Yehudith Carmon
Bar-Ilan University

Aryeh Wohl
Talpiot College of Education

Shmuel Even-Zohar
Bar-Ilan University

The Musical Notes Method for Initial Reading Acquisition

Abstract

A century of experimental approaches to reading instruction has not significantly reduced initial reading acquisition problems. Though researchers continue to identify more and more symptoms of deficiencies, they have, to date, come up with but few solutions. Reading instruction traditionally begins with the particular components of a specific language. In this study, we investigate a method that begins with general, basic reading components common to all written alphabetical languages, including musical notation. We propose to introduce reading by using an original and simple musical vehicle, the Toy Musical Notes (TMN) method. After creating a primary reading scheme through music, verbal reading becomes much easier. Our method was tested on 150 preschool children, who participated in three intervention programs: TMN, conventional music, and a control group, which had a non-musical intervention program. Pre- and posttests were administered with follow-up assessments in reading development conducted in the first grade. The results reflected significant achievements for the TMN group on all reading parameters: number of mistakes, vocal reading time, velocity, and comprehension. Applying this method allowed us to use children's natural musical interest to help them learn to read and comprehend better.

Key words: reading abilities, reading components, reading acquisition, musical notation, reading scheme

In recent years, international UNICEF tests have indicated weakness in reading achievements in affluent Western countries (Chiu & Mcbride-Chang, 2006). Reading experts seek new ways to solve problems of reading acquisition instruction (Glenn, Cousins, & Helps, 2005; Kerins, Winkler, Sweeney, & Carran, 2006). In almost 100 years of frequently changing approaches to teaching reading – synthetic, analytic, and eclectic (Kerins et al., 2006; Wohl, 1998) – difficulties have not been adequately reduced. The available reading acquisition methods, although rich in content, do not always answer the needs of all young learners. Preparing youngsters for reading readiness seems confined to elements of a specific language: teaching skills such as letter recognition, phonological awareness, the manipulation of consonants and vowels, spelling and syntax

(Evans, Bell, Shaw, Moretti, & Page, 2006; Katzir et al., 2006; Kerins et al., 2006). These skills, taught in traditional "emergent literacy" programs, seem not to enable coherent reading. This leaves many children frustrated and lacking the explicit competency for coherent reading. General reading components are also needed.

A recently developed approach to answer this need is the Toy Musical Notes (TMN) method. The approach is based on a small number of notation signs and explicit strategies to instruct general reading components common to all alphabetical languages as well as to music. Written musical notation has not been widely used thus far for closing the auditory-visual gap of novice readers because of the complexity of the standard notation. The TMN method provides a new means for achieving reading readiness by addressing the transition from spoken to written language. Children perceive the intonation and rhythm of words when they hear them, but not when they read them. TMN uses music to enhance the cognitive process, enabling children to absorb the much more complicated process of verbal reading. It is compatible with two other theories: Vygotzky's (1978) zone of proximal development and Gardner's (1997) multiple intelligences and influence of close domains. The method suits children's cognitive development at the preschool and initial school stages, and provides children with a comprehensive reading experience (in music) before they learn the alphabet. TMN uses the children's natural interest in music and helps to close the cognitive gap that occurs when children experience the first transition from auditory language to visual reading. Studies indicate the positive effects of music learning in early childhood on the development of the cognitive process of reading. Teaching music as part of children's initial reading experiences relates to three different areas of a child's cognitive development: auditory development, reading, and music.

Auditory Development

Children have a prenatal sense of hearing and are receptive to resonance frequencies. The process of audio-cognitive acquisition develops in a fixed order: timbre and volume precede pitch and rhythm, and finally proceed to phonemes – consonants and vowels (Inbar, 1999). The development of the senses influences the cognitive process before the infant acquires verbal abilities. Newborn babies recognize their mother's vocal timbre, first experienced in the womb (Inbar, 1991, 1999). They are sensitive to auditory volume, frightened by harsh voices, and comfortable with soft ones (Klein, 1997). Within 2-3 months, babies enjoy listening to variety in the pitch of tunes and react physically to rhythm by moving their bodies. These musical components assist in language comprehension (Inbar, 1999; Whalley & Hansen, 2006). Music, as the emotional language of children, serves to communicate with them earlier than words (Inbar, 1999). Children learn language through hearing the whole spectrum of language sounds before beginning to learn to read. When reading, however, the auditory components are absent; children need to focus on written phonemes only. This can be compared to hearing a robot speaking on a single-pitch level, repeating the same rhythm and prosody. Music expands and strengthens internal auditory memory and helps beginning readers to retrieve the entire sound spectrum for the word comprehension task (Adams, 1994; Koren, 1993).

Reading

Researchers agree that reading is not a natural skill and that the first language a child learns to read is the most difficult (Rayner & Pollatsek, 1989; Gibson & Levin, 1975). The second language is much easier, because the foundation – the first reading scheme of "how to read" – is already established and improves with further cognitive tasks and language experience (Kaniel, 2001).

Reading has two sets of components:

- The specific base of a particular language: letters, spelling, and syntax. Recent reading studies (Katzir et al., 2006) focus mainly on particular components in a specific language.
- The general base, common to all alphabetical languages including music, includes several cognitive processes: (a) expanding auditory memory; (b) gathering data – signs – and storing them in short-term memory until their meaning is comprehended; (c) developing audile memory to enable the gathering of written sounds of words leading to comprehension; (d) recognizing the alphabetical principle that every sign represents its unique sound in any context; (e) audio-visual integration (Yishay, 1992); (f) developing brain manipulations of sound segregation; (g) directionality; (h) sequence; and (i) fluency.

The multitude of specific components makes it difficult to teach the general reading base. Most young children do not easily learn rules out of context without specific examples (Weiss, 2000). Thus, teachers refrain from teaching the general base, because its complexity does not leave enough time and enthusiasm to teach the specific components. Teachers can more easily determine whether children have adequately internalized the alphabet than mastery of the alphabetical principle or expanded auditory memory. The gap between aural and written language thus may also be caused by the instructional mixture of too many specific-explicit and general-implicit components. It is clear that young children need concrete learning (Piaget & Inhelder, 1967).

In practice, the known approaches to reading instruction are: (a) the analytical-holistic, top-down model, from the reader to the text (Goodman, 1986; Wohl, 1998); (b) the synthetic-phonetic, bottom-up model, from the text to the reader's mind (Adams & Bruck, 1993; Wohl, 1998); (c) the integrated eclectic-balanced method, (Spiegel, 1998; Wohl, 1998). All involve teaching letter recognition, spelling, and syntax, appropriate for different children. These approaches have largely failed to reduce problems caused by the absence of the basic general reading components.

