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The Effects of Technology on the Sight-Reading Achievement of Beginning Choir Students

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The ultimate goal for many choral directors is to develop independent musicians within the ensemble. The ability to sing a series of pitches and rhythms at first sight is widely understood to be a fundamental building block of independent musicianship. Yet sight-reading is not simply a holistic skill. There are separate components of sight-reading, including pitch, rhythm, and harmonic context which must be considered when deciding how to teach sight-reading in the choral classroom.

Junda (1994) asserts that students must possess an arsenal of readiness skills before being expected to have success in music reading, including intonation, aural perception, rhythm, and inner hearing. The ability to translate pitch reading into sound is integral to the sight-reading process, particularly for singers (Henry, 2011). Henry (2001) developed The Vocal Sight-Reading Inventory (VSRI) for assessment using designated pitch skills, resulting in a hierarchy of difficulty levels for 28 distinct pitch skills. Subsequently, Henry applied a similar approach to create a hierarchy of difficulty for 26 discrete rhythm skills (2009). Lucas (1994) found a significant relationship between that sight-singing success and the harmonic context in which sight-singing skills were taught and tested among middle school choir students.

Other factors, such as visual stimulation and eye movement, can play an important role in determining sight-reading success. Rogers (1996) found that elementary general music students performed rhythm exercises with more interest and accuracy when the rhythms were written with colored chalk on a chalkboard, as opposed to white chalk. Goolsby (1994) explored the differences in eye movement between highly-skilled student musicians and students who are less skilled in music reading. Significant differences were discovered between the eye movements used by highly-skilled and less-skilled sight-readers during the music reading activity.

Researchers have explored many approaches for both sight-reading pedagogy and practice strategies for students. Killian and Henry (2005) discovered a relationship between specific practice strategies and success in sight-singing, including tonicizing, the use of hand signs, isolating problem areas, and keeping a steady tempo. In addition to group instruction, Demorest (1998) examined the effect of individual testing on the sight-reading success of high school choral students. Participants who received regular individual assessment as a part of instruction made significant gains in sight-reading performance, when compared to those who received only group instruction. Research has not investigated the effectiveness of this strategy with younger singers or beginning sight-readers.

Recently, significant strides have been made in the development of instructional technologies utilizing voice-recognition capabilities. As a result, this opens up a new field of inquiry for choral and vocal researchers. Henry (2012) found that high school singers initially were not receptive to the use of this technology for sight-reading assessment. However, after reaching a comfort level with the technology through a thorough introduction and significant practice opportunities, participants were more open to its use. Perhaps younger singers, just beginning sight-reading instruction, would be more receptive to this technology, as they will have had no prior means of instruction with which to compare it.

The advent of new technologies and voice recognition software, along with the previously-determined effective use of individual assessment as a teaching strategy, calls for an exploration into the possible benefits of using technology both to teach and to assess vocal sight-reading skills. The purpose of this study was to determine the effects of technology and individual practice on the vocal sight-reading achievement of beginning choir students. Research questions include:

1) What is the ability level of beginning choir singers in sight-reading?
2) Is there a significant gain in sight-reading scores after an 8-week instructional period using technology and/or individual practice?
3) Is there a significant difference in the scores of those who use technology versus those who do not use technology in instruction and individual practice time?
4) What is the effect of applied music instruction or previous choral experience on vocal sight-reading ability in for beginning choir singers?

Method

Participants in this study were sixth grade beginning choir students attending a suburban intermediate school in central Texas (N= 83). Participants were randomly assigned to gender-specific choir classes. Two classes were designated as technology classes (n = 47) and two classes were designated as non-technology classes (n = 36). Each choir class met daily for approximately 48 minutes. Prior to any sight-reading instruction, each participant was given a pretest to determine initial sight-reading ability. The pretest consisted of one of two similar 4-measure melodies and a written survey concerning previous musical experience. During the treatment period, all choir classes received teacher-directed instruction in sight-reading. Using identical materials, technology classes received instruction using the 2012b version of SmartMusic software and a headset microphone, while non-technology classes received instruction using a projection camera. Throughout the eight-week treatment period, each participant underwent a weekly individual assessment session, either using SmartMusic or paper notation, and a continuously-running video camera. At the end of the treatment period, participants completed a posttest in the same format as the pretest, using the melody that they did not see during pretesting. All performances were digitally recorded for scoring at a later time.

