Critical Review: What are the effects of adding music to the treatment of speech and language disorders in pre-school and school aged children?

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This critical review examines the effects of adding music to speech-language intervention for pre-school and school aged children. A literature search was conducted and the following types of articles were selected: case-control studies (2), single group pre-post studies (2), a systematic review (1), and informational articles (2). Overall, the examined research provides guarded support for practicing clinicians to utilize music as part of speech and language services. The addition of music to speech and language services is worthy of further experimental research.

Introduction

Music is an enjoyable tool used by teachers, caregivers and clinicians to motivate children to learn. However, music may be more than just a motivator; it may actually help children learn decoding skills necessary for reading (Butzlaff, 2000; Hansen & Bernstorf, 2002). Music and melody can provide an environment for learning linguistic text. For example, music notes are grouped together to form melodies which is similar to grouping phonemes to create words and phrases (Wallace, 1994). Developing a skill to hear tonal differences may help facilitate auditory sensitivity required to perceive phonological differences. In addition to this, children may learn song lyrics by viewing written text that is highly repetitive and thus predictable. This may help to develop reading skills outside of the musical context (Butzlaff, 2000).

Clinical Rationale

There is a growing trend in speech-language pathology to use musical activities in combination with traditional therapy for children with speech and language disorders. In fact, a dual-discipline approach to therapy that combines speech-language pathology and music therapy has been observed to have positive effects in children diagnosed with autism, apraxia of speech, and language disorders (Bronté-Tinkew & Magill, 2004; McCarthy & Geist, 2006). Music is used by many clinicians; however, it is necessary to justify its use in the therapy setting. Further research is critical to support the observed benefits and to determine the specific components of music that may assist young children who have speech and/or language disorders.

Objective

The primary objective of this paper is to critically evaluate existing literature regarding the effectiveness of adding music to the treatment of pre-school and school aged children with speech and/or language impairments.

Methods

Search Strategy

Computerized databases including Cochrane Library, CINAHL, Google Scholar, MEDLINE-OVID, ProQuest Education Journals, ProQuest Research Library, PsychARTICLES, PsychINFO, and PubMed were searched using the following search strategy:

(music) and (language)
(music) and (speech)
(music) and (phonological awareness)
(music) and (reading)
(music) and (math)
(music therapy) and (language)
(music therapy) and (speech-language pathology)

The search was limited to articles written in English.

Articles were also obtained through hand searching reference sections and searching journals through the Music Library at the University of Western Ontario. In addition to this, articles were obtained by contacting The Ontario Association of Speech-Language Pathologists and Audiologists (OSLA), Wilfred Laurier University Music Therapy Department, a private speech-language pathologist, and music therapist.

Selection Criteria

Studies selected for inclusion in this critical review paper were required to investigate the effect of music instruction on phonological awareness and/or reading performance or the relationship between music perception skills and early reading skills. Studies related to music and children with Autism Spectrum Disorder were excluded from this critical review because of additional impairments outside of speech and language skills.

Data Collection

Results of the literature search yielded the following types of articles congruent with the aforementioned selection criteria: case-control studies (2), single group pre-post studies (2), a systematic review (1), and informational articles (2).

Results

Gromko (2005) conducted an experimental study to evaluate the effects of music instruction on phonemic awareness and, more specifically, phonemic segmentation fluency in kindergarten children. The researchers used a between-groups control design without randomization. Kindergarten children (n = 103) from two Midwestern United States schools were evaluated pre- and post-intervention using the *Dynamic Indicators of Basic Early Literacy Skills* test (*DIBELS*) (Good, Gruba, & Kaminski, 2002). Four intact classrooms were selected from each school to serve as the treatment group (n = 43) and the control group (n = 60). Both groups received the same amount of reading instruction; however, the treatment group received an additional 30 minutes each week of music instruction from January 2004 to April 2004. Music instruction was taught by four advanced music methods students and consisted of learning to sing songs from various cultures; using percussion and kinaesthetic movement; and touching graphic charts during song. All participants were post-tested in May 2004 using three of the *DIBELS* subtests. Group pre- and post-test mean gains for letter-naming fluency, phoneme-segmentation fluency, and nonsense-word fluency were compared using a test of difference (t-test). Results showed a significant difference in mean gains for phoneme-segmentation fluency (t = -3.52, df = 101, p<.001). The treatment group (M = 26.12, SD = 16.05) showed significantly greater gains after music instruction compared with the control group (M = 15.72, SD = 13.83).

