

# Music in Cognition and Students with Learning Difficulties

Patricia L. Bygrave, PhD

Faculty of Education,

University of Canberra, P.O.Box 1, Belconnen, ACT, 2616,

Australia.

Fax: 61+6+2015065

Email: triciab@education.canberra.edu.au

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## Introduction

The development of cognition in children can be enhanced by music activities. This has been shown by the research of Serafine (1988) for example, who examined the development of cognitive processes in children involved in musical tasks. Studies with young children in pitch discrimination (Webster & Schlenrich, 1982) and the identification of tonality (Krumhansl & Keil, 1982), also indicate that music is linked with cognition. Other cognitive skills that develop with music in children are an ability to remember melodies (Bartlett & Dowling, 1980) and musical phrases (Abel-Struth, 1982). A developmental sequence associated with melodic information processing also has been discussed (Dowling, 1982). While these studies showed that cognitive

processes developed with age, a general finding pointed to the importance of early exposure to and experiences with music in developing cognitive skills in children.

Most, if not all published research into music and cognition has involved ordinary children. There is little research into this area in the field of special education. This may be due in part to many children in special education settings participating in few if any structured music activities (Bygrave, 1985, 1991). On the other hand, children such as those with learning difficulties, often lack the cognitive development and characteristics necessary for learning. These children may show little ability or inclination to learn in a structured, active and efficient way, thus leading to poor task performance (Torgesen, 1977, 1982). There are many studies detailing the success and failure of training students with special needs in developing cognitive processes such as memory and comprehension, especially in relation to language (Ashman & Conway, 1989). There appear however, to be no studies concerning the development of components of cognition in students with learning difficulties through music.

A study undertaken by this author (Bygrave, 1991) involving a music program, examined the development of skills associated with cognition in students with learning difficulties. A hypothesis was proposed that listening skills of the students such as listening comprehension, would develop through their participation in a music program. A full report of the study has been presented (Bygrave, 1991, 1994) as have specific aspects of the study (Bygrave, 1995/96, 1996). It is not the intention of the author to duplicate these publications. Rather, this paper will review the study (Bygrave, 1991) as it relates in part to the theme of the Seminar namely, "Music in Cognition".

## Method

The subjects who took part in this study were 29 students with learning difficulties (19 males, 10 females) in four special education settings in the Australian Capital Territory. The students had an average age of 7.7 years (range 6 years three months to 9 years two months), an average IQ score of 80 (range 58 to 103), and were in grades Kindergarten through to Grade 3. All of the students had problems in literacy and numeracy and had difficulties in cognitive processing, in particular comprehension. The students also experienced difficulties in other cognitive skill areas such as attention, memory and listening. Many of the students had difficulties with motor-skills, behaviour problems and lacked appropriate social skills. They were integrated into the mainstream classes of their schools mainly for art, physical education, sport and social science. Some of the students participated infrequently in music activities during the integration periods.

### Procedures

Two programs focussing on the development of listening skills, a music program and a story-telling program, were selected for use in the study. A decision to use two different listening-orientated programs was made for the purposes of introducing a comparative element into the study.

#### Music program

The music program (Leask & Thomas, 1986) provided a variety of listening experiences through the musical activities of singing, playing musical instruments, creating and movement. These activities were adapted and taught by the classroom teacher in a daily session alongside the introduction of musical concepts such as beat, pitch, tempo, dynamics, tone and form. The concept of beat for example, was learnt through listening, singing and moving to songs, and creative activities such as Beat Circles (Leask & Thomas, 1986, p. 22). In this activity, each student drew a circle of

dots or beats on paper and listened to one another play these on percussion instruments to the class.

### Story-telling program

The story-telling program (Field & Walsh, 1989) involved the students in daily listening to a story read by the teacher followed by answering factual questions about the story. The stories were constructed to develop the student's auditory receptive skills of listening and comprehension with the recalling of single, simple facts before progressing to recalling several facts and to making inferences.

The programs were randomly assigned to the four special education settings; the music program was implemented in one class, the story-telling program in another, both the music and story-telling programs in a third, while the fourth class acted as a control. The four classes participated in a 30-week intervention period. Each class received the same treatment throughout the period of weekly teacher-interviews, observations (a total of 6 per program) and videoing (a total of 2 per program), and interviews of students selected by the class teachers (a total of 2 per class) as case studies (Bygrave, 1997).

