The Effect of Learning Notation by means of an Innovative System on Children’s Musical Perception and Symbolic Behavior

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Introduction

This paper has two aims: (a) to study the effect of learning notation by means of an innovative system, called TMN (Toy-Musical-Notes), on the musical perception and symbolic behavior of first-grade boys and girls; (b) to explore gender differences in symbolic behavior between the boys and the girls. Participants were 83 first graders from four classes in two Jewish religious schools in central Israel. Boys and girls study in separate classrooms in these schools. Two classes have undergone a short learning program of four sessions, in which the TMN notation system was learned, hence the experimental group (N=44). The other classes, who did not undergo the intervention program, functioned as a control group (N=39). Pre- and post-tests were administered before and after the intervention, respectively. Results were based on comparing pre- and post-tests within the experimental and control groups, and among boys and girls. Findings indicate a significant influence of the learning program on the experimental students (when considering the boys and the girls as a single group). However, there were gender differences among the students: although boys and girls reached similar post-test results, girls had higher pre-test results and made little subsequent progress, whereas boys had lower pre-test results and progressed significantly higher. Music teachers are often reluctant to use “non-conventional” notation methods. This study shows that even a short intervention program with the TMN method will enhance pupils’ symbolizing skills.

Theoretical Background

Many educators in the Western culture assume that learning notation is an important element in music learning for young children, arguing that the acquisition of conventional notation enables musical enhancement and later professional growth (e.g. Lychner 2002; Mills & Phillips 2007). Others claim, by contrast, that the use of notation and musical scores is too difficult and sophisticated; therefore, they think that a notational reform should be instituted to either simplify the existing system as the initial stage of music education and/or to replace it altogether for non-professionals (e.g. Schoenberg 1924; Risatti 1976; Read 1987; Reed 1997). Episodes in the history of music education, such as the famous cases of the American John Tufts¹ and the Briton John Curwen,² reflect the difficulties and
obstacles that notation learners encounter, as well as the reforms that were suggested in order to ease the notation learning processes. In America, during the seventeenth and eighteenth centuries, reforms were carried out in an attempt to provide members of church choirs with a user-friendly method for sight-reading conventional notation.

Difficulties and frustrations in learning standard notation, and revolutionary experiments designed to counter these difficulties, are not merely part of our musical heritage; they remain a prominent feature in our present reality. Many musicians try to solve this problem by transforming the learning process into a pleasant and less stressful undertaking. Schafer (1981), for example, claims that conventional notation is too complicated, and therefore requires years of training. Our educational system needs a simple system that can be taught in minutes.

Since the end of World War II, hundreds of notational reforms have been suggested (e.g. Karkoschka 1972; Tisatti 1976; Burton 1982; Read 1987; Reed 1997). International organizations such as MNMA, whose members are musicians and music educators, are dedicated to musical literacy and notational innovation (Keisler 2006). It is interesting to realize that amateur and professional musicians alike are engaged in trying to invent new notations (Risatti 1976; Read 1987; Reed, 1997), as are scientists, philosophers, priests, lawyers and engineers (Read, 1987).

In Israel, composers and music educators invent new kinds of notation and apply these innovations in their compositions (e.g. Arbel, “Before Lachish,” cited in Carmon 1990, 22; Osnat 1980; Bukspan 1973 Dorfman, 1975, cited in Carmon 1990; and many others). Thus, for example, a large portion of Israeli music for solo string instruments composed from 1932-89 utilizes original notations (Carmon 1990). In the field of music education, dozens of booklets for pupils in the early stages of instrumental study make use of original notational systems (e.g. Carmon 2006; Atar 2006; Caganovitz 2005; Zolotoyavko 2004). Most notation inventors are convinced by their teaching experience that their notational invention is the ideal method for the promotion of musical skills. Atar (2006), for instance, describes the efficiency of his method: “My method enables effortless score reading…. It brings about an immediate improvement in playing the piano; it reduces mistakes and diminishes the need for intense concentration on the part of the player.”