Two similar melodies containing basic pitch (scalar motion and tonic skips/leaps) and rhythm (quarter and eighth notes) skills were composed for testing purposes. Participants were randomly assigned one melody for pretesting, and received the other melody for the posttest. Scoring procedures were designed to correspond with those of the SmartMusic program that a portion of the participants had been using throughout the treatment period. The two testing melodies each contained 12 notes. One point credit was awarded for each correct pitch and for each correct rhythm, resulting in a potential total score of 24 for each melody. One of the researchers served as the primary scorer, listening to the digital recordings in one sitting. For reliability purposes, another sixth grade choir director in the same district served as a second scorer, grading 28% of the total pretest and posttest performances (n = 46). Using the agreements/(agreements + disagreements) formula, the scorers obtained an interscorer reliability of .90. Suitability as parallel forms was determined through a t-test on scores between forms, which resulted in no significant difference, t = 1.50, 164 df, p = .14.

Results

On the pretest, participants achieved a mean score of 5.77 or 24%, N = 83, SD = 3.71, with a minimum score of 0 and a maximum score of 16. There was no significant difference between treatment groups on the pretest, with mean scores of 5.72 (n = 47) for the technology group and 5.83 for the non-technology group (n = 36), t = .13, 81 df, p = .89. On the posttest, participants achieved a mean score of 14.02, N = 83, SD = 5.38, with a minimum score of 2 and a maximum score of 24, with mean scores of 8.53 for the technology group and 8.11 for the non-technology group. When compared to performance on the pretest, posttest scores after instruction were significantly higher, t = 12.86, 82 df, p = < .0001. Each treatment group also scored significantly higher on the posttest when compare to pretest scores, t = 9.77, 46 df, p < .0001 for the technology group and t = 8.24, 35 df, p < .0001 for the non-technology group (see Figure 1).

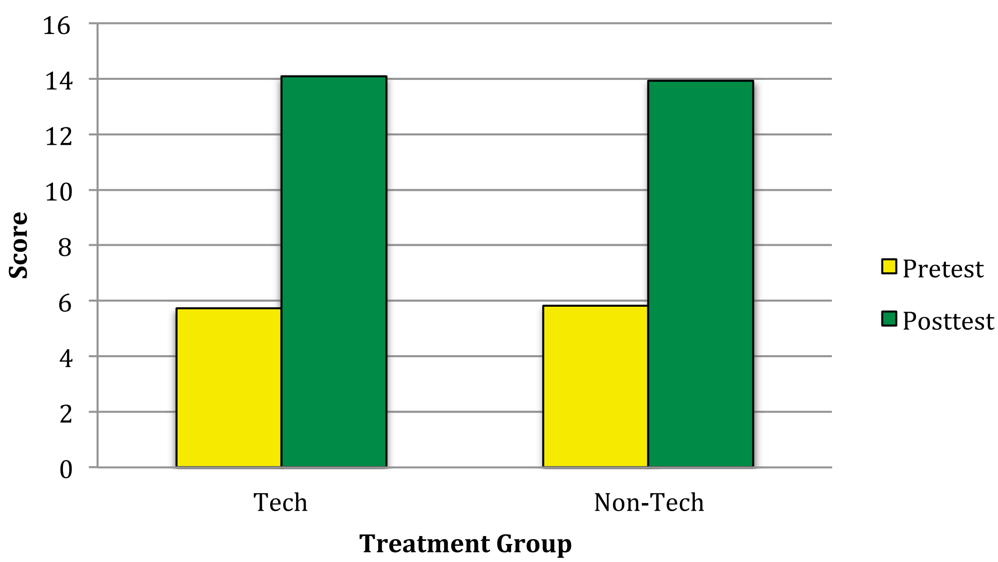

Figure 1. Pretest and Posttest Mean Scores by Treatment Group.

A comparison of difference scores between pretest and posttest revealed no significant differences between groups, t = -.32, 81 df, p = .75.

Twenty-one participants reported having one or more years of piano experience, with 16 of those indicating 1-2 years of experience. Six participants indicated having additional instrumental experience: percussion-3, violin-2, and cello-1. Because only one of the participants who had instrumental experience did not also have piano experience, only piano experience was considered in this analysis. Thirty-four participants reported previous choral experience, ranging from 1-10 years. While no significant difference was found between piano and non-piano participants on the pretest, a significant difference was found for posttest scores, $t = 2.54$, 81 *df*, $p = .01$. Those without piano experience ($n = 62$) obtained a mean score of 13.18 on the posttest, while those with piano experience ($n = 21$) obtained a mean score of 16.52 on the posttest (see Figure 2).

