning to the influence of harmonic accompaniment on singing accuracy and tonal performance, Atterbury and Silcox (1993) and Guilbault (2004) found no significant effects on kindergarten children. Both these quasi-experimental studies included an experimental group who sang with accompaniment and a control group without accompaniment.

Studies have also examined the effects of hand gestures on pitch accuracy. In Liao's (2008) study, 80 children aged 5 to 6 years imitated six tonal patterns with and without gestures (melodic motions). Results showed a significant relationship between gestures and singing accuracy: the gestures improved pitch accuracy, and horizontal sweeping and opening–closing gestures particularly helped the children grasp intervals. However, the correlational study design only allows relating two variables, without determining a cause-and-effect relationship. The author suggests further exploration of this topic. Martin (1991) compared the use of solfege, Curwen hand signs, and letter names in 65 first-grade students and found no significant difference between the three approaches. Similarly, Cousins and Persellin (1999) examined the effects of Curwen hand signs on vocal accuracy in 47 first graders. The experimental group sang along with both Curwen hand signs and the names of notes (*sol-mi-la*) while controls used only the notes. Results showed that all students improved on vocal accuracy, with no significant between-group difference. However, several methodological limitations may have affected the results interpretation: insufficient sample size, course length, and experimentation period. In sum, although hand gestures appear to positively impact singing accuracy in kindergarten children (Liao, 2008), the findings on Curwen signs are not significant.

Aim

The above review indicates that a variety of factors influence singing accuracy in kindergarten children. Besides age, gender, and home music environment, the different pedagogical approaches should be considered. Although some approaches do not significantly improve singing accuracy (phrase-by-phrase, with or without words, singing after or with the teacher, accompaniment), none of them appears to hinder learning. Among these proposed approaches, we note that small-group singing seems to develop vocal range better than whole-class singing, and arm gestures appear to be particularly interesting (Liao, 2008). Based on Liao's (2008) results, we therefore undertook to investigate the use of gestures in teaching kindergarten children to sing. Accordingly, we used a quasi-experimental design to compare the effects on singing accuracy of two pedagogical approaches: learning to sing with and without Curwen hand signs. Few studies have addressed the Curwen hand signs, and more specifically, in kindergarten children. Cousins and Persellin (1999) and Martin (1991) considered older children (first-graders), while Liao (2008), who examined kindergarten children, did not establish a causal relationship between the variables. It therefore appeared relevant to examine, from a scientific and pedagogical perspective, the contribution of Curwen signs on singing accuracy in kindergarten children. First, the research method allows a more reliable determination of whether a cause-and-effect relationship exists between use of Curwen signs and singing accuracy. Second, the results could be used to guide music educators who teach kindergarten children. We hope that our findings will help them select the most effective approach to develop singing accuracy in their young charges.

Method

Participants

The study took place in a school that hosted six kindergarten classes: three for boys and

three for girls. Of these, two classes of boys and two of girls were selected to participate. A well-established procedure was used to ensure equivalence between the experimental and control group according to the teacher's music education practices. Research has demonstrated that singing practice is an influential factor for improving vocal abilities (Pfordresher et al., 2015). Therefore, to control for this variable, the participating teachers completed a questionnaire to establish individual music teaching profiles (adapted from Bolduc, 2009). One teacher was subsequently excluded from the study for having only one year of kindergarten experience. The classes of two teachers with similar profiles were assigned to the experimental condition (one class of boys and one of girls), and two other classes formed the control group. The two teachers assigned to the experimental condition scored lower on the questionnaire and the teachers in the control condition scored higher. The sample therefore included 66 children in four complete kindergarten classes. At the start of the study, the experimental group contained 33 children (17 girls, 16 boys; average age 67.2 months), with 33 in the control group (16 girls, 17 boys; average age 67.8 months). The school was an advantaged French-speaking private school in Québec City, Canada. Only three children in each group were taking music lessons outside school. Three families in the experimental group regularly played a musical instrument at home, with five families in the control group.