Alternative reading methods for beginning readers were based on teaching verbal reading decoding skills, focusing on a visual base. These included: (a) attempts in the 1960s and 1970s to provide "reading aids," such as the color coded symbols of the 44 sounds in English, ITA (Initial Teaching Alphabet), described by Bond and Dykstra (1997); (b) Clarke's (1973) teaching of transparent Italian (in which every letter is written as read and vice versa) to English-speaking children, in which every phoneme had its own specific letter(s); (c) the Woodcock Rebus Reading Program (Woodcock, Clark, &

Davies, 1979), which employed visual illustrations (rebuses, i.e., picture-symbols) instead of words or letters, to assist in remembering word meaning visually. This was re-energized by Reiter (1999) and adapted for his "Rainbow Reading System," called "tailored reading," using both rebuses and colored letters. Pictograms, numbers, and colors have been used to stimulate interest in and capacity for reading, with varied success.

These methods focused on visual elements and on teaching specific reading components of verbal reading. The results were disappointing because children were often habituated to incorrect spelling and had difficulty making the transition to regular orthography. The focus on visual decoding, and not on integrating hearing, which is indispensable for reading and reading comprehension, may explain why these methods were not incorporated into classroom reading programs.

The Head-Start program, introduced in the late 1960s and 1970s, is an example of an intervention program that lacked preparation for verbal reading. It was based on aural language, not on reading (Paulson et al., 2004). Whalley and Hansen (2006) emphasized its prosodic sensitivity role in children's reading development but not its effectiveness for acquiring initial reading readiness.

Music

Reading musical notation requires an easier cognitive process than reading text and thus can be acquired earlier (Inbar, 1991, 1999). When children hear a word, they need only to refer to an object. When reading the word, they need to decipher the word and then relate to its connotation. Because reading musical notation requires only identifying a combination of sounds, and not referring to an object, comprehension is simply recognizing a read tune. Music provides children with tangible (motor) visual symbols and musical hearing. Therefore, even though reading music and text both use artificial-arbitrary elements, children are more readily able to acquire musical reading.

The ability to sing and enjoy music is as natural as speaking, and music reading can be used to enhance text reading. Hammer, Bentin, and Kahan (1992) claim that reading recursively is the best way to enhance reading. But for many children, initial text reading is not the best way to enhance reading. Many studies testify that music expands auditory memory (Koren, 1993), and helps cognitive development (e.g., the Mozart effect, Baby Mozart tapes; see Platel et al., 1997; Rauscher, 1995, 1997; Rauscher & Shaw, 1998; Rauscher, Shaw, & Ky, 1995; Rauscher et al. 1997). Music intonation (pitch) and prosody (rhythm), along with auditory memory development, also help to clarify the meaning of a sentence and improve comprehension (Adams, 1994; Sarnthein et al., 1997).

The TMN method consists of an audible integrated visual medium of reading with a focus on the preparation-for-reading stage, before the child can recognize the full alphabet. TMN provides the preverbal general reading components needed as a base for specific reading components, and expands auditory memory, allowing children to enjoy "first-time" reading without the need to recognize many verbal reading details. Learning to read the base with music elements as an introductory preparation to ease into

conventional verbal reading instruction may prevent reading deficiencies before children have fully learned the large number of phonemes.

Concrete-abstract distinction. Playing a musical instrument places the concrete before the abstract (Piaget & Inhelder, 1967) and provides a tactile reading experience in early exposure to musical notation. Concretely applied notation helps the player's imagination to anticipate the next abstract sound. Struggling with the abstract is a preparatory stage for learning to read intangible words. Children do not know how sung or spoken sounds are articulated in their bodies, but reading music while playing an instrument provides an easy concrete starting point. A musical keyboard is a tangible instrument that enables children to hear the musical notations by playing, before they can pronounce or sing them. There is no parallel tangible "text" instrument that can cause one to hear words while reading. Verbal reading thus demands a higher cognitive ability, which may be an obstacle to children who have not yet reached this cognitive level. Music reading can serve as an intermediate level. Singing the played tunes (solfège) is a stage that can gradually lead the way to text reading (abstract). The strategy of repetitious singing internalizes and encourages the solfège function. The tune does not have to be familiar to the reader. The ability to recognize tunes by singing without depending on instrument playing (internalizing solfège) achieves an important musical step, and gradually unknown tunes can be integrated. When children know enough sounds, they are asked to recognize known tunes from notations. At this point, a higher musical level is achieved, thus preparing the needed catalyst for verbal reading.

Audio-visual integration is indispensable for obtaining reading skill (Yishay, 1992). Associating the pitch and rhythm of the notes with the melody corresponds to the comprehension of accumulated words in a written sentence, thus providing children with an important reading-learning skill even before they know the alphabet.

Since this is the case, why hasn't reading music been widely used as a preliminary stage to teaching reading? The complexity of conventional musical notation may provide the answer (Schafer, 1967/1981). Musical methods were developed to circumvent this problem. Throughout the 20th century, music was taught without notation (e.g., Cohen, 1997; Jaques-Dalcroze, 1930; Kodaly, 1943-48, 1945; Orff, 1930; Ring, 2005; Suzuki & Grilli, 1992) or using methods of limited notation that focused on either pitch or duration (rhythm) without combining them (see, e.g., Amiran-Pougatchov, 1976, pitch only; Sobol, in press; Somervell, 1933, as cited in Cox & Howard, 2003, rhythm only;). The TMN method uses a combination of pitch and duration. Our preliminary studies have shown the potential of such music reading for enhancing general reading abilities.

The TMN Method

The TMN method has been developed and tested over more than a decade. It makes use of three teaching and assessment strategies: (a) from Feuerstein (Feuerstein, 1980; Feuerstein, Rand, & Hoffman, 1979), we adopted the Mediated Learning Experience approach; (b) we applied Klein's (2003) ideas about operationally mediating criteria for young children; (c) using Tzuriel's (1998, 2001) Dynamic Assessment Modifiability approach, we were able to lead children to register information systematically and to internalize efficient cognitive and meta-cognitive strategic processes. Dynamic

assessment through mediated learning examines the child's ability to cognitive change rather than end-stabilized-test-scores. Using the three strategies allows children to optimize and enhance the development of their learning potential, independent of the learned domain.