Carmon (2006) explains her TMN method, intended for music beginners:

The TMN method circumvents the difficulties of conventional notation. The method enables the student to play from notes in a short time (within several hours). The method is a very easy, enjoyable and creative way of learning to play and to develop reading abilities. The notation comprises a small amount of signs that are easily differentiated from each other, making it very easy for children to learn. By learning notation through the TMN method, the children develop their auditory memory, audio-visual integration, internalization of the alphabet principle, the accumulation of signs and holding them in memory up

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1 John Tufts (1689-1750) was a priest who collected and edited a booklet that included musical principles and written tunes in “fah-sol-la” notation. The booklet’s preface was an introduction to the simple and very easy art of Psalmody singing, and was published in many editions in Boston in the years 1721-44. This introduction assisted in the stimulation of a singing movement in New England that represents the beginning of established music education in America (Lowens in Cooke 2007).
2 John Curwen (1816-80) was an English teacher and priest, who believed that notation script should be the lot of all human beings, with no regard to status and age (Curwen 1872).
4 In the notation script named “wrinkle notes,” displacement signs in the five staff rows are represented by partial shadowing of fonts.
to achieving the meaning, directionality, succession, velocity and more. The system is adjusted for early childhood as a first reading acquisition.

Carmon investigated the effect of learning TMN on kindergarten children’s verbal reading acquisition ability (N=150) in the first grade (Carmon 2002). The two-year study indicates that the TMN program in kindergarten significantly improved the children’s reading skills in all reading measures as they reached first grade.

Another study (Elkoshi 2006) examined the influence of learning standard notation on schoolchildren's musical perceptions, as reflected in their invented graphic notations purporting to represent rhythmic patterns. The study showed that conventional notation learning enhanced the children’s associative reactions, in comparison with their pre-learning responses, as well as in comparison with a control group of students who had never studied standard notation. On the other hand, other studies showed that using musical notation might be an obstacle to musical performance (e.g. LoVetri 2005; Zdechlik 2007) and creativity (e.g. Auh & Walker 1999), mainly because of the incompatibility between sounds and specifications of the staff notation (Truman 2007).

Recent studies explored the impact of using alternative notations instead of the standard notation (e.g. Kerchner 2001; Shockley 2006; Blair 2006; Zdechlik 2007). It was found that mapping, namely designing a diagram that describes the main components of a musical work, supplies a general overview of a musical work for beginners (Shockley 2006). It was also found that the synchronization between digital graphic representation and traditional music notation assisted learners in discovering relationships between the two notational systems (Zdechlik 2007). Gromko (2002), for example, studied graphic maps designed by young children in response to their aural perception of European art music, and the children’s accurate reading of graphic maps while listening to the music. Following her research, Gromko recommends teaching listening skills before studying notation.

For over fifty years, research on children’s activities in the visual arts attracted the attention of psychologists, who believed in the possibility of explaining cognitive development through symbolic behavior (e.g. Arnheim 1974; Davidson & Scripp 1988; Gardner 1979, Golomb 1992; Matthews 1999, 2003). Consequently, researchers in recent years have explored the signs and symbols that children employ when inventing notations that represent music (Bamberger 1991; Barnett 1997; Burnard 2000; Elkoshi 2002, 2003, 2004a, 2004b, 2006; Elkoshi et al. 2007; Gromko 1994; Murphy & Elkoshi 2004). Studies show that invented notations act as a prism thorough which one can study the subject’s musical perception. Musical perception as a result of rote memorization training was also studied (Iломаки 2007). However, as far as we can ascertain, no previous study in Israel has addressed the effect of alternative symbolic systems on children’s musical perception and intuitive symbol behavior.

The TMN system is predicated on the notion, generally accepted by literacy researchers, that the first reading is the most difficult and any subsequent reading is easier (Rayner & Pollatsek 1996). In order to ease reading acquisition, we turned to the music domain, since many studies showed it to be more neutral and primary than verbal language (Inbar 1990, 1999 and others), and revealed its significant influence on cognitive processes, and specifically on reading (Rauscher 1996; Rauscher et al. 1998, 1998a). Conventional notation, being no less complicated than verbal script, cannot be used as preparatory reading in preparation for the acquisition of verbal script. TMN development enabled, for the first time, the use of music notation as potential material for reading abilities development, by creating a first reading scheme (music reading) to precede the second one (verbal reading).
The Purpose of the Study

The purpose of the current study was to explore the influence of learning an alternative notation system on the musical perception and symbolizing behavior of boys and girls in their first year at school. The research had two specific aims:
(a) To study the effect of learning notation by means of an innovative system entitled Toy-Musical-Notes (TMN) on the musical perception and symbolic behavior of first-grade children at initial stages.
(b) To explore gender differences in symbolic behavior between religious boys and girls who study in separate classrooms.

