CLASSROOM APPLICATION OF USING VISUAL STUMULI IN LEARNING DYNAMICS AND PITCH

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Music, mind and technology

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Tiivistelmä – Abstract Listening is a common activity in music lessons. It is difficult for teachers to know whether students are learning by listening. In this study, visual stimuli include imagery, metaphor, and symbols, were introduced to students in the experimental group to learn dynamics and pitch. A control group received the same lessons without any visual stimuli. Both groups received the same tests, pre-test and post-test, after the two lessons. Tests were divided into two parts including choosing the correct dynamic changes and distinguishing higher or lower pitch for the melody. Results showed the experimental group had improved more than the control group. The change of the experimental group in relation to dynamics was more significant than that of the control group. This suggested that the experimental improved recognition of different dynamics changes within the same period of time as the control group. Both groups did not have significant change in relation to pitch. There was no evidence showing there is an effect of learning with visual stimuli.	
Asiasanat – Keywords Visual stimuli, Dynamics, Pitch, Classroom teaching	
Säilytyspaikka – Depository	
Muitatietoja – Additional information	

CONTENTS

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1 INTRODUCTION

Listening, creating, and performing are the three elements that construct a comprehensive music lesson. According to The Curriculum Council (2003), a department in the Hong Kong Special Administrative Region, the integration of listening as an activity in music lessons is strongly encouraged as a means for students to gain more music experience. While it is recommended that teachers include listening elements in teaching and learning, this leaves the question of what kind of teaching strategy in listening to music as a learning activity is most helpful for better teaching and learning. Listening is a rather passive process, which is especially difficult to observe in a music class. According to some researchers' teaching experience, it can be difficult to evaluate whether students are actually listening to the music elements to which teachers would like them to listen. It is also often the case that students struggle to sustain attention on the intended element of focus.

The Curriculum Council (2003) advises curriculum development for the local school system in Hong Kong and proposes diversified activities for consolidating and developing students' listening skills. Two such examples of ways to help students concentrate on listening are designing worksheets to identify music elements and using symbols to indicate music characteristics. From this comes the motivation of the current research project, which aims to demonstrate whether visual stimuli help students to grasp musical information better, specifically in learning dynamics and pitch, in relation to perceiving the pitch of melody. Pitch and dynamics are addressed in this study because they belong to the basic level of music processing and are common learning objectives in elementary music lessons.

This study aimed to investigate whether visual stimuli enhance music learning. Visual stimuli include both symbols based on the Principle of Similarity from Gestalt theory, and a metaphor in the form of images. Two classes of music students were involved in conducting an empirical experiment in a local elementary school. The results of pre-listening and post-listening tests from both the experimental group and the control group were compared after two consecutive lessons.

2 LITERATURE REVIEW

The following review integrates different studies related to both music perception and music education. Perception can be defined as a chain of processes in the brain that interprets sensory information and understands the external stimuli. Music perception refers to the processes by which the mind parses sound signals and understands different music characteristics. Studies related to various stimuli explain how they might be beneficial to music learning. Analogy, metaphors, and images can, in this context, refer to visual elements which might included in the explanation of grasping musical characteristics, such as pictures in pedagogical music books. Studies related to imagination explain how visual stimuli can be imagined and applied into learning.

Gestalt's grouping principle may explain how the mind parses perceptual information. The principle of the Gestalt theory of similarity explains how objects with similar characteristics such as size, color, or shape will be grouped together in a person's perception. The brain may visual similarities of texture to distinguish objects from each other or identify parts of a single object. Jones et al. (2010), as reviewed in many studies, showed that Gestalt principles are useful in describing musical patterns, although the study argued that Gestalt's principles do not completely explain all elements of melody perception, such as tonality and consonance versus dissonance. Kohn and Eitan (2009) videotaped participants' movement responses to music and found that pitch changes are mainly associated with vertical motion, while loudness changes are associated with both muscular energy and vertical motion. This helps to consolidate the design of the current experiment by suggesting visual stimuli and vertical motion as elements to enhance the teaching of pitch and dynamic perception.

2.1 Learning by visual stimuli

The idea of learning by visual stimuli was mentioned in many studies. Lacombe (2003) identified there are different types of learners. A visual learner is someone who learns more effectively by seeing or reading material. Young (1996) pointed out that visual representations of music elements were very prevalent in the classroom. Davidson (1993) reported in her study that vision could be more informative in music perception

than sound, as the perceiver understands the performers' expressive intentions.

Regarding visual stimuli in music learning, Deliége (2006) stated that visual stimuli could function as an analogy, cue, coding, or acoustical image, which enhances perception of sound. In the study of Deliége (1987), symbols were used as visual stimuli designed after the Gestalt principle. Visual stimuli were in the form of symbols such that selected individuals could identify the relationship between symbols and music. Narmour (as cited in Jones et al., 2010) showed listeners' melodic perception was determined by Gestalt principles of proximity and continuity, as well as similarity. Another study from Deliége (1987) discussed the use of analogy as a cue in the perception of rhythmic groupings according to the Gestalt theory about visual perception. The use of analogy has been emphasized in the unique process to grasp information. Segmentation is generated by the principles of similarity and proximity. Individuals were stimulated by vision while they perceived. Swain (1986) also stated that the grouping effect explains how the brain organizes and interprets information.

2.2 Metaphor and Imagination

A metaphor may be defined as a something used to represent something else, usually something abstract, and often takes the form of a visual image. According to Rudolf Arnheim (as cited in Egan & Nadaner, 1988), images are defined as abstractions of significant visual features in the environment. Gordon (as cited in Egan & Nadaner, 1988) stated that imagery is a raw material which is used to imagine and to symbolize. Zbikowski (1998) stated that metaphors are conceptual and pointed out that, through metaphor, mapping was established between two cognitive domains. Zbikowski (1998) also stated the relationship between the verticality schema, which is considered to be an image schema, and our characterization of musical pitch with reference to the spatial orientation (up-down) is fairly immediate. The theory of image schemata provides one way of explaining how conceptual metaphors are grounded. This helps organize the students' understanding of music. In his study, Harris (1996) suggested that teachers widely use more metaphor and imagery to help children engage in music.