### Tests

A test battery of seven measures was used to assess the effects before and after the students participated in the programs. The measures, detailed and discussed elsewhere (Bygrave, 1991, 1994), mainly assessed aspects of the student's listening skills such as receptive vocabulary (Bygrave, 1995/96), phonological processing and listening comprehension. All the students were tested before the intervention period (pretest), after the intervention period (posttest), and then 7 weeks later (postposttest). The tests

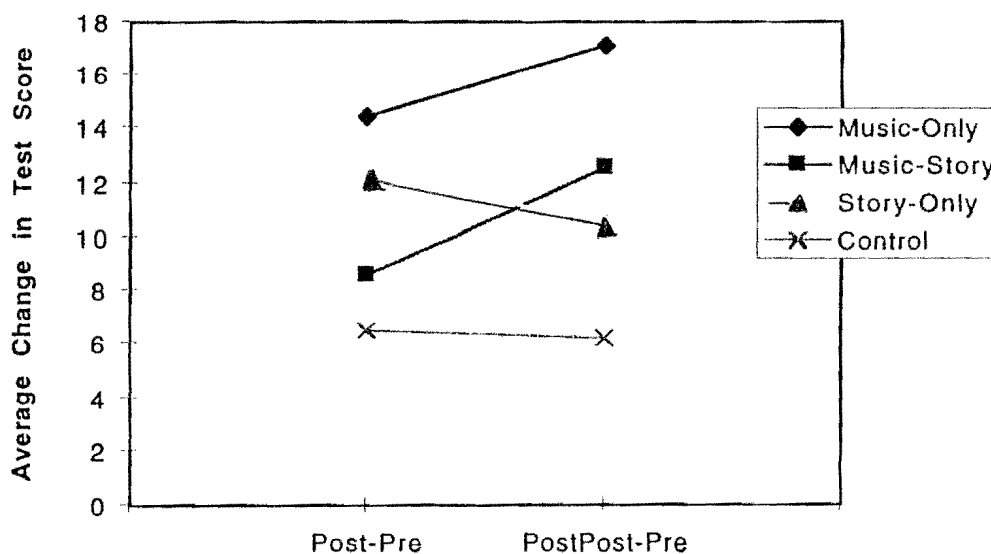
were administered and marked by two trained independent examiners unaware of the programs being undertaken by the students. The teachers were not informed of the results until after the postposttest.

The results to be discussed in this paper concern the student's listening comprehension skills. The Token Test (DeRenzi & Vigolo, 1962) was used to assess the development of these skills. This measure has been adapted for use with children (Noll & Berry, 1969) and adapted further for use with Australian children to assess auditory comprehension problems (Mackie & Dermody, 1981; Dermody, Kehoe & Bochner, 1989). The Token Test involves the identifying of a particular token by a student while listening to and comprehending the directions of the examiner. There are 20 tokens of 2 different shapes (circles and squares) and sizes (large and small), and of 5 different colours (red, blue, white, yellow and green). The 61 commands in the test are grouped into 5 parts and progress from a simple direction in Part One such as "Point to the red circle", to more complex directions in Part Five for example, "After picking up the green square touch the white circle".

## Results

No significant difference was found between the four classes in a one-way analysis of the pretest scores of the Token Test (Bygrave, 1991, 1994). A two-way factorial treatment (music yes or story no) was used to analyse data from the pretests, posttests and postposttests. This analysis was designed to measure whether involvement by the students in a music program, a story-telling program, or in both a music program and a story-telling program, would develop their listening comprehension skills. The analysis showed that music had a significant effect ( $p < .05$ ) on the students' listening comprehension skills for the postposttest-pretest period (Bygrave, 1991, 1994).

The results indicate that the students in the control class increased their score on the Token Test by an average of 6.5 between the pretest and posttest (see Figure 1). The average scores of the control class remained at about the same level when the postposttest was carried out. Students in the music-only class had the highest average improvement in Token Test scores between the pretest and posttest. These students also continued to improve between the posttest and the postposttest and were showing the greatest overall improvement when the postposttest was conducted. Students in the story-only class also improved between the pretest and the posttest, although not by as much as the music-only class. The students in the story-only class however, decreased in their average score between the posttest and the postposttest. Students that were subjected to both music and story showed only a small increase between the pretest and posttests. Like the music-only class however, they continued to increase their scores in the period between the posttest and postposttests.



**Figure 1:** Average change in Token Test scores for students between pretest, posttest and postposttests. Students from all four classes obtained results that were not significantly different from each other at the pretest.

The mean gains on the Token Test (post-pretest) for the classes were control: 6.5 ( $n=6$ ); music: 14.4 ( $n=8$ ); music and story: 8.6 ( $n=9$ ); story: 12.1 ( $n=6$ ) and on the Token Test (postpost-pretest) were control; 6.2 ( $n=6$ ); music: 17.12 ( $n=8$ ); music and story: 12.6 ( $n=9$ ); story: 10.7 ( $n=6$ ).

## Discussion

This paper has presented aspects of a study concerning the development of listening skills in students with learning difficulties. The hypothesis was examined that listening skills such as listening comprehension, would develop through students' participation in a music program. Data from the Token Test appear to indicate that the music program had a positive effect on the listening comprehension skills of the students. This effect developed through the pretest to the postposttest. While the listening comprehension skills of all the students developed from the pretest to the posttest, only the listening comprehension skills of the students in the music programs continued to improve over the posttest to postposttest period.

Of interest is the delayed effect of the music on the student's listening comprehension skills in the class with the combination of the music and story-telling programs. This could be attributed to the presentation of the two programs on alternate weeks of the intervention period. In the story-telling program, this involved the teacher reading different stories to the students. In the music program however, this resulted in a short delay before the introduction of music activities and related musical concepts by the teacher, as compared to the procedure for the students in the music-only class.