The TMN method uses eight signs arranged in a hierarchic order: three for pitch, three for duration, one for a pause, and one to represent octaves (Carmon, 2002). It has a logical order, easy to remember, with enjoyable musical combinations. The small number of differentiated signs make it much easier for children to learn and focus on the general reading components instead of dealing with the 26 letters of the alphabet. TMN enables the full experience of music reading, focusing first on general components, before or parallel to the language-specific ones. A basic reading scheme is established that allows children to internalize the general reading experience before adding the necessary phonemes of text reading. This simple system, using a small number of easily distinguished notations, solves the problem of habitual misspelling in the transition to standard text reading. The method can also become part of an "emergent literacy" system, with the additional advantage of musical development.

Figure 1 demonstrates the notation of the song "Mary Had a Little Lamb," illustrating the mnemonic simplicity of the TMN method. One symbol (O) used in different combinations signifies three different pitches: O (one circle) represents the sound C (Do); OO (two circles) represents D (Re); OOO (three circles) represents E (Mi). A duration sign follows every pitch symbol: a horizontal line (–) represents the duration of one beat; two converging lines (<) represents the duration of two beats; and two sets of converging lines (<>) represents the duration of four beats.

Mary Had a Little Lamb

```
OOO- OO- O- OO-    OOO- OOO- OOO<
 Ma- ry  had a      li-   ttle    lamb
OO- OO- OO<        OOO- OOO- OOO<
li- ttle    lamb      li-   ttle    lamb
OOO- OO- O- OO-    OOO- OOO- OOO<
 Ma-  ry   had  a    li-  ttle    lamb
OOO- OO- OO- OOO- OO- O<>
 Its    fleece was white   as   snow
```

Figure 1. Example of TMN tune notation.

Snyder (2000) explains an important aspect of easing recall: just as 10 numerals can represent all multiple numbers, linked chains are cognitively helpful for recall of more complicated combinations. TMN uses this principle with note symbols in logical combinations and with unique didactic strategies, and explicitly focuses on general, basic reading components. The tangible (concrete) music played on instruments is followed by singing the music (abstract). Establishment of the concrete playing and abstract singing helps to connect to textual reading and comprehension (i.e., recognition of the tune).

Music Education

TMN can also influence musical education because it is much easier than conventional music notation and lays the foundation for subsequent musical education. Experience shows that the transition from TMN notes to conventional ones takes between 2 and 4 lessons, and comprehension levels are much higher than traditional learning of conventional notation. Carmon and Elkoshi (2008) showed the effect of notation learning using the TMN method on children's symbolic behavior and concluded that TMN will contribute to better reading – both textual and musical. We now describe an intervention program using this method.

Method

With the permission of the Israeli Ministry of Education, the principals and the parents, we performed the research on preschool children of low-medium socioeconomic background, in 10 kindergartens in the center of Israel. Pre- and posttests were given to preschoolers in the intervention year, and three follow-up observations were carried out to compare actual reading performance at the beginning, middle and end of the first grade.

Participants

The sample consisted of 150 5-year-olds in 10 kindergartens, with an equal number of boys and girls, who were assigned to three groups: a TMN intervention group (4 kindergartens), a conventional music intervention group (3 kindergartens), and a non-musical intervention (involving spatial gymnastics and animal care) control group (3 kindergartens).

Research Tools

Five tests, designed to assess formal reading-readiness, reading ability, and cognitive development were administered at the pre-reading stage and reading tests in the first grade.

1. Goodenough's *Draw-a-Man Test* (Harris, 1963), an indicator of readiness for formal learning, general cognitive processes, and intelligence. The test was administered three times: at the beginning and end of the preschool intervention program and at the beginning of first grade. This test has no direct connection to reading, but to general intelligence, and was used to compare the groups. Gardner (1997) found that the general intelligence base is related to specific abilities. Accordingly, we can depend on cognitive processes and intelligence (as shown in *Draw-a-Man*) to assess the children's ability to grasp reading.

2. *Concept of Print* (Hebrew version of Clay, 1977) was used for assessment of the skill of general reading components in text and pictures. It shows the development level of reading abilities in emergent literacy. The test was administered twice: before and after the intervention. It is a time consuming test, and not appropriate for the first grade, when specific verbal language reading is being acquired.

3. *Bentley's Music Abilities Test* (Bentley, 1966, translated by Sharvit, 1992) tests the discrimination of pitch, rhythm, and melodic couplets. The test was administered three times: pre- and postintervention and at the end of first grade, to determine long-term effects of the intervention. Because of the children's young age, a shortened version of the test was administered.

4. *Phonological Awareness Test* (Lapidot, Tubul, & Wohl, 1995) is considered a prognostic tool for reading success, and shows the potential level of reading acquisition skills. A shortened version of the test was administered to a random sample of children at the end of the kindergarten year and the beginning of first grade. Forty-six items were used, 2 from the beginning and 2 or 3 from the end of each of the 10 sections (initially containing 10 to 16 items each). The maximum score was 46.

5. *Informal Reading Inventory* (IRI) assesses vocal, silent, and comprehension reading levels (Silvaroli & Wheelock, 2001, based on Gray, 1968). The test battery was adjusted for each of the time frames to show how readers functioned informally. It gives a picture of children's reading on various levels:

- At the beginning of first grade, the "Stories for Beginners" (Wohl, 1995), which has a picture and sentence on every page, was used. The children retold the story and answered comprehension questions.
- In the middle of the school year, the children were asked to read two short stories, four independent sentences, and to answer comprehension questions. Teachers were also asked to complete a questionnaire on their students' reading achievements.
- At the end of the first grade, vocal and silent reading times were assessed, with questionnaires to be completed after each story. The vocal reading was tape-recorded and subsequently analyzed for the number of correctly read words out of a sample of 89. In addition, a questionnaire concerning attitudes towards reading was administered.

The Intervention Program

The preschool music intervention and the standard music group sessions lasted 30 minutes, twice a week, in groups of 5 or 6 children. The control group had a spatial-gymnastics program that included styled movement games oriented to improving posture. The sessions lasted 60 minutes, twice a week, in groups of 12 children.

Third-year university students, who administered the tests, participated in interviews and workshops before every battery of tests, including simulations with non-participating children. Reading materials were designed to ease reading and facilitate comprehension. Each test was conducted after pre-planned breaks, and its duration depended on the children's concentration level. The assessors, two graduate students majoring in special education and psychology, checked the tests separately. The inter-scorer reliability coefficient was $r = 0.96$. Analysis of variance (ANOVA) tests were performed on the dependent variables with Scheffé or Duncan tests to identify the sources of divergence. The reading parameters and correlations between dependent variables were also noted.