To simplify the idea of using metaphor and imagery, teachers encourage students to imagine from visual stimuli or visual scenery, in order to depict the characteristics of

music while listening. Imagining a flute as a singing bird is a common example of using a metaphor in perceiving how a flute sounds.

Students understand music by imagining when they are given visualized elements to use in their imaginations. In the learning process, imagination may explain how visual stimuli are processed, and there are studies related to imagination in learning music. Imagination has been found in different musical areas such as composition, performances, and listening. Imagination is interpreted as creative music thinking which children can compose (Burnard, 2006). In the area of performance, development of creative credentials is important to improvisation (Tafuri, 2006). When linking imagination to performance, Reichling (1997) suggested that imagination is used to enliven memory, trigger fantasy, generate illusions, and break through barriers, such as overcoming technical problems.

In relation to interpretations of imagination, Harris (1996) defined the significance of music education and the nature of imagination from the ideas of R.G. Collingwood and Eduard Hanslick. In the case study of Ioffe (2007), imagination was defined as exploratory imagination. Students were encouraged to use brainstorming as a kind of imagination in the learning process. Reichling (1997) quoted the idea from Kant, that the free play of imagination and understanding is the productive power of the mind and key to aesthetic judgment. The author also reviewed Howard's idea, that imagination functioning in fantasy may enable a performer to break through barriers, in such contexts as overcoming a technical performance problem. Reichling (1991) pointed out the importance of imagination in music education by philosophical methods. The idea of imagination is related to the relationship between a vision of reality and musical symbols. Artistic perception might be identified as perception of imagination. Participants in the research area included performers, listeners, and composers.

In relation to the effect of imagination, the results of Harris (1996) showed that children's imagination might engage them in mental, social, and emotional activities, which leads them to envision, and to having sufficient knowledge of and understanding the different art forms. By imagining visual and motor experiences, musical development is enhanced. The study of Ioffe (2007) reported how to use creativity and

imagination in order to find relationships. Students experienced imagination and finally showed the enjoyment of musical learning. Reichling (1991) stated that intuition is functioned to guide, to grasp meanings and relations, to integrate or to synthesize. Implications for music education have been suggested in the article, emphasizing the centrality of imagination as a mode of inquiry that is crucial to teaching and learning.

2.3 Figurative imagination

Reichling (1997) introduced one type of imagination in her study, namely figurative imagination. Figurative imagination is a transformation process in listening, to imagine X as Y, while visual image is generated. She explained the idea of "hearing as," which was applied to timbre and musical theme. A prime example of this is hearing the sound of a timpani roll as hearing thunder. The composer Sergei Prokofiev in his composition "Peter and the Wolf" also employed this idea*,* in which he projects his music into a story and assigns animal characters to several instruments. Children imagine the story's plotline while they are listening to different instruments, especially those in the woodwind family. Imagination generalizes the idea of using metaphors, imagery, or analogy in the listening process. It is an interactive process in which visual images can be evoked cognitively through listening. Visual images can be additional stimuli during listening.

Apart from, but related to the topic of music understanding, there is a qualitative teacher-study by Ferguson (2004) discussing how children understand music by movement, and whether expressive movement matches their verbal music understandings. In the research article by Byo (1999), music specialists were suggested to teach composition, improvisation, and understanding music in relation to history or culture.

3 AIMS AND HYPOTHESIS

The current research investigated the effect of two teaching methods, with and without metaphorical visual stimuli in the teaching materials. It was hypothesized that applying metaphorical visual stimuli in music classroom teaching and learning would enhance perception in the students while learning dynamics and pitch. The results of the two tests were compared and connected with the two teaching methods. Empirical research was conducted to find out whether visual stimuli are an effective way for grasping music characteristics.

Research questions:
a. Do students learn better with the use of imagination and visual stimuli in listening process?
b. Can this be a strategy for teachers to use teaching music listening?

4 METHODS

4.1 Participants

Two groups of students in the fourth grade attending the same school were participants in the current research. Both the experimental group and control group received formal music lessons by different teachers once per week. The results of students who only attended the second lesson were excluded from the analysis.

Experimental group: n = 19 (9 females and 10 males); mean age of 10.34 years.
Control group: n = 17 (8 females and 9 males); mean age of 10.37 years.

4.2 Listening tests

Pre-test and post-test control group design was used in this research. Madsen & Madsen (1997) explain this design as a cause-and-effect relationship for studying music experience. Table 1 shows the details of the pre-test and post-test design. Both the experimental and control groups received the same test in the pre-test and post-test as shown in Appendix I and II. The order of the questions and the samples in the two tests were identical, but the first two columns of choices, Choice A and B, were switched in post-test as shown in Appendix II.

Participants were asked to provide background information including age, number of years receiving instrumental training, and understanding of musical terms, such as dynamics and pitch. Participants were asked to listen to 10 samples and answer a multiple-choice test with three choices for each question. 10 MIDI tracks were produced by using ProTools 11 software and recorded at 44.1 kHz with a bit rate of 24. Questions 1 to 5 were related to dynamics. The sample dynamics were recorded with a range from approximately 50 to 130 by changing the velocity. It was decided to use sinusoidal waveforms due to their flat envelope (attack, sustain, and decay) with no amplitude modulation. Questions 6 to 10 were related to pitch. Participants were asked to recognize the pitch of the melody with a simple accompaniment. The melodies were played in a higher pitch ranged from 440 Hz to 880 Hz and in a lower pitch ranged from 110 Hz to 220 Hz. Participants needed to choose whether the melody was in the higher pitch range, the lower pitch range, or both, which meant the lower melody appeared before the higher melody.

To reduce the possibility of familiarity of music in the test, nine out of ten samples were derived from Chinese melodies and one was an arrangement of western hand bell music. Each sample was approximately 20 seconds in length and between 120 and 140 beats per minute in tempo. There were 10 seconds of silence between each question and its repetition.