One possibility why the listening comprehension skills of the students in the music program improved more than those in the story-telling program, could relate to the structure of the two programs. On the one hand, the teachers of the story-telling program taught listening skills in a traditional classroom approach. On the other, the teachers of the music program provided a variety of musical activities and experiences to which students could actively apply their listening skills. The impact of task-structured programs such as a music program versus a story-telling-routine, on the development of cognitive skills in young children, has been well-documented in a study by Sylva, Roy and Painter (1980).

In his discussion of children with learning disabilities as "inactive learners", Torgesen (1977) lists a number of variables associated with cognitive development. Amongst these are "the ability to assume an active and efficient approach to learning" (p. 37). It can be argued that such an approach was adopted by the students in the music program. These students, through their active participation in task-structured music activities such as the Beat Circle referred to earlier, acquired efficient listening skills that led to the development of the cognitive skills of listening comprehension.

## **Conclusion**

This study attempts to address the paucity of research into music and cognition and special education. The findings suggest that music enhances the development of cognition in students with learning difficulties. Of particular relevance is that the age of these students is comparable to those children participating in the studies discussed in the introduction. Such findings have implications for the teaching of music, especially with the current educational emphasis on integration for students with learning difficulties. Students often have limited listening experiences to develop efficient



listening skills. The selection and implementation of a music program with appropriate task-structured activities can provide various listening experiences. Clearly, as this study shows, these experiences are effective in the development of cognitive skills such as listening comprehension, and impact on the cognitive development and learning of students with learning difficulties.

## References

- Abel-Struth, S. (1982). Experiment on music recognition. (Special Issue). *Psychology of Music*, 7-10.
- Ashman, A. F. , & Conway, R. N. F. (1989). *Cognitive strategies for special education*. London: Routledge.
- Bartlett, J. C. , & Dowling, W. J. (1980). Recognition of transposed melodies: A key-distance effect in developmental perspective. *Journal of Experimental Psychology*, 6, 501-515.
- Bygrave, P. L. (1985). *Music as a cognitive developing activity: Implications for learning and the learning disabled child*. Master's thesis, University of Canberra, Australia.
- Bygrave, P. L. (1991). *Music and the development of listening skills in children with learning difficulties*. PhD thesis, Macquarie University, Sydney.
- Bygrave, P. L. (1994). Development of listening skills in students in special education settings. *International Journal of Disability, Development and Education*, 41 (1), 51-60.
- Bygrave, P. L. (1995/96). Development of receptive vocabulary skills through exposure to music. *Bulletin for the Council of Research in Music Education*, (Special Issue), 127, 28-34.

- Bygrave, P. L. (1996). Activity in a music program and the development of cognitive processing skills. *Proceedings of the Australian Association for Research in Music Education XVIIIth Annual Conference*, Sydney, 33-38.
- Bygrave, P. L. (1997). Students with learning difficulties: Skill development through the music program. *Proceedings of the Australian Society for Music Education XI National Conference*, Brisbane, 48 - 53 .
- DeRenzi, E. , & Vignolo, L. A. (1962). The Token Test: A sensitive test to detect receptive disturbances in aphasics. *Brain*, 85, 665-678.
- Dermody, P. , Kehoe, M. , & Bochner, S. (1989). *National Acoustic Laboratory Test of Auditory Language Learning Capabilities in Kindergarten Children (NALTALLCK)*. Sydney: National Acoustic Laboratory.
- Dowling, J. W. (1982). Melodic information processing and its development. In D. Deutsch (Ed.), *The psychology of music* (pp. 413-429). New York: Academic Press.
- Field, H. , & Walsh, J. (1989). *Learning to listen and remember*. Sydney: Macquarie University Special Education Centre.
- Leask, J. , & Thomas, L. (1986). *Upbeat*. South Yarra, Melbourne: Bojangles Music.
- Mackie, K. , & Dermody, P. (1981). A normative study of the Token Test. *Australian Journal of Human Communication Disorders*, 9, 14-23.

Noll, J. D. , & Berry, W. R. (1969). Some thoughts on the Token Test.

*Journal of Indiana Speech and Hearing Association, 27, 37-40.*

Serafine, M. L. (1988). *Music as cognition*. New York: Columbia

University Press.

Sylva, K. , Roy, C. , & Painter, M. (1980). *Childwatching at playgroup and*

*nursery school*. London: Grant McIntyre.

Torgesen, J. K. (1977). The role of nonspecific factors in the task

performance of learning disabled children: A theoretical assessment.

*Journal of Learning Disabilities, 10 (1), 27-34.*

Torgesen, J. K. (1982). The learning disabled child as an inactive learner:

educational implications. *Topics in Learning and Learning Disabilities,*

*2, 45-52.*

Webster, P. , & Schlenrich, K. (1982). Discrimination of pitch direction

by preschool children with verbal and non-verbal tasks. *Journal of*

*Research in Music Education, 30, 151-161.*

Krumhansl, C., & Keil, F. C. ( 1982). Acquisition of the hierarchy of tonal

functions in music. *Memory and Cognition, 10, 243-251.*