Results

In this article, we report results on reading acquisition skills, intelligence, cognitive processes, and reading development of the three groups (TMN, conventional music, control). The reading measures mainly showed the positive effect of the kindergarten intervention on the general reading components when applied to specific textual material. As regards the Draw-a-Man Test, all group scores except one were enhanced between the time intervals (see Table 1). No significant differences were found between groups.

Table 1. Means and Standard Deviations of the Draw-a-Man Test for the Three Groups: Analysis of Variance with Repeated Measurement 3 Times

Group	n	Preintervention M (SD)	Postintervention M (SD)	First grade M (SD)
TMN	54	4.96 (2.15)	5.06 (1.35)	6.43 (1.79)
Conventional music	51	5.31 (1.93)	5.82 (1.73)	6.02 (1.81)
Control	44	5.07 (2.41)	4.95 (1.31)	5.75 (1.83)
Total	149	5.11	5.29	6.09

A two-way two-tailed analysis of variance with repeated measures was applied and yielded an F ratio of 16.57 for time (i.e., occasions of measurement), 2 df, $p < .001$. There was no significant difference across groups, and no significant interaction of group x time.

Concept of Print involved story telling with the children's comments and answers analyzed to determine their recognition of the printed word and illustrations. Table 2 shows that significant differences were found between pre- and postintervention during the kindergarten year.

Table 2. Means of "Concept of Print" Measurement in Each Group: Analysis of Variance with Repeated Measurement, Pre- and Postintervention

Group	n	Preintervention M (SD)	Postintervention M (SD)
TMN	54	21.65 (4.89)	28.06 (6.08)
Conventional music	51	22.74 (4.70)	26.18 (6.83)
Control	44	21.33 (4.09)	25.22 (5.01)
Total	149	21.94	26.57

A two-way two-tailed analysis of variance with repeated measures was applied and yielded an F ratio of 128.86 for time (i.e., occasions of measurement), 2 df, $p < .001$. Although there was no significant difference across groups, there was significant interaction of group x time. ($F = 5.33$, 2 df, $p < .01$). Seeking the source of the significant interaction effect, we used the repeated measures ANOVA with the TMN and conventional music groups combined into one group. The combined group was found to be significantly higher than the control group ($F = 5.11$, 2 df, $p < .01$).

From our first grade reading measurements, we report on three variables: phonological awareness, vocal reading (number of correct words), and vocal reading (measured in seconds). These assessments were performed at different times in the first grade: some in the beginning, others in the middle and at the end.

The short version of the Phonological Awareness Test was administered only at the beginning of first grade (see Table 3).

Table 3. Means and Standard Deviations of "Phonological Awareness" Measurement, at the Beginning of First Grade: One-Way Analysis of Variance

Group	n	M	SD
TMN	54	33.8	7.28
Conventional music	51	32.45	6.20
Control	44	30.05	7.29
Total	149	32.2	

A one-way two-tailed ANOVA showed significant differences ($F = 3.58$, 2 df, $p < .05$) between groups. The TMN group had the highest mean (33.8), the conventional music group was second (32.45), and the control group was lowest at (30.05). By Scheffé analysis, the main difference was found to be between TMN and the control group. The conventional music group's score was near that of the TMN group but no significant differences were found between it and the control group. Duncan analysis showed significant differences ($p < .05$) between the two music groups taken together ($M = 33.14$) and the control group ($M = 30.05$), and also when the TMN group ($M = 33.8$) was compared to the other two groups combined ($M = 31.34$).

The Informal Reading Inventory (IRI) battery (administered after formal reading instruction had begun) was differentially adjusted to the level of learning at each period. Silvaroli and Wheelock (2001) suggested three index levels for the IRI: (a) Independent level – either one or no mistakes in reading and at least 80% correct answers to comprehension questions; (b) Dependent level – two or three mistakes and 70 % correct reading and answers to comprehension questions; (c) Frustrated level – more than three mistakes in reading and 60% or fewer correct answers to comprehension questions. These results are presented in Tables 4, 5, and 6.

Vocal reading was the first reading test administered in the middle of first grade (Table 4).

Table 4. Means of Correct "Vocal Reading" Words, in the Middle of First Grade: One-Way Analysis of Variance

Group	n	M	SD
TMN	50	74.36	15.56
Conventional music	51	70.14	22.19
Control	41	53.10	31.32
Total	142	61.92	23.02

A one-way two-tailed analysis of variance was applied and yielded an *F* ratio of 10.21 for groups (i.e., occasions of measurement), 2 *df*, *p* < .001. A Duncan analysis showed the two music groups, combined, to be significantly different from the control group (*p* < .001). The TMN group score was highest with a mean of 74.36 as compared to the conventional music group, whose mean score was 70.14.

The vocal reading test was administered at the end of first grade, with the results tape-recorded and analyzed for speed in seconds (Table 5).

Table 5. Means of "Vocal Reading" Time (in seconds) at the End of First Grade: One-Way Analysis of Variance

Group	*n*	*M*	*SD*
TMN	54	55.23	32.38
Conventional music	50	60.27	39.94
Control	44	108.84	81.92
Total	148	61.92	58.56

A one-way two-tailed ANOVA showed significant group differences (*F* = 14.02, 2 *df*, *p* < .001). The TMN group was fastest (mean time 55.23 seconds), whereas the conventional music group was second (mean time 60.27 seconds) and the control group was the slowest (mean time 108.84 seconds). By Scheffé analysis, the combined music groups mean (57.65) was significantly different from the control group (108.84 seconds), but no significant differences were found between the two music groups.

Immediately after the vocal reading test, a comprehension questionnaire for the IRI was administered (Table 6).

Table 6. Means of Correct Answers on "Vocal Reading Comprehension" at the End of First Grade: One-Way Analysis of Variance

Group	*n*	*M*	*SD*
TMN	54	70.03	11.67
Conventional music	50	61.41	13.65
Control	44	65.85	13.65
Total	148	65.90	14.68

A one-way two-tailed ANOVA showed significant differences (*F* = 4.70, 2 *df*, *p* < .01) between groups. The TMN group achieved the highest mean score (70.03) and the conventional music group (61.41) scored lowest. The control group fell in between. Scheffé analysis showed that each of the groups differed significantly from the other two.