Table 1: Pre-test Post-test Control Group Design

Group	Pre-test	Teaching intervention	Post-test
Experimental Group	Listening test	With visual stimuli	Listening test
Control Group	Listening test	Without visual stimuli	Listening test

4.3 Procedure of intervention

The stimuli were comprised of two lesson plans applied over two continuous weeks between the pre-test and post-test. Each lesson lasted approximately 35 to 40 minutes. The learning objectives of each lesson were focused on the students' conceptualization and understanding of dynamics and pitch, respectively. Piano, forte, and mezzo forte were covered during the first lesson and the concept of higher pitch and lower pitch were taught in the second lesson. The researcher taught both lessons to both groups.

The structure in each of the two lessons in both groups was the same. The first lesson began with a warm up listening exercise, followed by reading a sentence with dynamics and finally singing a Chinese melody with dynamics. Figure 1 shows the comparison of the teaching materials in learning dynamics between the experimental group and the control group. More verbal instructions were given to the control group. Active discussion played an important role in the lessons. The experimental group was asked to think about the relationship between the animals used in the teaching materials and dynamics. Similarly, students were guided to think about the relationship between symbols and dynamics. The control group was asked to repeat the sentences by first reading aloud with the whole class. The number of students reading aloud was reduced to create *forte*, *mezzo forte* and *piano* sounds. Both groups could read the music terms and say the sentence in corresponding dynamics as shown in the last row of Figure 1. The lesson then continued with a Chinese melody with Finnish lyrics. Finally, students in both groups could follow the musical terms and sing the song with appropriate dynamics.

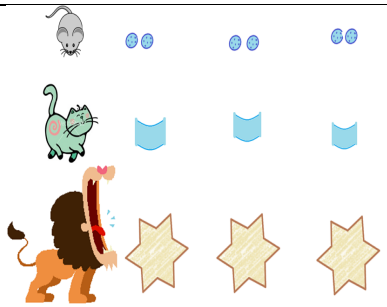
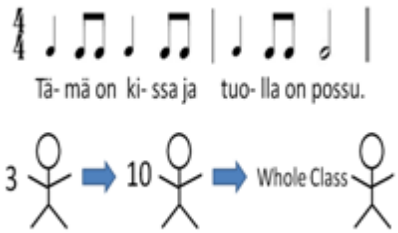
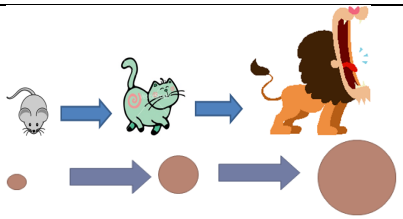
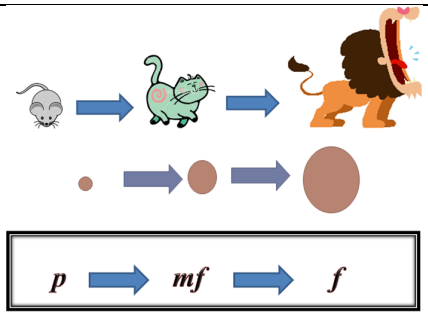
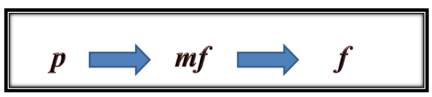
Learning Objective	Experimental group	Control group
Introducing an idea of dynamics by imitating sounds of animals		Not included
Clapping and saying the sentence with dynamics		
Recognizing the relationship between animals and symbols		Not included
Knowing the musical terms in dynamics		
Speaking the sentences with dynamics	*f* Tämä on kissa ja tuolla on possu. *p* Tämä on kissa ja tuolla on possu. *mf* Tämä on kissa ja tuolla on possu.	*f* Tämä on kissa ja tuolla on possu. *p* Tämä on kissa ja tuolla on possu. *mf* Tämä on kissa ja tuolla on possu.

Figure 1: Comparison in teaching materials between two groups in learning dynamics

The structure of the second lesson began with reviewing dynamics and the Chinese melody. Visual stimuli were again applied to the experimental group in learning pitch. Figure 2 shows the comparison of the materials between the experimental group and the control group. Both the experimental and the control group were asked to response to music according to the pitch. Pictures were shown to students in the experimental group while the teacher demonstrated the movements to the students in the control group. According to Kohn and Eitan (2009), pitch is highly related to height. Climbing upstairs or going downstairs became a warm-up exercise for students to visualise the concept of pitch. Students were asked to mimic climbing upstairs when they listened to higher pitch music, i.e. an octave higher than middle C. Climbing downstairs represented music below the middle C. Flying, walking, and diving were used as metaphors in both groups. Walking was then introduced as an accompaniment to the music, while flying represented higher pitch and diving represented lower pitch. Students were asked to play chime bars (Middle C and G) to get an idea of making an accompaniment. The teacher then played the Chinese melody in a higher and lower pitch with the accompaniment, i.e. repeating C and G.

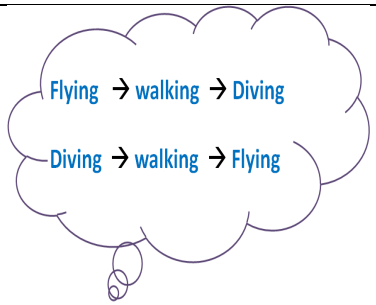
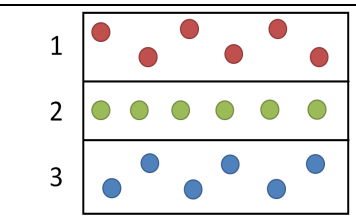
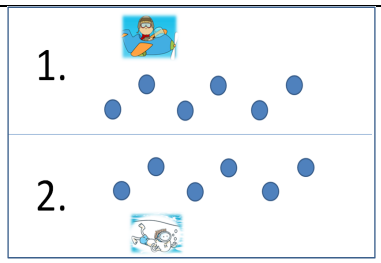
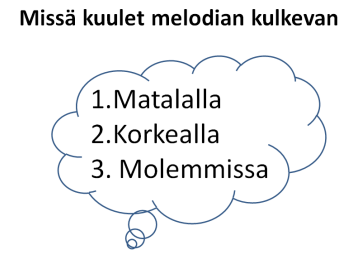
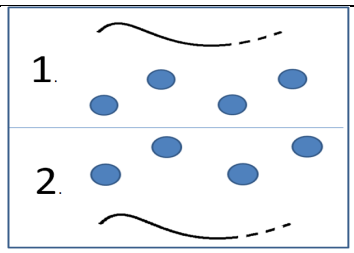
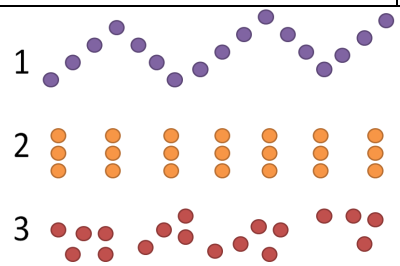
Learning objectives	Experimental Group	Control group
Responding to music according to pitch (Climbing upstairs and going downstairs)		Verbal instruction and teacher's demonstration
Knowing the relationship between height and pitch		
Knowing an accompaniment pattern by repeating middle C and G.		Students were asked to play chime bars for middle C and G
Distinguishing higher or lower pitch with accompaniment		
Distinguishing higher or lower pitch with accompaniment (only symbols in experimental group)		
Knowing different forms of accompaniment		Verbal instruction and demonstration