Procedure

The experiment took place in two religious schools in central Israel, where boys and girls learn in separate classrooms. The participants were eighty-three first-graders from four classes. The experimental group (N=44), which received a short learning program of four meetings, in which they studied notation in the TMN method, consisted of two classes (one of boys and one of girls). The control group consisted of two other classes (one of boys and one of girls) that did not participate in the intervention program (N=39). A test was administered prior to and after the intervention period.

Pre- and Post-tests

Prior to the implementation of the learning program, all of the participants had a pre-test named “Drawing Notations.” This test was intended to examine the children’s ability to invent spontaneous symbols that represent a short rhythmic phrase consisting of five sounds: quarter, quarter, two eighths, and quarter. The rhythmic pattern was embedded in a story that was dramatized as a puppet show. Soon after the children had performed the rhythmic pattern, they were asked to invent a graphic notation that represented it, and each pupil explained his or her painting in a personal interview. The pre-test was conducted again as a post-test at the end of the intervention program.

The Intervention Program

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6 According to the division: A1 boys’ class (N=19) and A1 girls’ class (N=25).
7 According to the division: A2 boys’ class (N=19) and A2 girls’ class (N=20).
8 In this test, children created a connection between rhythm sounds and language sounds (syllables of the rhythm) and spontaneous visual representations. That is, the personal, invented graphemes of every tested child were examined for pattern representation. This process is named “phono-graphic translation” (Elkoshi 2000).
The intervention program lasted three months and consisted of four meetings with each experimental class. During the meetings, pupils learned to read and write music using the TMN notation method.

The Toy Musical Notes is an original notation system invented by Carmon (2002). The system includes separate symbols to represent pitch and duration. Three signs in various logical combinations represent twelve pitches (OXI). For example, C (Do) is represented by a circle, D (Re) by two circles, E (Mi) by three circles, and so forth. Durations are represented by three signs: · · · < representing an eighth-note, quarter-note and half-note respectively. The pitch sign is followed by its duration—for example, a circle and horizontal line represent Do quarter. Two other signs represent rests and register.

The TMN system is organized in a method of gradations, from concrete (playing according to the symbols) to abstract musical concepts. The method integrates strategies with games activities; stories and improvisation are used to develop the discrimination of musical structures and literacy base.

**The Research-program Learning Process**

The first two 45-minute meetings were conducted with the entire class, whereas the last two meetings were conducted in smaller sub-groups, each consisting of 6-7 pupils; each group was given a 10-minute lesson.

In the first meeting, pupils learned to drum words according to the number of syllables (not phonemes) in each word, and to represent the number of syllables with an appropriate sequence of dashes (for instance: “Riv-ka” - - ). Eventually, the children were asked to classify their names according to the number of syllables, and to represent a list graphically.

Accordingly, for instance: “Dan/ Riv-ka /Ev-ya-tar/ Da-ni-e-la” / - / / / / / - / - - - /

The second meeting covered two subjects:

(a) The children learned rhythmic values through a story about “a pilot who identified traces of footprints in the sand.” The footprints were represented using the following symbols: [- · · · · · · · .. .. .. < < < ]. Here, a short line [- ] represents a quarter (as in the word “go”); two dots represent two eighths [.. ] (as in the word “run-ning”); and a small angle [< ] represents a half-note (as in the word “ly-ing”). The children performed various rhythmic patterns while using these symbols.

(b) The children learned to play middle C (Do) and second octave ‘C on a xylophone marked by a circle [O], and a circle with an apostrophe [’O] respectively. Symbols in between circles represent time values. The children played and sang the TMN notes that now integrated pitch and duration. For example: O- ‘O- O. O. O-

The third meeting focused on two new pitches: D (Re), symbolized by a pair of circles [OO], and E (Mi), symbolized by three circles [OOO]. The training was accomplished using a repertoire of short songs.

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9 For instance: go- go- go- running.. running.. running.. running.. lying< lying

- - - · · · .. · · · .. · · · .. < <

© Y. Carmon & readandplay.co.il (2002).