At the end of the first grade, multivariate analysis of variance was carried out on scores from the tests of vocal reading times and comprehension. This analysis yielded a between-groups *F* ratio of 9.52, 4 *df*, *p* < .001. The correlation between them was significant but relatively low, *r* = +.244.

Table 7 shows a χ^2 analysis of the comparative frequency with which pupils scored on vocal reading (comprehending or not comprehending), at the end of first grade.

Table 7. Frequency of Reading Comprehension at the End of First Grade

Group	n	Comprehending	Non-comprehending
TMN	54	45	9
Conventional music	50	38	11
Control	44	26	18
Total	148	109	38

The relationship between group and comprehending measured by χ^2 was 7.877, 2 *df*, *p* < .01. The highest frequency (45) was found in the TMN group while conventional music children were second (38) and the control group had a frequency of 26. The findings for non-comprehension were the opposite. The lowest frequency (9) was found in the TMN group while conventional music children were second (11) and the control group had a frequency of 18.

To determine the correlation between phonological awareness (Lapidot et al., 1995) and Music Ability Test parameters (Bentley, 1966), we administered both tests at the end of the kindergarten year to a random sample of 27 children. The Pearson correlation was +.70, *p* < .001. The Phonological Awareness Test could not be administered before the end of the year, as it was too difficult for kindergarten beginners.

The findings confirm our research assumptions. Regarding reading variables, the TMN group achieved the best scores. The conventional music group's results were generally higher than those of the non-music group. Participation in the experimental groups was found to be the best variable for predicting the level of reading in first grade, irrespective of reading instruction methods.

Discussion

Many studies have demonstrated the effect of music on cognition and reading, but they related only to audile music without script. The full potential of music can be realized only with the addition of script, which facilitates building the base for verbal reading. TMN enhances cognitive perception of musical notation at an early age, while implementing the first reading scheme.

The standard notation group failed to implement music reading, as shown in the results. Audible music effects were confirmed in previous studies (e.g., Koren, 1993). The follow-up indicated a clear link between music and reading development. The conventional music group generally performed better than the non-music group. In most measures, the raw findings show higher achievements for the TMN intervention group. The two musical groups were sometimes combined to emphasize the general effect of music compared to the control group. In other cases, the two control groups were combined to emphasize TMN achievements.

All groups received the standard Israeli emergent literacy program for reading preparation, connecting verbal sounds to letter symbols. All of them improved in time. But the TMN group's consistently higher achievements, even in first grade, showed the value of introducing a modified music program in kindergarten. This upholds the view that active reading, even if not verbal, supports and facilitates reading skills (Hammer et al., 1992). Our studies indicate that TMN positively influences cognitive processes and helps recursive reading skills.

The differences on the Draw-a-Man Test did not appear shortly after the intervention, but rather, after the summer vacation. This seems to go hand in hand with the concept of a psychological latency period while learning is processed in the mind. The findings showed that TMN, the lowest scoring group at the beginning of kindergarten, had the highest results after the latency period. Seemingly, the results demonstrated again that the TMN learning also affects the development of children's intelligence.

The Concept of Print test, which shows emergent reading readiness of the general reading components, with some verbal specific ones, indicated that all groups enhanced significantly in time. But the interaction among the groups showed that the TMN group had the greatest improvement, and even when combined with the conventional-music group, was significantly higher than the control group. This result shows the effect of music in general, and especially of applying the TMN system to accelerate fluent reading. This is the first time that the combination of audible and visual written music was used to have an effect on early reading acceleration, accuracy, and comprehension.

The phonological awareness test was taken only at the end of the intervention year because it needs cognitive readiness, mostly not available at age 5. At the beginning of the first grade, it was delivered in a shortened version. The last two tests predicted reading achievement. The high correlation between phonological awareness and Bentley's Music Abilities Test ($r = .70$) may indicate parallel development of the discrimination of the musical components of sounds (pitch and duration) and the discrimination of verbal phonemes into consonants and vowels – an important cognitive step towards reading. These results indicate music's apparent role in the significant differences of phonological awareness and comprehension, and suggest the importance of examining the effect of progress in the awareness of different musical components on the awareness of phonemic elements. The cognition of reading-writing musical pitch (intonation) and duration (rhythm-fluency) of sounds may have been easier for the TMN group, which had the highest achievements, followed closely by the conventional music group. This result also confirms the assumption of the value of audible music. As we can see from most of our results, music has greater effect when integrated with the use of the TMN script method.

The individual vocal story-reading test (IRI) was given in the middle of the first grade, to find the number of correctly read words. The reading times were measured at the end of the first grade. Results of both tests showed significant differences among the groups, and the conventional music group was closer to the highest scores of the TMN group than it was to the control group.

At the end of the first grade, the comprehension test results were of special interest. The TMN followed the usual pattern of leading in achievement, but the conventional music group had the lowest scores. The reason for this was revealed unwittingly when examining the taping procedure. We used different techniques for the two groups. The TMN children were taped individually, each playing from notes, from two to seven songs, giving the children an opportunity to perform their notation reading. The conventional music group, on the other hand, was taught to play with carioca background music. They only participated by beating on the xylophones when they were occasionally presented with conventional notation. They did not read or play any entire musical phrase or tune. Thus, they did not develop any linear accumulation of decoded signs in full musical phrases. This activity limited their attention to the accumulated linear data, which is necessary for musical comprehension (recognition of the tune). With regard to the comprehension of a whole phrase, this may have proved to be a negative learning experience, which the control group avoided. The habit of mechanical note-by-note reading, without grasping a musical phrase, may have been the cause of the hesitated reading, which continued in the textual mode, with no evidence of children's ambition or the wish to comprehend their reading.

Furthermore, analyzing the preintervention results showed that the conventional music group was significantly higher in rhythm and somewhat higher (though insignificantly) in discernment and memory, as shown in the Bentley test. These unusual results led us to examine the cause, and revealed that the conventional music group came from higher socioeconomic levels in which the parents could afford to pay for music lessons, and many of the children had received music training before our intervention. This prior experience could explain the greater resemblance in achievement to the TMN group than to the control group. Considering the advantages of the conventional group, the scores on most measures probably under-represented the results of the TMN group. The positive results of the TMN group also continued in the first grade after the end of the intervention year.

Finally, if kindergarten children were ready to read—i.e., if they had already acquired the skills associated with reading readiness—perhaps they could acquire reading competency while still in pre-school. Most of them had not only not developed reading readiness, but could not even recognize letters or some concept of print.