Figure 2: Comparison of teaching materials between two groups in learning pitch

4.4 Score system of the listening tests

The tests were scored such that each correct answer received one point, while each incorrect answer received zero points. Both SPSS and MATLAB were used for data analysis. *T*-tests and correlations were performed in the data analysis.

The mean scores of pre-test and post-test from question 1 to 10 were compared between the groups. Two different mean scores from question 1 to 5 and question 6 to 10 were used for analysing dynamics and pitch separately. There was a section asking what participants thought about the test in terms of difficulty. There were five choices including very easy, easy, average, difficult and very difficult both in the pre-test and the post-test. The level of difficulty appeared at the end of the listening test was scored 1 to 5, from very easy to very difficult difficult. The mean score of the difficulty level assessment was determined using MATLAB. Regarding the music background of the participants, participants who could explain the meaning of mezzo forte, forte and piano received six points, with two points for each term. In the experimental group, many of the students wrote down the animals used as imagery in the lesson instead of the meaning or the musical terms and this was scored as one point per each term.

4.5 Follow-up interviews

Follow-up interviews with teachers from both groups were conducted after the post-test. The purpose of the interviews was to act as a backup data to support the opinion about the lesson design. Listening tests and students' performances were collected. The interview was semi-structured. E-mails were sent to both teachers, and content analysis was used for data analysis of their answers. Questions were basically the same for both teachers. The teacher of the experimental group was asked about using visual stimuli in the teaching process, whereas the teacher of the control group was asked about the lesson design and the flow of the lesson.

A coding scheme was developed after collection of the data. The content of teachers' opinion was coded as the data. Coding included difficulties and benefits of the teaching process and students' reaction. The data was then sorted to link to the empirical data in the listening tests.

The teacher of the experimental group was asked the following:

1. What did you think about the listening test? (Familiarity/difficulty)

2. What do you think about using pictures, symbols, and metaphors to teach dynamics and pitch?
3. Have you noticed any differences of the students' reaction? How?

The teacher of the control group was asked in the following:

1. What did you think about the listening test? (Familiarity/difficulty)
2. What do you think about students learning dynamics and pitch with teacher's demonstration and student discussion?
3. Have you noticed any differences of the students' reaction? How?

5 RESULTS

5.1 Background information of participants

In the experimental group, 16% of students had studied at least one instrument for an average of 1.67 years. The maximum number of instruments that students studied was two. In the control group, 56.25%, of the students had studied at least one instrument for an average of 1.94 years. The maximum number of instruments that the students played was three.

Regarding the familiarity of the terms in the experimental group, none of the students knew the terms related to dynamics, nor did they correctly explain them in the pre-test. However, 89% students knew the terms in the post-test, and the mean score of writing down the terms before the listening test was 4.74. 80% of the students knew the term pitch in the pre-test and it increased to 90% in the post-test.

Regarding the familiarity of the terms in the control group, there were 12.5% students who knew the terms about dynamics, but the mean score of writing the terms down was 0.94 in the pre-test. It has increased to 87.5% of students knowing the terms dynamics and the mean score of writing the terms down was 5.75 in the post-test. 81.25% of students stated to know the pitch, but this decreased to 62.5% in the post-test.

5.2 Results of Entire test

Results of the *t*-tests are demonstrated in Figures 3 and 4. Figure 3 shows that the experimental group had a lower mean score in the pre-test than in the post-test. The box and whisker diagram has shifted to the top in the post-test of the experimental group. Figure 4 shows that the control group had almost the same mean score in the pre-test and post-test.

Figure 5 and 6 show that both groups made improvement on questions 1 to 5, which were about dynamics. The distribution was quite different in question 6 to 10 in relation to pitch. The scores from question 6 to 10 were comparatively

lower than that from questions 1 to 5 in both groups. In question 9, the control group got all correct answers in the post-test whereas the experimental group performed worse in the post-test. Question 9 was related to pitch, as there were two melodies appearing both in higher and lower pitch. Both groups did not get correct answers in the post-test on question 8. The melody was played in a higher pitch while an accompaniment played in chords and close to the melody. The score of the control group in each question, shown in Figure 6, was always higher than that of the experimental group. There were three questions where all students from the control group answered correctly. Question 2 and 3 were related to dynamics and question 9 was related to pitch.