A limitation of the Gromko (2005) study was the difference between the two schools chosen for the study. The treatment school children were from a lower socioeconomic background and produced lower scores during the pre-treatment testing than the control group. It would have been beneficial to control for the school differences by randomly assigning the classrooms to each condition. There may have also been differences between classroom teachers, which could have accounted for the mean gains. However, the research provides tentative support for the use of music to assist phoneme-segmentation development in beginning readers.

Register, Darrow, Standley and Swedberg (2007) investigated the efficacy of using music as a remedial strategy to improve reading skills in children with an identified specific learning disability (SLD) in reading (n = 8) and in normal learning grade two children (n = 33). The control group consisted of 16 normal learning grade two children and the treatment group consisted of all the SLD children and 17 normal learning grade two children. All participants were evaluated pre- and post-intervention using vocabulary and comprehension subtests of the *Gates-MacGinitie Reading Tests* (*GMRT*), Fourth Edition (2000). Both groups participated in the normal reading program with the treatment group receiving additional music programming three times per week over the course of four weeks from a music therapist. The activities in each music and/or reading lesson targeted three reading skills: word knowledge, word decoding and reading comprehension skills. For example, to practice word knowledge, the music therapist taught the students familiar children's songs and then asked the students to define words from the songs. Students were encouraged to use context clues in the song to help them produce a definition. Songs were also used to help the students sequence the events of a story. While singing a song, the students would place story cards in the correct sequence.

Pre- and post-test scores for the children with a SLD in reading were analyzed using paired t-tests and Wilcoxon signed rank tests due to the small sample size (n = 8). The pre- and post-test scores of the treatment and control normal learning classes were analyzed using paired t-tests. Children identified with a SLD in reading showed significant improvements from pre- to post-testing on all three of the *GMRT* subtests and the test total. Results of the treatment and control grade two classes revealed significant improvement pre- to post-testing on the word decoding and word knowledge subtests, and the test total. However, neither class improved significantly on the reading comprehension subtest. An Analysis of Covariance revealed that the treatment class made greater gains than the control class on the three subtests of the *GMRT* and

significantly greater gains on the word knowledge subtest. The researchers concluded that this intervention program could be used to supplement current reading and music curriculum to assist children of various abilities to learn literacy strategies.

Limitations of this study include the lack of randomization of the participants and teachers, ceiling effects, and issues regarding validity and reliability of the *GMRT*. The classes were not randomized and this could have left the study open to variability from different teaching styles. In addition, they did not provide the age of the students with a SLD in reading. This leaves the reader to assume that the students are similar in age to the grade two classes when this might not be the case. The researchers noted that the pre-test scores of the treatment group were higher than the control group, which could have limited gain scores. The researchers also noted that they did not have any information regarding the reliability and validity of the *GMRT*. They explain that the test is widely used to assess reading competence; however, this lack of statistical evidence makes it difficult to determine if the results of the present study are accurate. Overall, the results of this study provide equivocal evidence for the use of this music-based reading program. Further research is necessary to determine if it should be considered as a supplement to music and reading curriculum.

Lamb and Gregory (1993) investigated the relationship between the ability to discriminate musical sounds and phonemic awareness. They hypothesized that children who achieved high scores on a musical ability test would have equally high scores on a test of phonemic awareness. The participants were four- and five-year old children (n = 18) in their first year of school. Although they did not use a large sample size in their correlational study, the researchers attempted to include a range of social backgrounds. The battery of tests included: simple reading, phonic reading, musical ability, phonemic awareness, and cognitive ability. Results revealed a large correlation between pitch discrimination and simple reading $r = 0.74$, $p<.01$ and phonic reading $r= 0.59$, $p <.01$. It also showed a large correlation between phonemic awareness and simple reading $r= 0.70$, $p<.01$, phonic reading $r= 0.83$, $p<.01$, and pitch discrimination $r= 0.65$, $p<.01$. The researchers conclude that having the ability to perceive small changes in phonemes may depend on the ability to hear differences in the frequencies of speech sounds. This may be related to the ability to discriminate between pitches in music.

There are limitations to this study that may have influenced the results. First, the authors did not provide the validity and reliability information for each test used during the study. A music ability test was designed for the purpose of this study since a test normed on this age group could not be found. Unfortunately, the researchers only provide a description of the test and do not describe how this test was created and if it had been tested apart from the study (i.e., obtained satisfactory validity and reliability ratings). The researchers also do not describe who administered the test to the participants. If the researchers administered the tests, this could have introduced bias into the study. Finally, the authors make a considerable leap in logic when reporting their conclusions. Pitch discrimination and phonemic awareness could be related to several factors and causation could be in multiple directions. Despite these limitations, the size of the correlation is impressively large given the small sample size. Therefore, the results are suggestive of a relationship between musical sound discrimination and reading performance but causality cannot be assumed. Clinicians and teachers may consider the addition of music to the curriculum of young children to assist with the development of phonemic awareness.