By encouraging teachers to be aware of and appreciate the distinction between the two kinds of reading components, the TMN method promotes the use of explicit instructional strategies, and thus reduces the use of implicit ones, probably resulting in a positive cognitive change in the children. The method creates a graded path from the aural to the written language, comprising reading acquisition itself, though of music, before text.

A decade ago, the reading and writing phases of learning were separated, and only recent studies showed that merging the techniques helps both and improves reading readiness. In the same way, we believe that separating the general from the specific reading components by introducing TMN, and later merging them, is a most effective strategy for alleviating children's reading difficulties.

TMN reduces gaps in ability in audible-written language without arousing negative attitudes toward reading-skill training. TMN is very practical, naturally integrating into beginners' activities, without any need to change physical or pedagogical settings. Learning reading basics through TMN allows teachers to retain their regular approaches and methods for reading instruction, while supplying the basic general techniques that are not in the usual curriculum.

The results of this study show that there is a great potential for the use of music in the development of pre-reading skills. Music is known to aid in the cognitive process of text processing, and the TMN can help children to absorb the complicated cognitive process of text reading.

We believe this research should be followed by additional studies: (a) integrating computer programs with unique groups, such as gifted children or children with learning deficiencies; (b) understanding how TMN affects different cognitive processes such as attention and concentration; (c) identifying the influences of music on different languages and populations.

References

Adams, M. J. (1994). Phonics and beginning reading instruction. In F. Lehr & S. Osborn (Eds.), *Reading, language, and literacy* (pp. 3-23). Mahwah, NJ: Erlbaum.

Adams, M. J., & Bruck, M. (1993). Word recognition: The interface of educational policies and scientific research. *Reading and Writing, 5*(2), 113-139.

Amiran-Pougatchov, E. (1976). *Traffic lights and paths in musical education*. Tel Aviv: Nissimov Music Library (Hebrew).

Bentley, A. (1966). Measures of musical abilities: Tonal memory, pitch discrimination, perception of loudness [Audio cassette translated into Hebrew by U. Sharvit, 1992].

Bond, G. L., & Dykstra, R. (1997). The cooperative research program in first-grade reading instruction. *Reading Research Quarterly, 32*(4), 348-427.

Carmon, Y. (2002). *The influence of learning to read music on the ability to learn: How to decode Hebrew*. Unpublished doctoral dissertation, Bar-Ilan University, Ramat-Gan, Israel (Hebrew).

Carmon, Y., & Elkoshi, R. (2008). The effect of learning notation by means of an innovative system on children's musical perception and symbolic behavior. *Min-Ad: Israeli Studies in Musicology Online*, 1-20.

Chiu, M. M., & McBride-Chang, C. (2006). Gender, context, and reading: A comparison of students in 43 countries. *Scientific Studies of Reading, 10*(4), 331-362.

Clarke, L. (1973). *Can't read, can't write, can't talk too good either: How to recognize and overcome dyslexia in your child*. Baltimore, MD: Penguin.

Clay, M. M. (1977/1995). *Concepts about print test* (C. Tuval & I. Zeiler, Trans.). Jerusalem: The Ministry of Education (Hebrew).

Cohen, V. (1997). *The movements' method*. Paper presented at the Music Education Conference, Jerusalem.

Cox, G., & Howard, E. J. (Eds.). (2003). *Sir Arthur Somervell on music education: His writings, speeches and letters*. Woodbridge: Boydell Press.

Evans, M. A., Bell, M., Shaw, D., Moretti, S., & Page, J. (2006). Letter names, letter sounds and phonological awareness: An examination of kindergarten children across letters and of letters across children. *Reading and Writing, 19*(9), 959-989.

Feuerstein, R. (1980). *Instrumental enrichment: Redevelopment of cognitive functions of retarded performers*. New York: University Park Press.

Feuerstein, R., Rand, Y., & Hoffman, M. B. (1979). *The dynamic assessment of retarded performers*. Baltimore, MD: University Park Press.

Gardner, H. (1997). Multiple intelligences as a partner in school improvement. *Educational Leadership, 55*(1), 20-21.

Gibson, E. J., & Levin, H. (1975). *The psychology of reading*. Cambridge, MA: MIT Press.

Glenn, A., Cousins, J., & Helps, A. (2005). *Ready to read and write in the early years: Meeting individual needs*. London: David Fulton Publishers.

Goodman, K. (1986). *What's whole about whole language?* Portsmouth, NH: Heinemann.

Gray, W. S. (1968). *Gray Oral Reading Test*. New York: Psychological Corporation.

Hammer, R., Bentin, S., & Kahan, S. (1992). The influence of first graders' learning to read, on the phonological awareness development of children. *Megamot, 34*, 442-445 (Hebrew).

Harris, D. B. (1963). *Children's drawings as measures of intellectual maturity: A revision and extension of the Goodenough Draw-a-Man Test*. New York: Harcourt, Brace & World.

Inbar, E. (1991). *Music and language: Similarities and differences.* Unpublished master's thesis, Hebrew University of Jerusalem.

Inbar, E. (1999). *Emotional expression in the linguistic and musical systems in responses to verbal and musical stimuli through report and musical creation.* Unpublished doctoral dissertation, Hebrew University of Jerusalem.

Jaques-Dalcroze, E. (1930). *Art and education* (F. Rothwell, Trans.). London: Chatto and Windus.

Kaniel, S. (2001). Teaching for transfer from the learner's point of view. *Journal of Cognitive Education and Psychology, 1*(3), 266-293.

Katzir, T., Kim, Y. S., Wolf, M., Kennedy, B., Lovett, M., & Morris, R. (2006). The relationship of spelling recognition, RAN, and phonological awareness to reading skills in older poor readers and younger reading-matched controls. *Reading and Writing, 19*(8), 845-872.

Kerins, M., Winkler, K., Sweeney, M., & Carran, D. (2006). The effects of systematic reading instruction on three classifications of readers. *Reading Research and Instruction, 45*(3), 243-260.

Klein, P. S. (1997). *A smarter child*. Ramat-Gan: Bar-Ilan University Press (Hebrew).

Klein, P. S. (2003). A mediational approach to early intervention: Israel. In S. L. Odom, M. J. Hanson, J. A. Blackman, & S. Kaul (Eds.), *Early intervention practices around the world*. Baltimore, MD: Paul H. Brookes.