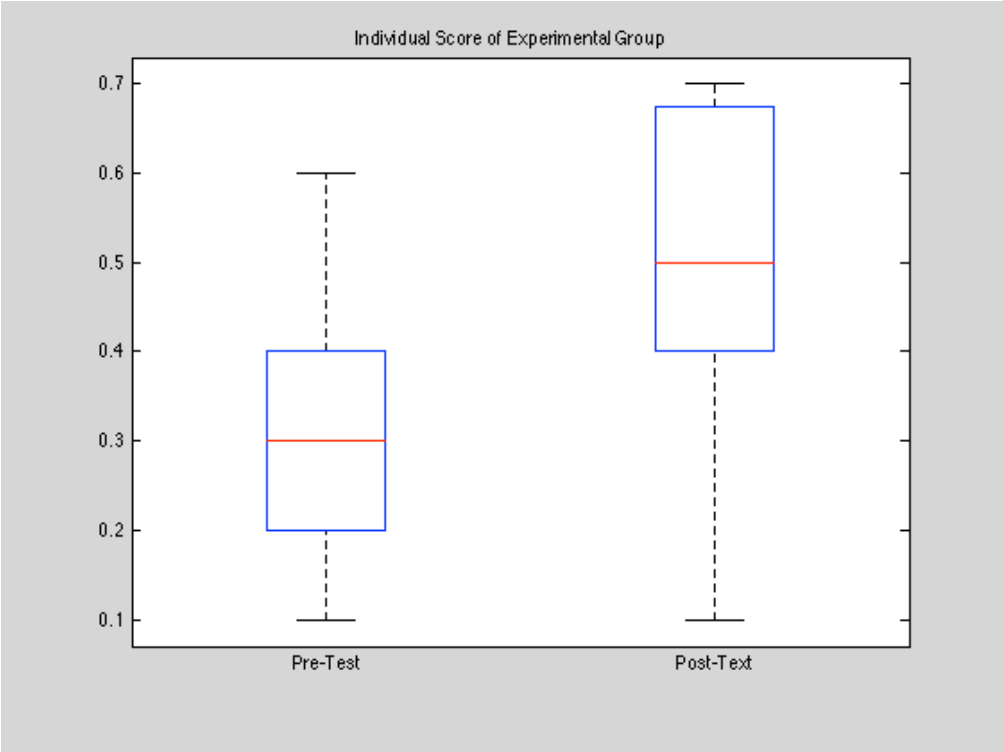


Figure 3: Individual score of experimental group in pre-test and post-test (y-axis represents the score of the test).

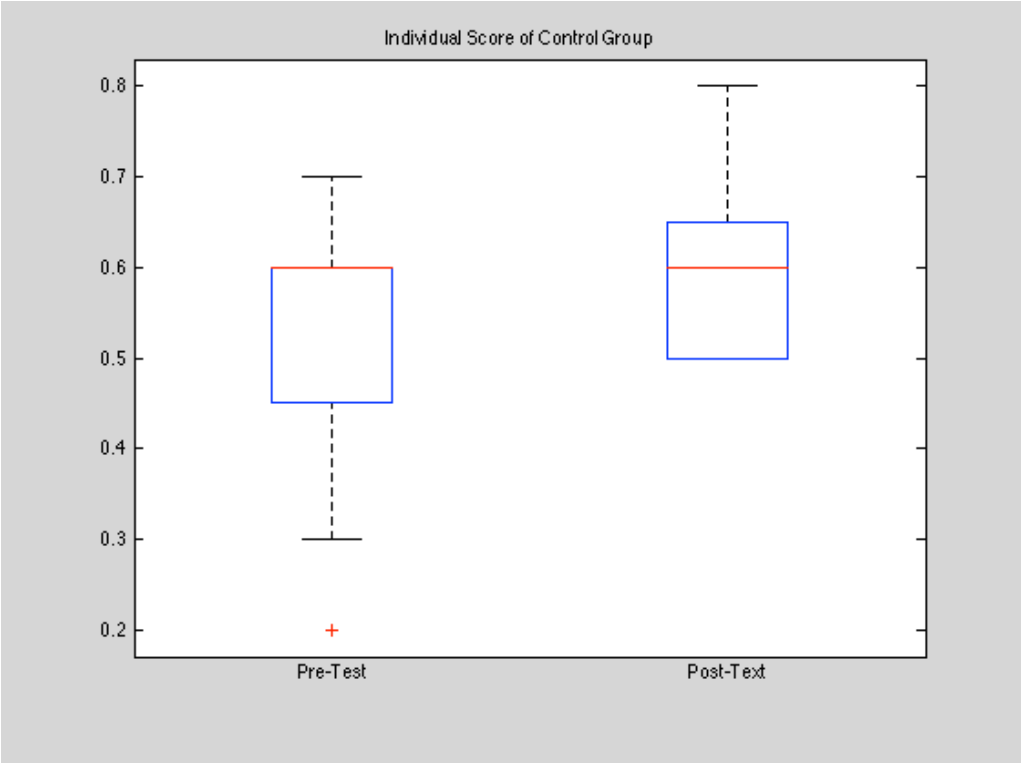


Figure 4: Individual Score of Control group in pre-test and post-test (y-axis represents the score of the test).

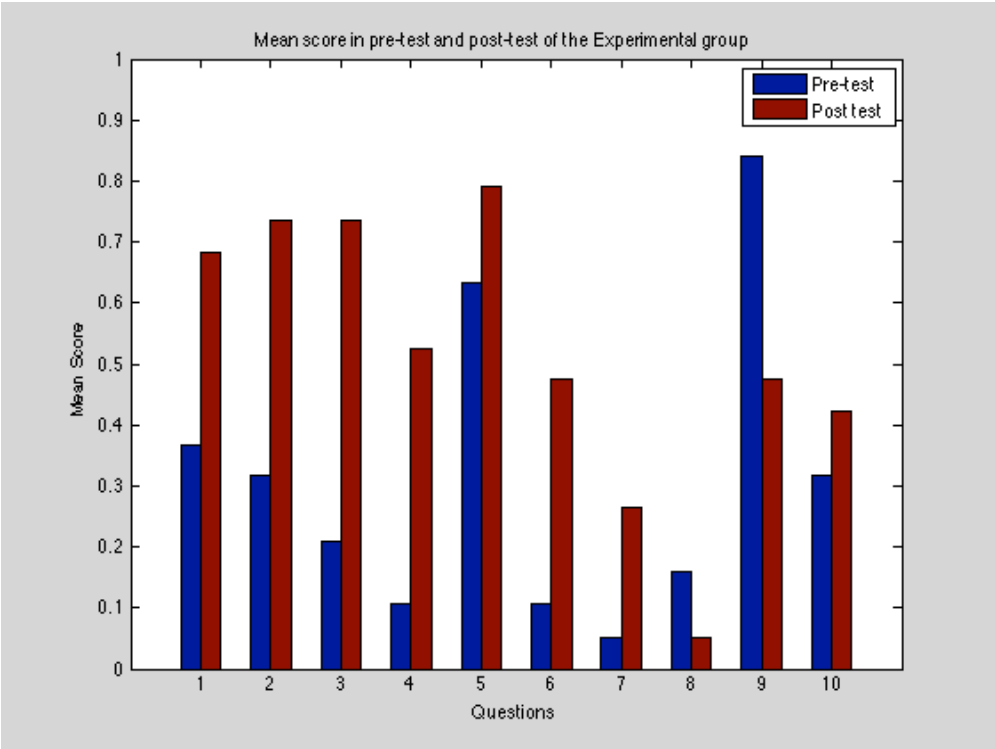


Figure 5: Mean Score of experimental group in the two tests, questions 1 to 5 were related to dynamics and questions 6 to 10 were related to pitch