Procedure

At pretest, the researcher and her team met with all participants to perform two assessments: production (vocal accuracy) and melodic perception. Cognitive measures (short-term memory and logical reasoning) were assessed to ensure between-group equivalence. The children performed each of the three tests separately in a quiet location at the school. Each test took about 20 minutes to complete. The experimental period (singing instruction) lasted 15 weeks. Both groups received 30 half-hour music lessons, as described below. At post-test, the researchers met with each participant

to assess production and perception.

The experimental group and the control group.

To compare learning to sing with and without Curwen signs, lesson plans were adapted from relevant kindergarten studies (Atterbury & Silcox, 1993; Gault, 2000; Guilbault, 2004; Jacobi-Karna, 1996; Lange, 1999; Levinowitz, 1987, 1989; Persellin, 2006; Rutkowski, 1993, 1996; Smale, 1987). All lessons were developed according to the same pedagogical routine. The teacher began with a vocal warmup inspired by Montgomery (2002). The teacher then sang along with the students to review previously learned songs. The experimental group sang the words with Curwen hand signs referring to the name and sound of the pitches. The teacher then taught a new song phrase-by-phrase, first using words and hand signs, and subsequently with the names of the pitches and hand signs. The children were then divided into small groups according to the number of pitches (*do-re-mi-sol* and *la*) contained in the song, with each group singing its assigned pitch. The small groups then sang each note of the melody in turn accompanied by the relevant hand sign, with all groups practicing all notes at least once. The control group followed the same procedure and received the same lessons as the experimental group, except that they did not use the Curwen hand signs.

Measures

We used several measurement instruments: i) a parent questionnaire adapted from Moreno Sala (2003) to gather information on the musical background of the child and family; ii) Bolduc's (2009) questionnaire to form the experimental and control groups according to teachers' music practices; iii) memory and logical reasoning tasks to establish between-group equivalence; and iv) measures of singing accuracy and perception aptitude to determine the effects of the training. All

measures are described below.

Questionnaire on the home music environment (adapted from Moreno Sala (2003)).

This descriptive questionnaire was used to gather information on the child (name, date of birth, and gender). It includes 18 questions on the home music environment. It assesses whether the child was exposed to music outside school as well as the frequency of music activities at home, such as singing, playing an instrument, or listening to music. Parents' education level was also determined.

Questionnaire on kindergarten teachers' music teaching practices (Bolduc, 2009).

To ensure between-group equivalence in terms of teachers' music teaching practices, the six initially approached teachers completed Bolduc's (2009) questionnaire. It gathers descriptive data (age, teaching experience) and information on the type and frequency of music activities used in practice. More specifically, items referred to sound characteristics (low, high, lound, soft, short, long), vocal reproduction (imitation), sound recognition (listening activities with environmental or instrumental sound), beat and rhythm, singing practice, creation (song melodies and lyrics), children's music presentations, music listening, and instrument making. The responses were compiled to obtain music teaching practice profiles for each teacher.

Cognitive tasks: The KABC-II.

To ensure between-group equivalence of short-term memory and logical reasoning before training, we used three tasks from the Kaufman Assessment Battery for Children, Second Edition (KABC-II, (Kaufman, 2004), an individually administered measure of cognitive processing abilities of children aged 3 through 18 years. Short-term memory was measured by immediate number

recall; nonverbal logical reasoning was measured by choosing among abstract pictures to complete a logical pattern; and visuospatial short-term memory was measured by reproducing a sequence of hand taps with the fist, palm, or side of the hand.

Vocal accuracy and melodic perception tasks: The VAMDA.

To compare learning to sing with and without Curwen signs, we assessed vocal accuracy: and melodic perception. We used tasks from the Vocal Auditory Motor Development Assessment (VAMDA) (Tsang, Friendly, Trainor, & Dalla Bella, 2011), based on Berkowska and Dalla Bella (2009) Vocal Sensorimotor Loop.

The VAMDA: production tasks (vocal accuracy).

First, individual vocal range was determined with a brief note imitation exercise. The production software was then configured to suit each participant's natural range, and the children were asked to vocally reproduce notes or melodies in three tasks: one note (5 items), two notes (8 items), and four notes (8 items). Prior to each task, the children were exposed to two training items. Vocal performance was recorded with a microphone attached to a second computer. Production was acoustically analyzed with Melodyne (Celemony Software GmbH, Munich, Germany). One point was awarded when the child produced a note within ¼ tone of the original note (higher or lower; total error margin = ½ note). Production was tested at pretest and post-test.