Kodály, Z. (1945). Zenei kozneveles [public musical education]. *Emberneveles, 1*, 1-2. Reprinted in E. Blom (Ed.), (1970), *Grove dictionary of music and musicians* (5th ed., Vol. 4, p. 805b). New York: St. Martin's Press.

Kodály, Z. (1943-48). Szo-Mi for children. Reprinted in E. Blom (Ed.), (1970), *Grove dictionary of music and musicians* (5th ed., Vol. 4, p. 804b). New York: St. Martin's Press.

Koren, S. (1993). *The relevance of musicality to the acquisition of foreign language pronunciation.* Unpublished doctoral dissertation, Bar-Ilan University, Ramat Gan, Israel.

Lapidot, M., Tubul, G., & Wohl, A. (1995). A test of phonological awareness as a predictor of reading acquisition. *Chelkat Lashon, 19-20*, 169-188 (Hebrew).

Orff, C. (1930-33). Schulwerk, elementare musikubung [elementary school mastering of music]. Reprinted in E. Blom (Ed.), (1970), *Grove dictionary of music and musicians* (5th ed., Vol. 6, p. 282). New York: St. Martin's Press.

Paulson, L. H., Kelly, K. L., Jepson, S., Van Den Pol, R., Ashmore, R., Farrier, M., & Guilfoyle, S. (2004). The effects of an early reading curriculum on language and literacy development of head start children. *Journal of Research in Childhood Education, 18*(3), 169.

Piaget, J., & Inhelder, B. (1967). *The child's conception of space*. New York: Norton.

Platel, H., Price, C., Baron, J. C., Wise, R., Lambert, J., Frackowiak, R. S., Lechevalier, B., & Eustache, F. (1997). The structural components of music perception: A functional anatomical study. *Brain, 120*(2), 229-243.

Rauscher, F. H. (1995). Does music make you smarter? *PTA Today, 20*(5), 8-9.

Rauscher, F. H. (1997). A cognitive basis for the facilitation of spatial-temporal cognition through music instruction. In V. Brummett (Ed.), *Ithaca conference '96: Music as intelligence: A sourcebook* (pp. 31-44). Ithaca: Ithaca College Press.

Rauscher, F. H., & Shaw, G. L. (1998). Key components of the Mozart effect. *Perceptual and Motor Skills, 86*, 835-841.

Rauscher, F. H., Shaw, G. L., & Ky, K. N. (1995). Listening to Mozart enhances spatial-temporal reasoning: Towards a neurophysiological basis. *Neuroscience Letters, 185*(1), 44-47.

Rauscher, F. H., Shaw, G. L., Levine, L. J., Wright, E. L., Dennis, W. R., & Newcomb, R. L. (1997). Music training causes long-term enhancement of preschool children's spatial-temporal reasoning abilities. *Neurological Research, 19*(1), 1-8.

Rayner, K., & Pollatsek, A. (1989). *The psychology of reading*. Englewood Cliffs, NJ: Prentice-Hall.

Reiter, J. B. (1999). The rainbow word/rebus association sheet (Rebus Sheet). From http://www.geocities.com/Athens/Cyprus/8493/RebusSheet.htm

Ring, R. (2005). Dalcroze versus eurhythmics? *Le Rythme*, 6-8.

Sarnthein, J., von Stein, A., Rappeisberger, P., Petsche, H., Rauscher, F. H., & Shaw, G. L. (1997). Persistent patterns of brain activity: An EEG coherence study of the positive effect of music on spatial-temporal reasoning. *Neurological Research, 19*(1), 107-116.

Schafer, R. M. (1967/1981). *Ear cleaning* (V. Hacohen & S. Hacohen, Trans.). Tel-Aviv: Reshafim (Hebrew).

Silvaroli, N., & Wheelock, W. (2001). *Classroom reading inventory* (9th ed.). Boston, MA: McGraw Hill.

Snyder, B. (2000). *Music and memory: An introduction*. Cambridge, MA: The MIT Press.

Sobol, E. S. (in press). *An attitude and approach for teaching music to special learners* (2nd ed.). New York: MENC / Rowman & Littlefield Education.

Spiegel, D. L. (1998). Silver bullets, babies, and bath water: Literature response groups in a balanced literacy program. *Reading Teacher, 52*(2), 114-124.

Suzuki, S., & Grilli, S. (1992). An interview with Dr. Shin'ichi Suzuki at the Talent Education Institute, Matsumoto, Japan, on 18 April 1991. *International Review of Education, 38*(5), 547-551.

Tzuriel, D. (1998). *Cognitive modifiability: Dynamic assessment of learning potential*. Tel Aviv: Sifriat Poalim (Hebrew).

Tzuriel, D. (2001). *Dynamic assessment of young children* New York: Kluwer Academic/Plenum.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes.* Cambridge, MA: Harvard University Press.

Weiss, I. (2000). *Are cognitive skills context bound? Evidence from analogical problem-solving training.* Unpublished doctoral dissertation, Bar-Ilan University, Ramat Gan.

Whalley, K., & Hansen, J. (2006). The role of prosodic sensitivity in children's reading development. *Journal of Research in Reading, 29*(3), 288-303.

Wohl, A. (1995). *Stories for beginners*. Tel Aviv: Center of Educational Technology (Hebrew).

Wohl, A. (1998). The beginnings of literacy. In *Reading: Theory and practice* (pp. 34-35). Tel Aviv: The Open University (Hebrew).

Woodcock, R. W., Clark, C. R., & Davies, C. O. (1979). *Peabody Rebus Reading Program.* Circle Pines, MN: AGS Publishing.

Yishay, A. (1992). *Two pre-school enrichments influence on learning skills.* Unpublished doctoral dissertation, Bar-Ilan University, Ramat-Gan, Israel.