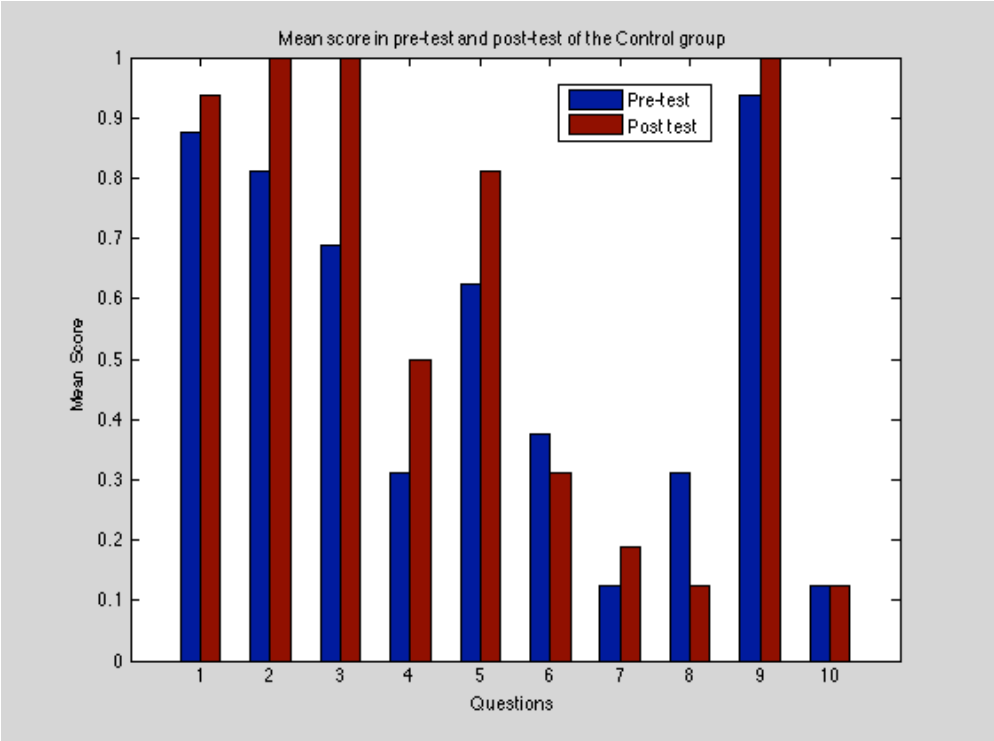


Figure 6. Mean score of control group in the two tests, questions 1 to 5 were related to dynamics and question 6 to 10 were related to pitch

5.3 Results of dynamics

A paired-samples *t*-test was conducted to compare the mean score of the experimental group in pre-test and the post-test related to dynamics. There was a significant difference in the scores for the pre-test ($M = 0.33$, $SD = 0.31$) and the post-test ($M = 0.70$, $SD = 0.32$) conditions; $t(18) = -5.224$, $p < 0.001$. These results suggest that the experimental group had made progress in the time between the pre-test to the post-test. Specifically, the results suggest that the experimental group has learned to distinguish changes in dynamics.

A paired-samples *t*-test was conducted to compare the mean score of the control group in pre-test and the post-test related to dynamics. There was a significant difference in the scores for the pre-test ($M = 0.66$, $SD = 0.28$) and the post-test ($M = 0.85$, $SD = 0.15$) conditions; $t(15) = -3.34$, $p = 0.004$. These results suggest that the control group had made progress in the time between the pre-test to the post-test. However, the improvements were smaller when compare to the experimental group.

5.4 Results of pitch

A paired-samples *t*-test was conducted to compare the mean scores of the experimental group in the pre-test and the post-test related to pitch. There was a non-significant difference in the scores between the pre-test ($M = 0.30$, $SD = 0.17$) and the post-test ($M = 0.34$, $SD = 0.20$); $t(18) = -0.81$, $p = 0.43$. These results suggest that the experimental group were not able to learn better in distinguishing higher or lower melody.

A paired-samples *t*-test was conducted to compare the mean scores of the control group in pre-test and the post-test related to pitch. There was not a significant difference in the scores for the pre-test ($M = 0.38$, $SD = 0.22$) and the post-test ($M=0.35$, $SD=0.15$) conditions; $t(15) = 0.436$, $p = 0.67$. These results suggest that the students in the control group were not able to accurately distinguishing a higher or lower melody.

5.5 Results of dynamics and pitch combined

A paired-samples *t*-test was conducted to compare the mean scores of the experimental group's combined scores on dynamics and pitch. These scores ranged from 0 to 2, as the two tests were added together for the purpose of statistical comparison. There was a significant difference between the pre-test ($M = 0.62$, $SD = 0.30$) and the post-test ($M = 1.03$, $SD = 0.34$) of the experimental group; $t(18) = 4.44$, $p < 0.001$. There was not a significant difference between the pre-test ($M = 1.04$, $SD = 0.32$) and the post-test ($M = 1.20$, $SD = 0.18$) of the control group; $t(15) = -1.98$, $p = 0.07$. The results support the previous results that the experimental group made significant improvement in the post-test, indicating that they have learnt more than the control group.