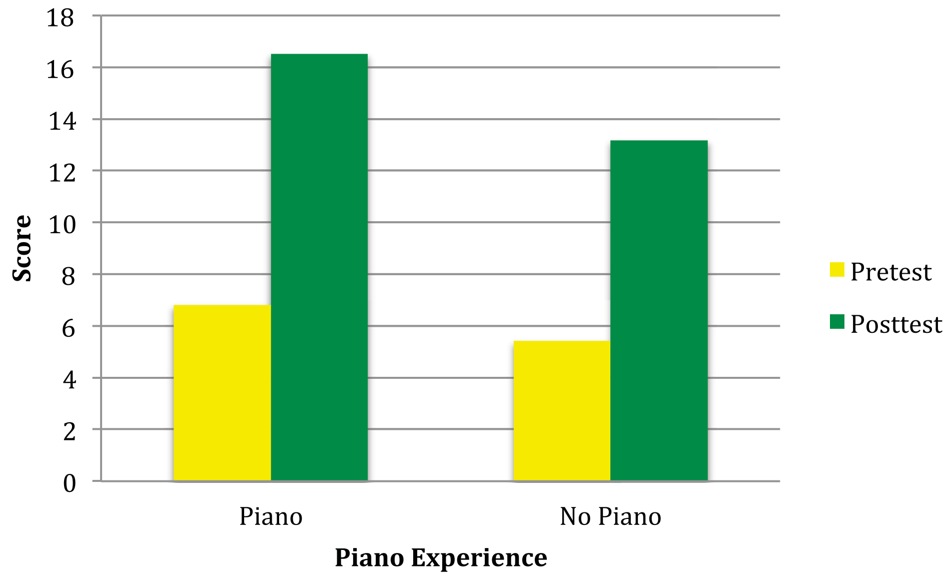

Figure 2. Pretest and Posttest Mean Scores by Piano Experience.

Choral experience was not significantly related to success on either the pretest or the posttest.

Discussion

Vocal sight-reading instruction typically begins with formalized choral instruction. Because these singers have virtually no prior experience in regard to vocal sight-reading or familiarity with any instructional strategies, this population provides an opportunity to isolate the effects of instructional strategies. This study sought to determine the effectiveness of technology and individual practice on the vocal sight-reading achievement of beginning choir students.

The participants in this study had minimal sight-reading skill prior to instruction, as evidenced by the mean score of 5.77/24 on the pretest. The skill that was displayed was likely the result of music reading skills acquired in previous general music classes, as well as minimal additional training in piano or auxiliary choral experience for approximately one third of the population. After the eight-week treatment period, the mean score on the posttest was 14.02/24, an increase of 143%. It is clear that vocal sight-reading skill improved throughout the treatment period. Part of this may be ascribed to familiarity with testing procedures through repetition of the process during individual practice. The teaching strategies used in the classroom instruction and individual practice appear to have been effective.

Between those who experienced instruction with technology and those who did not, no significant difference was found. This indicates that classroom instruction and individual practice were effective instructional strategies for the improvement of sight-reading skills regardless of the medium by which the instruction and practice were delivered. The results suggest that teachers who lack financial resources to equip practice rooms with computers and software can feel confident that instruction and opportunity provided through traditional methods (sight-reading books, overhead projection, audio recording, etc.) are an effective means of providing effective instruction on sight-reading. Those who have the means and interest in technology (and who may have students interested in acquiring the technology for their own personal practice) may use such resources to achieve individual sight-reading success. An advantage of using technology, when teaching sight-reading, is that computer programs provide automatic feedback to singers reducing the time teachers spend administering and scoring the exercises.

Previous auxiliary choral experience did not significantly impact results, yet those with piano experience achieved a significantly higher mean score on the posttest. While piano experience has frequently correlated with higher vocal sight-reading achievement (Demorest, 1998; Demorest & May, 1995; Henry, 2011; Henry, 2001; Henry & Demorest, 1994; Killian & Henry, 2005), these results are somewhat unique in that the scores between experience groups were not significantly different on the pretest. Perhaps the piano background allowed these students to progress at a faster pace during instruction, but they did not come into the treatment with a noticeable advantage. While encouraging singers to pursue additional music instruction is an obvious strategy for improving individual sight-reading skill, perhaps practitioners might also look for other means for making connections with prior and current music study beyond the typical choral rehearsal components. Piano (or other instrument study) may provide a more tangible or concrete means for singers to make connections between notation reading and physical production of sound.

One potential benefit of the technology utilized in this study is the instantaneous feedback feature. While it was beyond the scope of current study, research should be conducted to determine whether the feedback provided through the software during individual practice can impact aural skills acquisition and error detection skills. Future research might also include investigation into preference for technology between genders. Practitioners should commit themselves to regular vocal sight-reading instruction and to providing a means for individualized practice and feedback, recognizing that the opportunity to execute the process individually is an important part of the learning and mastery process.

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