10 For instance: “come here children come and play, Game of hiding hideaway” is transcribed in this notation as: O- OO- O- OO- O- OO- O< O- OOO- O- OOO- O- O- O<

© Y. Carmon & readandplay.co.il (2002).
The fourth meeting became a spontaneous improvisation lesson, based on the children’s enthusiastic welcoming cry: “Yu-dit and Riv-ka.” This rhythmic call was turned into learning material: The children played it on their instruments, notated it using TMN symbols, in the pitch and duration of the theme, and developed variations and improvisations.

Data Analysis

In order to investigate the impact of the intervention program on the children’s musical perception and musical symbolizing behavior, we compared the spontaneous notation children invented in the “picture-script” pre-test to their representations of the same rhythmic pattern at the end of the intervention program.

The Method for Drawing Analysis

Drawings were analyzed by a method entitled MSC (Morphological-Structural-Conceptual analysis) that had been developed in previous studies (Elkoshi 2000) and implemented in several other research projects (Elkoshi 2002, 2003, 2004a-d; Murphy & Elkoshi 2003; Elkoshi, Murphy & Burnard 2007). The method, which applies principles from graphology and child art studies, proved reliability and validity in a current research study (Elkoshi 2006). The analysis of drawings and notations according to the MSC method proceeds progressively and consistently in three phases: Material Analysis (M), which engages in morphological descriptions of visual phenomenon (colors, shapes, scribbles, icons); Structural Analysis (S), which examines the drawing as a gestalt and explores the interrelationships between its parts (proportions, directionality, symmetry); and Conceptual Interpretation (C), which defines the content of the drawing and evaluates the subject’s reaction. Final interpretations of drawings are supported by the subjects’ verbal explanations of their drawings. Each drawing is then classified under five categories of perception: OAPFG

- **O** – Out-of-context: unrelated drawings; displays of idiosyncratic themes not connected to the assignment;
- **A** – Association: representation of story elements, metaphors, images showing evidence of the subjects’ focus on the narrative elements presented;
- **P** – Pictogram: representations of musical instruments used in the experiment, showing evidence of the subjects’ focus on sound producers;
- **F** – Formal Response: representations of sound sequences (usually with a one-to-one correspondence between sound and symbol), showing evidence of the subjects’ focus on musical sound;
- **G** – Gestalt: representations of musical units, showing evidence of the subjects’ focus on figural aspects of sound (e.g. repetitions of a musical phrase, division of phrase into sub-units).

Examples

The following drawings, arranged in pairs, were made by the boys and girls from the experimental and control groups prior to and after the intervention, respectively:
Example 1  Nitzan (Experimental Group—Boys)

<table>
<thead>
<tr>
<th>Prior to the Intervention</th>
<th>Post-intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
</tr>
</tbody>
</table>

Nitzan represents the musical instruments: “here is a bell” (on the right, in black) “the wooden-block” (in the middle, in brown) and “Darbuka” (on the left, in red). The drawing is categorized as P, as it is a pictogram of the musical instruments.

Example 2  Eli (Experimental Group—Boys)

<table>
<thead>
<tr>
<th>Prior to the Intervention</th>
<th>Post-intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image3.png" alt="Image" /></td>
<td><img src="image4.png" alt="Image" /></td>
</tr>
</tbody>
</table>

Eli represents the musical instruments with long lines: a brown wooden block (top right), a black bell (bottom right), and a reddish drum (on the left), with a drumstick above each instrument. The drawing, which represents a pictogram of musical instruments, is categorized as P.

Nitzan’s second representation is in TMN notation, written from left to right as required, with vertical lines representing two quarters (“ta ta”) and three tiny circles representing three eighths(“ti ti ti”). The drawing is categorized as F, as it is a formal representation of the sound succession.
**Example 3  Talia (Experimental Group—Girls)**

<table>
<thead>
<tr>
<th>Prior to the Intervention</th>
<th>Post-intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Drawing Prior to the Intervention" /></td>
<td><img src="image2.png" alt="Drawing Post-intervention" /></td>
</tr>
</tbody>
</table>

Talia draws three musical instruments from right to left: a brown wooden block, a metal bell and a hollow Darbuka drum. The drawing represents pictogram musical instruments and is categorized as P.

Musical instruments with specified colors appear in Talia’s second drawing: an orange wooden block, a red bell with a yellow handle, and a green drum with a brown drum surface. Numbers appear above the instruments representing the series of respective tapings: 1, 1, 123. The drawing falls under categories PF for representing, respectively, instruments (P) and a sound succession (F).