5.6 Differences between groups

Independent samples *t*-tests were conducted to explore differences between the experimental group and the control group. For dynamics, there was not a significant difference between the experimental group ($M = 0.32$) and the control group on dynamics for the pre-test ($M = 0.66$), $t(16) = 0.44$, $p = 0.75$. In comparing the experimental ($M = 0.69$) and the control group ($M= 0.85$) on the dynamics post-test, there was not a significant difference, $t(16) = 0.37$, $p = 0.80$.

For pitch, there was not a significant difference between the experimental group (M = 0.30) and the control group on dynamics for the pre-test (M = 0.34), $t(16)$ = 0.26, p = 0.82. In comparing the experimental (M = 0.38) and the control group (M = 0.35) on the dynamics post-test, there was not significant difference, $t(16)$ = 0.17, p = 0.87. These results show there were no significant differences between the two groups.

5.7 Level of difficulty and correlations

The reported level of difficulty reported by the experimental group in the post-test (M = 2.31) was lower in the pre-test (M = 3.42). These showed that the post-test was perceived as easier than the pre-test to the experimental group. The level of difficulty reported by the control group in the post-test (M = 2.0) was lower in the pre-test (M = 2.47).

There was not a significant correlation between the knowledge of dynamics and the results, the knowledge of pitch and the results, reported level of difficulty and the results of both groups in the pre-test and post-test.

5.8 Follow-up interviews

According to the coding scheme, the listening tests were difficult for both groups. The lessons were different from what the two groups usually do, such as playing instruments in their music lessons. However, there was no difference in students' behavior, although the lessons were exotic and different for them. Both teachers thought the lessons were clear. The teacher from the experimental group thought that visual stimuli were more concrete to understand. Table 2 showed the comparison between two teachers' opinion about the lessons.

Table 2: Coding scheme for the follow-up interview from the teachers

Area concerned	Experimental group	Control group
Listening tests	Difficult, wasn´t familiar	Had to consider and think a lot to choose the right alternation
Usually activities in the	playing instruments, doing presentations	Playing instruments, music theory and singing. Listen to classical music.
Lessons	Good, more concrete to understand	Clear and systematic. different and exotic, “a little easy”
Students’ performance	No difference	No difference, learned the dynamics

6 DISCUSSION

The study investigated whether visual stimuli can enhance perception in learning dynamics and pitch. It was hypothesised that applying visual stimuli in the learning process helps to grasp music characteristics. The results showed the experimental group improved more than the control group in the post-test, supporting that visual stimuli might help students to understand better during the learning process.

The results of the pre-test and post-test of the two groups showed the experimental group got a more significant change in learning dynamics than the control group. This supports the acoustic difference in dynamics, which is more quickly picked up by ear (Deliége, 1987). The experimental group showed more significant change in the *t*-test than the control group, indicating that the experimental group improved more than the control group. Although there was no significant change in relation to pitch, the *p* value of the experimental is closer to significant than that of the control group. This may suggest the experimental group had understood more and improved more within the same time. Both groups received the lessons and finished the tests within two weeks.

Neither group got a better result in the post-test in relation to pitch especially, in question 8. This might be because the sample was played in a higher frequency range, although the accompaniment was in chord form and just slightly higher than the melody. Students in both groups may have gotten confused after grasping the concept of higher and lower pitch. During the lessons, both groups were asked to distinguish the pitch of the melodies. By putting their hands up, students answered questions to distinguish the pitch of the melody during lessons. Based on observation, students were hesitated and fewer students gave correct response to questions related to pitch by putting their hands up. This might explain the lower results in relation to pitch, as they did not react correctly during the lesson.

There was no cause-and-effect relationship, as explained by Madsen & Madsen (1997), showing that using visual stimuli enhances better perception of learning dynamics and pitch. When asking to define dynamics in the post-test, there were students from the experimental group who identified the animals. Many students wrote mouse as piano, cat as mezzo forte and lion as forte. This was also the reason that the experimental group received lower scores in defining the terms. This may suggest the experimental group was better able to remember the terms by imagining them into animals, supporting the figurative imagination suggested by Reichling (1997). The teacher from the experimental group commented the lessons were more concrete. This supports the study of Young (1996) about using visual representations in classroom and Davidson (1993) that vision could be more informative than sound.

Based on observations and evaluations in the class, the control group had higher musical ability than that of the experimental group prior to the study. During the lessons, the control group sang louder and performed more actively in the class. The control group were able to sing the Chinese melody after two to three times and clapped the rhythm more accurately. The experimental group was less active in answering questions and discussion when compare to the control group. The experimental group had music lessons every Monday morning. It was the first lesson of the day. Students seemed to be tired and it required extra time to warm them up. The pre-test was included at the beginning of the first lesson whereas the post-test was added at the end of the second lesson. The lesson became longer than the normal one. Students came to the lessons earlier without any break. Students might have found it difficult to concentrate on the same lesson. This might also explain the control group got higher results due to their active learning in the lessons.

More than 50 % of students played at least one instrument in the control group, which is a contrast to just about less than one fifth of the experimental group, who had not played any instrument. More students in the control group were engaged in playing more than one instrument and had longer time of playing on average. In addition, the control group always had lower values in the reported level of difficulty. The higher musical ability in the control group may explain

the higher average score of the two tests in the control group. The teacher of the control group stated that some of the students might have found the lessons a bit easy for them. The level of the tests reflected their ability; the tests were in general rather too easy for them.

According to the follow up interviews, teachers usually play guitars and percussion instruments with the students in the music lessons rather than piano. Discussion among classmates was highly encouraged in these lessons, which might be a new learning style for students, as was body movement in classes. A familiar learning environment could have provided a comfortable atmosphere, and contributed to efficient and effective learning. There were no observations before the experiment, thus the students did not meet the researcher prior to the tests. These results for both teachers and students might indicate a need for some extra time to warm up and get to know each other. Meanwhile, elements such as both groups having different teachers and the teacher of the control group having just recently joined the school might have been a factor affecting students' performances. Listening was a common activity in music lessons but the tests were very uncommon. Students were not used to having multiple-choice questions. They had queries on circling the answers: whether should the whole answer, or just the choice A, B or C be circled. This showed the unfamiliarity of the testing style.