Address for correspondence:
Yehudith Carmon
School of Education, Bar-Ilan University
Ramat-Gan
18, Herman-Cohen Street
Tel-Aviv, ISRAEL 64385
Carmonj@barak.net.il

Reśumé

La Méthode des Notes Musicales pour l'Apprentissage Initial de la Lecture

Un siècle d'approches expérimentales dans l'enseignement n'a pas permis de réduire significativement les problèmes d'acquisition initiale de la lecture. Bien que les chercheurs continuent à mettre en lumière de plus en plus de symptômes à l'origine des déficiences, ils n'ont, jusqu'à présent, trouvé que peu de solutions. L'enseignement initial de la lecture commence traditionnellement par les composants particuliers d'une langue spécifique. Dans cette recherche, nous proposons une méthode qui commence par les composants généraux de base de la lecture communs à toutes les langues alphabétiques écrites, y compris la notation musicale. Nous proposons d'introduire la lecture en utilisant un outil musical original et simple, la méthode du « Jeu des Notes Musicales ». Après avoir créé un premier schème de lecture à travers la musique, la lecture verbale devient beaucoup plus facile. Notre méthode a été évaluée sur 150 enfants d'école maternelle

(préscolaire), qui ont participé à trois programmes d'intervention : un groupe a bénéficié du « Jeu des Notes Musicales », un groupe d'un enseignement de la musique conventionnel et un groupe contrôle n'a reçu aucun programme d'intervention musicale. Les pré- et post-tests ont été administrés dans les écoles menant un suivi pour évaluer les effets sur le développement de la lecture. Les résultats ont reflété des réussites significatives pour le groupe qui a bénéficié de la méthode « Jeu des Notes Musicales » sur tous les paramètres de lecture : nombre d'erreurs, temps de lecture à haute voix, vitesse de lecture et compréhension. L'application de cette méthode nous a permis d'utiliser l'intérêt musical facilement éprouvé par les enfants pour les aider à apprendre à lire et à mieux comprendre.

Resumen

El Método de Notas Musicales para la Adquisición Inicial de la Lectura

Un siglo de enfoques experimentales en la enseñanza de la lectura no ha logrado reducir significativamente los problemas de adquisición inicial de la lectura. Aunque los investigadores continúan en sacar a la luz, cada vez más, que están en el origen de las deficiencias, han encontrado, hasta el día de hoy, muy pocas soluciones. La enseñanza inicial de la lectura comienza tradicionalmente por los componentes específicos de una lengua. En esta investigación hemos experimentado un método que comienza por los componentes generales y básicos de la lectura, que son comunes en todas las lenguas alfabéticas escritas, incluyendo la notación musical. Proponemos introducir la lectura utilizando una herramienta musical original y simple, denominada "Juego de Notas Musicales." Después de haber creado un primer esquema de lectura a través de la música, la lectura verbal llega a ser mucho más fácil. Nuestro método fue experimentado con 150 niños de la escuela infantil, que han participado en tres programas de intervención: un grupo trabajó con el método "Juego de Notas Musicales", otro grupo a través de la enseñanza de la música convencional y el grupo de control no recibió ningún programa de intervención musical. El pretest y el posted fueron aplicados en las escuelas, llevando a cabo un seguimiento para evaluar los efectos sobre el desarrollo de la lectura. Los resultados reflejaron efectos significativos a favor del grupo enseñado con el método "juego de las notas musicales" en todos los parámetros de lectura analizados: número de errores, tiempo de lectura en voz alta, velocidad lectora y comprensión. La aplicación de este método nos ha permitido utilizar el interés musical de los niños para ayudarles a aprender mejor a leer y a comprender.

Zusammenfassung

Die Methode der Musikalischen Noten für die Initialen Leseerwerb

Ein Jahrhundert experimenteller Ansätze zum Leseunterricht hat initiale Probleme des Leseerwerbs nicht signifikant verringert. Obwohl Forscher fortfahren, immer mehr Symptome von Defiziten zu identifizieren, sind sie bis heute mit nur wenigen

Lösungsvorschlägen hervorgetreten. Leseunterricht beginnt traditionellerweise mit den einzelnen Komponenten einer spezifischen Sprache. In der vorliegenden Forschung schlagen wir eine Methode vor, die mit allgemeinen, grundlegenden Lesekomponenten beginnt, wie sie in allen geschriebenen alphabetischen Sprachen einschließlich der musikalischen Notation vorkommen. Wir schlagen vor, Lesen mit Hilfe eines originären und einfachen musikalischen Verfahrens, der Toy Musical Notes-Methode (TMN, Musikalische-Notenspielzeug-Methode) einzuführen. Nachdem hierbei über Musik ein einfaches Leseschema geschaffen worden ist, erweist sich verbales Lesen als viel einfacher zu bewerkstelligen. Unsere Methode wurde bei 150 Vorschulkindern untersucht, die auf drei Interventionsprogramme aufgeteilt wurden: TMN, konventionelle Musik sowie eine Kontrollgruppe, die ein nicht-musikalisches Interventionsprogramm erhielt. Es wurden Prä- und Posttests durchgeführt. Anschließend wurden an den Schulen Follow-up-Untersuchungen zur Entwicklung der Lesefähigkeit angestellt. Die Ergebnisse zeigten bei der TMN-Gruppe signifikante Verbesserungen auf allen Leseparametern: Anzahl der Fehler, vokale Lesezeit, Schnelligkeit und Verständnis. Die Anwendung dieser Methode erlaubte es uns, das bereitwillig verfügbare musikalische Interesse von Kindern zu nutzen, um ihnen zu helfen, besser lesen und verstehen zu lernen.

Abstract Italiano

Il Metodo delle Note Musicali per l'Acquisizione Iniziale della Lettura

Un centenario di approcci sperimentali alla lettura non ha ridotto in modo significativo i problemi iniziali nell'acquisizione della lettura. Sebbene i ricercatori continuino ad identificare sempre più sintomi di carenze, essi hanno finora trovato poche di soluzioni. L'insegnamento della lettura tradizionalmente inizia con componenti particolari di uno specifico linguaggio. In questa ricerca proponiamo un metodo che parte con componenti generali della lettura, comuni a tutti i linguaggi scritti di tipo alfabetico, inclusa la notazione musicale. Proponiamo di introdurre la lettura usando un semplice e originale mezzo musicale, il metodo del Gioco delle Note Musicali (TMN, Toy Musical Notes). Dopo aver creato attraverso la musica un primo schema di lettura, la lettura verbale diventa molto più semplice. Il nostro metodo è stato testato su 150 bambini di età prescolare che hanno partecipato a 3 programmi di intervento: TMN, musica convenzionale, e un gruppo di controllo che ha ricevuto un programma di intervento non-musicale. Sono stati somministrati pre e post test nelle scuole conducendo valutazioni di follow-up nello sviluppo della lettura. I risultati hanno mostrato acquisizioni significative per il gruppo TMN su tutti i parametri legati alla lettura: numero di errori, tempo di lettura vocale, velocità e comprensione. Applicare questo metodo ci permette di usare da subito l'interesse musicale di cui i bambini dispongono, per aiutarli ad imparare a leggere e comprendere meglio.