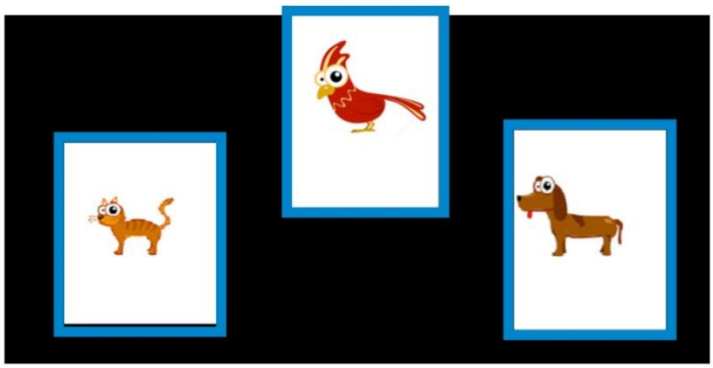
The VAMDA: perception tasks.

Perception was assessed with a one-note task (28 items) and a four-note task (8 items). On specialized software, the children watched and listened to an animal singing a note that was imitated by a second animal. The first animal sang the note again and was imitated by a third animal

(Figure 1). The children had to determine whether the second or third animal did the best imitation. The second task was conducted similarly, but with a four-note melody. Numbers of correct responses were recorded at pretest and post-test.

Figure 1

Software interface for the perception task



Results

Analyses.

Mixed-model repeated measures analysis (ANOVA) was used to compare learning with and without Curwen hand signs. Intersubject variability was decomposed into three sources: fixed effect of group (experimental vs. control), random effect of classes within groups (2 classes per group), and random effect of individuals within groups. The only source of intrasubject variation was the fixed effect of time (pre- vs. post-test). The interaction effect of group and time was also considered to compare between-group changes over time.

First, to ensure between-group cognitive equivalence, analyses of variance (ANOVA) were run for the three KABC-II tasks. The results showed no between-group differences: immediate number recall (short-term memory ($F(1,2) = 0.75$, $p = .48$), logical sequence (logical reasoning)

($F(1,2) = 0.23$, $p = 0.68$), and hand taps (short-term memory) ($F(1,2) = 0.78$, $p = 0.47$).

Vocal accuracy.

The results on vocal accuracy showed that both groups improved significantly from pre- to post-test ($F(1,64) = 26.85$, $p < 0.0001$). The average score for the experimental group improved from 17.23 to 22.68, with from 17.30 to 21.97 for the control group. As can be seen, no significant between-group difference was found ($F = 0.16$, $p = 0.73$). In terms of gender, no significant differences were found between boys and girls ($F(4,62)= 0.87$ $p = 0.49$). We found no significant relationship between the home music environment and vocal accuracy.

Melodic perception.

The VAMDA results on perception (1-note and 4-note tasks) showed a significant effect from pre- to post-test. The post-test results on the one-note test were significantly higher over those at pretest ($F(1,64) = 41.08$, $p <0.0001$), with the average(M) score for the experimental group rising from 20.21 to 22.21 and from 19.36 to 22.75 for controls. However, no between-group difference was found ($F(1,64) = 2.74$, $p = 0.10$). All children improved significantly on the four-note task from pre-to post-test ($F(1, 64) = 11.03$, $p = 0.0015$). The average score for the experimental group rose from 5.46 to 5.92 and from 5.24 to 6.18 for controls. Again, no between-group difference was found ($F(1,64) = 1.33$, $p <0.25$). Home music environment also had an impact on the four-note perception task: (F $(4,62)= 3.5$, $p = 0.175$), with a significantly higher average (M) score for children whose parents regularly played an instrument at home (M= 6.96) compared to no instrument (M= 5.55), regardless of group and time (pre- or post-test).