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**Example 4  Rivka (Experimental Group—Girls)**

<table>
<thead>
<tr>
<th>Prior to the Intervention</th>
<th>Post-intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image3.png" alt="Drawing Prior to the Intervention" /></td>
<td><img src="image4.png" alt="Drawing Post-intervention" /></td>
</tr>
</tbody>
</table>

With a pencil, Rivka draws a wooden block, a bell and an Arab drum (from right to left) and inscribes verbal labels accordingly: “wood,” “metal,” and “leather” (category P).

Following TMN learning, Rivka changes the former right-to-left directionality and draws from left to right: a wooden box, a metal cymbal, and a drum (painted upside down with the tapering cone at the bottom). This time, alphabetical labels represent the succession of strokes accordingly: “wood, metal [with spelling mistake], leather, leather, leather [with spelling mistake].” The drawing is categorized as PF because it represents a pictogram of musical instruments (P) and a sound succession (in alphabet labels) (F).
Example 5  Achinoam (Control Group—Girls)

<table>
<thead>
<tr>
<th>Prior to the Intervention period</th>
<th>After Three Months</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Drawing 1" /></td>
<td><img src="image2.png" alt="Drawing 2" /></td>
</tr>
</tbody>
</table>

In this monochrome drawing, musical instruments appear from right to left according to the order of sounds: a wooden block with a drumstick, a metal bell, and three drums one on top of the other. Five items (a wooden block, a bell, and three drums) represent five sounds in succession. The drawing is categorized as PF because it represents, respectively, musical instruments (P) and five sounds (F) through five items.

In the second, multi-color drawing, Achinoam includes a wooden tree described in schematic colors (brown trunk, green treetop), which is an associative representation of the first sound, which was performed on a wooden instrument. On the left are the musical instruments: a rectangular wooden block, a bell beneath it, and three blue drums – one above the other. Every instrument has a drumstick (with a yellow handle and red bead). Five instruments and sticks represent five sounds, respectively. The drawing is categorized as APF for including, respectively, associations (a wooden tree) (A), pictograms of musical instruments (P), and a sound succession represented by instruments and drumsticks (F).

Example 6  Matanel (Control Group—Boys)

<table>
<thead>
<tr>
<th>Prior to the Intervention Period</th>
<th>After Three Months</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image3.png" alt="Drawing 3" /></td>
<td><img src="image4.png" alt="Drawing 4" /></td>
</tr>
</tbody>
</table>

Matanel explains his drawing: “this is a palace with guards and a wall…. In the palace there are musical instruments.” The instruments are differentiated by colors: a brown drum, a yellow triangle 82 82

In his second painting Matanel draws four instruments: a big drumstick on the right, a drum in the center (a colored circle with three flat legs), and cymbals on the left (brown with a blue handle). At the bottom
Summary of the Sample of Drawings:

The following table summarizes perceptions among boys and girls in the experimental and control groups:

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Pre-</th>
<th>Post-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Talia</td>
<td>P</td>
<td>PF</td>
</tr>
<tr>
<td>Rivka</td>
<td>P</td>
<td>PF</td>
</tr>
<tr>
<td>Nitzan</td>
<td>P</td>
<td>F</td>
</tr>
<tr>
<td>Eli</td>
<td>P</td>
<td>FG</td>
</tr>
<tr>
<td>Achinoam</td>
<td>PF</td>
<td>APF</td>
</tr>
<tr>
<td>Matanel</td>
<td>A</td>
<td>P</td>
</tr>
</tbody>
</table>

From the table it appears that O (Out of context) responses are not to be found at all, and G responses are rare and found only once, in Eli’s later drawing (experimental group). Following the TMN program, boys change their representations, and move from descriptions of instruments (P) to representations of sounds, using the TMN calligraphy. Eli’s formal drawing is more complex than Nitzan’s, as it represents phrase repetitions. By contrast, the girls consistently employ P representations. Their later drawings are more complex (thanks to the addition of F elements to their pictograms), and more detailed (for example, Talia uses color differentiation to represent different parts of the musical instruments).

A comparison between boys and girls in the experimental group shows that girls continue to use pictograms, but they enrich them with F representations (numbers and words), whereas boys abandon P responses in their representation of sound sequences and adopt the TMN calligraphy instead, thereby employing F representation exclusively. Boys and girls in the experimental group share one common structural feature: they both replace their former directionality (girls from right to left, boys in a circular motion) with the newly acquired left-to-right directionality.