Anvari, Trainor, Woodside and Levy (2002) examined the relations among phonological awareness, music perception skills, and early reading skills in four- and five-year old children (n = 100). The participants were administered a battery of tests that targeted phonemic awareness, reading, vocabulary, music, digit span, and mathematics. The targeted factors were evaluated using standardized tests; however, the researchers created a test of music for the purpose of this study. The test appeared to cover a wide variety of discrimination tasks for rhythm, melody and chords. Relations among music variables and phonological variables were assessed using factor analysis to determine related constructs. Hierarchical regression analysis was then used to investigate the predictive ability of music perception skills on reading after shared variance with phonemic awareness was removed. Results showed the expected significant correlation between phonemic awareness and reading and the predicted significant correlation between phonemic awareness and musical ability. The researchers also found that music perception is predictive of reading skill even after removal of the shared variance with phonemic awareness. It is suggested that music perception and phonological awareness may share some auditory mechanisms; however, music perception skills may be related to auditory or cognitive mechanisms beyond those utilized by phonological awareness.

The Anvari, Trainor, Woodside and Levy (2002) study had a few limitations that could have influenced the results. The researchers did not

provide enough detail regarding the recruitment of the participants for this study. It is stated that the participants were recruited from schools and daycares in the Hamilton-Wentworth region of Ontario; however, it is not known if this population was representative of the general population e.g., cultural or socioeconomic background. The researchers also do not explain who administered the tests. There could have been a potential for bias if the tests were administered by the researchers. Despite these potential limitations, this study provides evidence to suggest that linguistic and non-linguistic auditory mechanisms may be involved in reading.

Butzlaff (2000) performed a meta-analysis on studies that investigated the effect of music on reading in children. The reviewed literature included articles obtained through seven electronic databases including: Arts and Humanities Index, Dissertation Abstracts International, Educational Resource information Clearinghouse, Language Linguistics Behavioural Abstracts, MedLine, PsychLit/PsychINFO, and Social Science Index. All databases were searched from their inception year up to and including 1998. The search also included hand-searching of journals from 1950 to 1998. Three criteria were determined for inclusion in the meta-analysis: the dependent variable was a standardized measure of reading ability, music instruction was followed by a reading test, and sufficient statistical information to calculate an effect size. Six experimental and 24 correlational studies were included. The meta-analysis for the six experimental studies resulted in a modest mean effect size (r= .18) that was not considered reliable due to the considerable variation in the individual study effect sizes. In the correlational studies, reading performance was compared between students with music experience and students without music experience. The meta-analysis of the correlational studies showed a statistically significant correlation between reading ability and music instruction (Stouffer's Z = 301.38, p<.0001 and t = 4.2, df = 23, p<.001). Butzlaff (2000) also reported that 80% of the studies had positive effect sizes ranging from r = -.19 to r = .65. This lends further support to the possible relationship between music and reading.

The limitation of the Butzlaff (2000) meta-analysis is that no statements about causation can be made regarding music and reading. An association between music and reading is evident from the meta-analysis of the correlational studies; however, causality cannot be established from the meta-analysis of the experimental studies. Another limitation is the small number of experimental studies included in the meta-analysis. The article provides tentative support for the use of music to assist in reading instruction.

Recommendations

The present evidence suggests that music may be an effective tool to assist in the development of decoding skills. However, there are issues in participant selection and methodology. It is also difficult to make comparisons between the studies due to the variety of research designs. The following recommendations are suggested for future research in this area:

a) Utilize reliable and valid measurement tools that are standardized on the preschool and/or school age population.
b) Develop research designs that minimize the introduction of bias and/or confounding factors.
c) Replicate previous studies to confirm and/or clarify results.
d) Establish the amount and type of music instruction that produces optimal results e.g., use of live music versus recorded music, music instruction provided by music therapist versus classroom teachers, music instruction once per week versus three times per week.
e) Specify the elements of music that contribute to improved speech and language outcomes e.g., ability to discriminate pitch, rhythm or duration.

Conclusions

The current available literature is suggestive of a relationship between music and the decoding skills necessary for reading. Speech-language pathologists should consider incorporating this underutilized tool into their practice or consider collaborative practice with a music therapist. Further research is necessary to determine the musical factor(s) that contribute to the development of decoding skills in children. Music is frequently used in the classroom and in therapy sessions; however, we need proper evidence to support its use.

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