Discussion

The aim of this study was to compare the effects of learning to sing with and without the Curwen hand signs on vocal accuracy in kindergarten children. The results show that all participants significantly improved in vocal accuracy from pretest to post-test, with no significant

differences between the two conditions. Therefore, whereas learning to sing with Curwen signs is an effective approach to foster singing accuracy in kindergarten, it was not demonstrated as better than a similar approach without the hand signs. Although Liao (2008) found a significant relationship between vocal accuracy and the use of gestures while singing, we draw a different conclusion, which could perhaps be explained by the type of gestures used in our study. Liao (2008) used sweeping horizontal gestures that matched sound intervals: the larger the interval, the more widespread the gesture, and vice versa. However, the Curwen hand signs involve mainly up and down movements that reflect note pitch. It is possible that broader, full-body movement would have advantages over the more limited Curwen hand signs. In this sense, our results concur with Cousins and Persellin (1999) and Martin (1991), who also experimented with Curwen signs. They showed that use of hand signs with first-graders did not result in better vocal performance (vocal accuracy and tonal performance) over non-use. However, their population differed from ours.

We also examined the influence of gender on vocal accuracy and found no difference between boys and girls, at either pretest or post-test. These findings corroborate those of several studies that used similar measures (Cooper, 1995; Goetze, 1985; Leighton & Lamont, 2006; Welch et al., 1997). Furthermore, these studies noted that kindergarten boys achieved the same vocal accuracy as same-age girls on melody imitation tasks (Cooper, 1995; Goetze, 1985; Leighton & Lamont, 2006; Welch et al., 1997).

The home music environment appears to influence melodic perception. On the four-note task, children with a parent who regularly played a musical instrument scored better, in both groups. Interestingly, no study to our knowledge has verified the connection between melodic perception and home music environment in kindergarten children. Although some authors have measured these two variables, they did not attempt to establish a relationship between them (Apfelstadt, 1984).

The results also show a time effect on perceptual abilities. In other words, the children improved significantly on perceptual abilities from pre- to post-test, and across all groups. Thus, perceptual abilities were equivalent between children who learned to sing with and without the Curwen signs. Although the use of Curwen signs does not appear to be an influential factor on children's perceptual abilities, it is worth noting that all the participants improved in this area after learning to sing.

Limitations

Certain limitations of this study should be considered. First, the children were assigned to the experimental or control group according to the teachers' music education practices. The control classes had the teachers who did more music activities, and the experimental classes had the teachers who did fewer music activities. Thus, the lack of difference between the effects of the two conditions (Curwen hand signs vs no hand signs) could be attributed to the group assignment procedure. Second, although the teachers'questionnaire was well intentioned, their responses may not have accurately reflected their practices, which could have resulted in bias. Third, the teachers changed their practices during the experimental period. Knowing that they were participating in a study, they may have been inspired to increase or even reduce the number of music activities in class. There are also some methodological limitations. Although the production and perception measures were carefully chosen, they are not standardized assessments. Moreover, the length of the study (15 weeks) could have played a role. Had the training been longer or the lessons more condensed, the results might have differed. Finally, a third control group with no music training would have been informative: we could have determined the effect of maturation on the development of singing ability and auditory perception skills.

Conclusions

The results of this study and those reviewed in the literature shed light on a number of points to consider. First, the majority of studies that used an experimental design to compare the effects of different pedagogical approaches on vocal performance in kindergarten children did not obtain significant results. In fact, none of the various approaches to learning to sing—using the Curwen hand signs, using words, phrase-by-phrase, by singing after or with the teacher, or singing with accompaniment—seems to significantly influence children's singing ability. Nevertheless, one fact emerges from these studies: all participants made significant improvements in their singing performance from pretest to post-test, irrespective of the program used. This fact testifies to the importance of practicing singing in order to improve singing skills, and particularly regular singing at school. Furthermore, because all the approaches described here have been shown to improve children's singing ability, it would be advantageous to encourage music teachers to vary their methods. Besides regular singing practice and varied methods, our results open up some promising avenues. Notably, the positive contribution of a musical home environment on children's melodic perception confirms the benefits of family music activities. Without intruding into home life, music teachers could always suggest ideas for musical games and activities to do at home, or they could simply provide parents with suitable songs.

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