The control group boys continue to employ P representations consistently, showing that they focus on sound producers. The directionality of the control group children does not change either: Matanel and Achinoam continue to use a circular flow and a right-to-left directionality, respectively. Associate representations appears only in the control group, though at varied times.
The Statistic Analysis of the Research Results

The statistical analysis of the research results shows that the only significant differences between pre- and post-intervention in the boys’ experimental group pertain to OFG responses (N=20). The girls’ experimental group (N=25) showed no significant differences in AFG responses. In this group, O responses were found neither before nor after the learning process.

The results of the boys’ control group did not reveal any significant differences, in either the pre- or the post-learning phase, in any type of response.

The results of the girls’ control group (N=20) showed a significant difference in the three-month period (without the intervention program) only in F responses. In the pre-test period, one F response was found, and after three months it ascended to 7 (p=0.016).

An examination of the experimental group seemed to reveal more significant changes in the different responses between the pre- and post-learning phrases, compared to the control group.

The findings from the examination of the entire experimental group—treating the boys and the girls as a single group—revealed significant differences between the pre- and post-learning phases in responses O, F, G. In the F responses, an examination of the general experimental group revealed significant differences between the pre- and post-learning phase. Eleven pupils responded F after the learning period without intervention.

In order to find differences between experimental and control groups regarding the sum of all of the responses, each response was assigned a different numerical value as follows: O=0; A=1; P=2; F=4; G=8. Using this procedure, we measured a larger overall post-learning ascent in the experimental group, compared to the control group: The ascent index in the experimental group was from 2.89 in the pre-learning period to 8.38 post-learning, while the control group only ascended from 4.33 to 6.56.

11 The analysis was prepared by Dr. Shmuel Even-Zohar, Scientific Applications Department, Computer Sciences, Bar-Ilan University.

12 The differences between pre- and post-intervention program tests refer to every response separately. They were checked by the McNemar Software Test, which refers to the frequency of finding the response in every group. The test considered at the beginning considered separately every examined group of the table. The five responses (O, A, P, F, G) checked the pre-post intervention program that received value 1 when appearing in tested drawing, or value Zero 0 if not.

13 Response O was found in one boy’s pre-intervention drawing and disappeared afterwards (p=0.031). Response F was found in four boys’ pre-intervention drawings and ascended to 16 afterwards (p=0.001); Response G was found in one boy’s pre-intervention program drawing and ascended afterwards to 13 (p=0.000).

14 Response A was found in one girl’s pre-intervention painting and ascended to 8 afterwards (p=0.039). Response F was found in one girl’s pre-intervention drawing and ascended to 13 afterwards (p=0.016).

15 Response O was found in 6 tested children and disappeared afterwards; and 39 tested children had no O response at all, neither pre- nor post-learning. Response F was found in 24 tested children who had not had it in at the pre-learning stage; One F tested child’s response disappeared after the learning; 15 tested children did not have an F response in pre-learning but acquired it after the learning, and 5 tested children continued with an F response. In the G response, 19 tested children, who had not had such a response in pre-intervention, acquired it afterwards, and 23 tested children did not acquire this type of response. Only three tested children dropped this response.

16 The F and G categories, as formal categories in music, got the highest numerical values. While they do not constitute musicality categories, they got relatively low numerical values (representation of sound source and not sound product) and middle numerical values.
We also discovered a correlation between gender and group: the index in the boys’ experimental group is higher than in the boys’ control group, and the index in the girls’ control group is higher than in the girls’ experimental group.

A triple correlation was also observed between gender, group, and time. In the boys’ experimental group, there is a high ascent after learning (from 2.1 to 9.7), whereas in the control group there is virtually no ascent (from 3.6 to 3.8). By contrast, the ascent in the girls’ group is quite similar both in the experimental group (from 3.5 to 7.2) and in the control group (from 5.0 to 9.1).

Figure 1 represents the experimental and control groups before and after the intervention program with boys and girls together.
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Figure 2  Experimental and Control Groups before and after Intervention, Boys Only

Figure 3  Experimental and Control Groups before and after Intervention, Girls Only
Summary of Results and Discussion

- The intervention program had a significant influence on the overall experimental group (treating boys and girls as a single group); that is, compared to the control group, learning the TMN notation method significantly influenced the pupils in the experimental group.
- When we analyze the boys’ and girls’ results separately, we find that the intervention programs’ impact on boys was higher than on girls.
- Prior to the implementation of the study program, there was a difference between the boys’ and girls’ phonographic concepts. The girls responded more to OFG parameters. However, at the end of the intervention, the boys’ and girls’ results were similar.

The research reveals significant differences between the experimental group children’s pre- and post-intervention phonographic responses, compared with the control group. The intervention program might have had a greater influence on the boys than on the girls (according to the McNemar test).

We must also consider the possibility that, at this age, boys develop more slowly than girls, and their initial level is lower. Therefore, we could not be sure that the boys and the girls were at the same initial level. We noted that, given the girls’ faster development, they already showed symptoms of the ceiling effect.

Even though the program consisted of only four meetings, the impact on the pupils’ symbolic behavior was significant. It seems that intervention duration is a decisive factor on the impact of the notation learning process on symbolic behavior. One could reasonably assume that, had the program lasted longer, the impact on symbolic behavior would have increased. However, in order to prove this, another research study is needed.

The research shows that girls’ musical symbolic responses are more developed than the boys’ at the elementary school stage. From this point of view, the gender differences might have influenced the pace of musical notation literacy enhancement. Even though this research showed that the initial gap in favor of the girls had been closed as a result of performing the program curriculum, more research is needed to trace the origin of the differences between boys and girls in the areas of musical literacy and musical conception.

The Significance for Musical Education

The issue of notation instruction deserves to occupy a significant position in the school educational curriculum, because this learning process enhances the pupils’ symbolization ability and cultivates their abstraction capability. But selecting the kind of notation is of great importance in musical education. Hence, the notation system that teachers use will influence learners’ musical concepts and their symbolizing responses. “General” graphic notation systems (such as graphic listening maps or descriptive diagrams related to musical structure, melodic contour and/or other elements of the musical composition) could have a more wide-ranging influence than symbol systems based on a one-to-one “matching” between symbol and sound (such as the conventional notation system). However, while the “general” systems provide a
wide scope for musical composition and the concept of structure on the macro level (e.g. Shockley 2006), “matching” systems, like the TMN method, assist pupils in acquiring the concept of short phrase sound succession, and in grasping musical structures at the initial micro level.

Music teachers are frequently wary of “nonconventional” or novel methods. However, this research shows that using the alternative notation system “TMN” enhanced learners’ formal musical concepts. The success of the TMN-method notation in stimulating formal musical cognition stems from the fact that the symbolic system and the manner of instruction themselves emphasize formal musical elements. Teachers who use this method may advance their pupils in formalized responses to music, for instance, by focusing on the audible succession of rhythmic patterns, writing directionality from left to right, and the gestalt concept of the rhythmic phrase. The TMN calligraphy, based as it is on small assorted symbols, may make it easier for pupils at this early age to grasp the concept of tonal succession, and facilitate their figural comprehension of the rhythmic phrase construction (See also Carmon 2002; and in print).

Teachers, however, need to reject the one-sided approach, in which notation instruction is based only on an arbitrary system of symbols and rules (conventional or alternative). Vygotsky helped us realize that if the pupil learns to play from notations in a mechanical manner, “he will never be involved in the music itself” (Vygotsky 1978, 105-106). Cultivating subjective and spontaneous expression is no less important than the formal learning of a given symbol system; analytic cogitation is based on intuitive cognition, and vice versa. In other words, neither planned activity provided by the school nor mere unconscious, intuitive expression is sufficient in itself; musicality in general, and musical literacy in particular, arises from the integration of both. Teachers who encourage the spontaneous invention of notation stimulate their pupils’ capacity for organization, classification, and integrative connection. This enables the pupils to translate concrete sound experience into symbols. This is what makes notation an important research tool, enabling us to recognize the pupil’s musical concepts and observations.

The Research Limitations

This research—which, to the best of our knowledge, is the first of its kind in Israel—proves that the innovative TMN symbol system can enhance formal and gestalt pattern cognition in the first school year. But certain questions remain open. For example: How will longer intervention programs influence the learner? Do the teachers’ personalities and their instruction strategies impact the learners? More empirical research in musical education is needed to answer these questions.
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