6.1 Limitations

The language of instruction in the school is Finnish. Although the students have been learning English for more than one year, English is not commonly used in the classrooms. The two teachers from the two groups acted as the translators in the lessons. The instructions for activities and the opinions of students were translated. There were Powerpoint slides to assist in the teaching, especially for the experimental group. The language translation was not an obstacle for teaching but it took extra time. In addition, there might have been some translation errors or some difference between exact wordings from English to Finnish. For instance, melody in Finnish, i.e. *melodia*, is an uncommon word in Finnish. The teachers needed to explain the idea of melody in Finnish, which eventually became a 'tip' for the listening test.

Dynamics and pitch were common topics in music lessons beginning in early grades. These might not be a new concept for all students. The lessons might be more suitable for students in the first through third grades. Since the experiment was conducted by the teachers voluntarily, the tests answers were not given to the students as there were no follow up lessons. Students did not know whether they had learned the right skills. Checking a result can be important for both teachers and students in the learning process. Singing the melody with appropriate dynamics was the learning outcome and students were answered through hand gestures as a checking for the learning process.

The experiment contained only two lessons. Each lesson covered a different music area. The Chinese melody was the only connection between the two lessons. Due to time constraints, teachers were not able to recapitulate the key points of lesson one to let students recall what they had learned about dynamics in the second lesson. The experiment was conducted during the teacher's normal lessons. Extra time was taken from the resting time of the students and part of the previous lesson. The teachers were only able to give a brief answer to the follow-up interview after the experiment. Contacting both teachers became quite challenging due to their busy schedules.

6.2 Conclusions

The study found that both groups performed better on test questions in relation to dynamics than pitch. The control group performed generally better in both tests than the experimental group. With previously existing higher musical ability, the control group received a higher score in the two tests. However, the experimental group showed greater improvement with the smaller *p*-value than that of the control group. This suggests that using visual stimuli might be beneficial in the learning process and might support the studies of Deliége (1987, 2006). The experimental group remembered the pictures they have seen and related to what they have actually learnt. This supports the study of Reichling (1997) visual stimuli trigger imagination and become a transformation in the listening process.

The sample size of the experiment was rather small. The results could be more significant if the sample size were bigger. Increasing the number of classes could enlarge the scope of the experiment, so that two classes can be the experimental group and two classes could be the control group. In addition, the same experiment could be repeated in two different schools with the same grade.

Besides choosing one particular grade, the experiment could be applied to more than one grade of students such as grades two to four in the same school. The results would be more objective in observing whether the design of the lessons was too easy or too difficult for one particular grade. This could also provide a reference for teachers to design lesson plans.

Follow-up interviews with both teachers and students could also be useful in further studies. Besides asking what both teachers and students thought about the experiment, difficulties in any particular topics in both teaching and learning could also be discovered. In addition, students with different musical abilities could be asked their opinion about the lessons. There were some students who thought the opposite, in which the melody in higher pitch was belonged to diving and lower pitch belonged to flying. Since imagination is difficult to measure from individuals, qualitative opinion from students may explain how they learn.

This study has found that visual stimuli were useful for a group of students to improve more within the same period of time when compared to the other group. Further study about how visual stimuli contribute to the learning process could be done. The learning process can be given more time, and different formats of testing can be used. Besides using the multiple-choice test formats, drawing or writing what students listened to can be used in the data of follow-up experiments.

Students from different areas or countries can be compared to avoid the effect of cultural differences in learning style. Videotaping student performances might also provide another form of results, as a means of reviewing the success of the learning outcome. Besides using visual stimuli, learning with the help of other sensations could also be investigated to support the idea of learning music in a different and effective way.

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Appendix

Appendix I

Kuuntelutesti

Nimi: Ikä:

Soittimet: Kuinka kauan olet soittanut? vuotta

Tiedätkö eri äänenvoimakkuusmerkkejä?

(*f*, *mf* ja *p*) Joo ☐ Ei ☐

Kirjoita tietämäsi äänenvoimakkuusmerkit viivoille.

f mf p

Tiedätkö, mitä äänenkorkeus tarkoittaa?

(Korkeampi / Matalampi ääni) Joo ☐ Ei ☐

Mitä äänenvoimakkuuseroja kuulet musiikissa? Ympyröi oikea vaihtoehto.

1.	A. *fp f*	B. *f f p*	C. *p f f*
2.	A. *fp f*	B. *f f p*	C. *p f f*
3.	A. *fp f*	B. *f f p*	C. *p f f*
4.	A. *p f mf*	B. *mf f p*	C.*p mf f*
5	A. *p f mf*	B. *mf f p*	C.*p mf f*

Missä kuulet melodian kulkevan ? Ympyröi oikea vaihtoehto.

6.	A. Korkealla	B. Matalalla	C. Molemmissa
7.	A. Korkealla	B. Matalalla	C. Molemmissa
8.	A. Korkealla	B. Matalalla	C. Molemmissa
9.	A. Korkealla	B. Matalalla	C. Molemmissa
10	A. Korkealla	B. Matalalla	C. Molemmissa

Kiitos paljon! ☺Miltä testi tuntui?

Tosi helppo ☐Helppo☐ Siltä väliltä☐Vaikea☐Tosi vaikea☐

Appendix II

Kuuntelutesti

Nimi: Ikä:

Soittimet:

Kuinka kauan olet soittanut? vuotta

Tiedätköeri äänenvoimakkuusmerkkejä?

(*f*, *mf* ja *p*) Joo☐ Ei ☐

Kirjoita tietämäsi äänenvoimakkuusmerkit viivoille.

f *mf* *p*

Tiedätkö, mitä äänenkorkeus tarkoittaa?

(Korkeampi / Matalampi ääni) Joo ☐ Ei ☐

Mitä äänenvoimakkuuseroja kuulet musiikissa?
Ympyröi oikea vaihtoehto.

1.	A. *f f p*	B. *f p f*	C. *p f f*
2.	A. *f f p*	B. *f p f*	C. *p f f*
3.	A. *f f p*	B. *fp f*	C. *p f f*
4.	A. *mf f p*	B. *p f mf*	C.*p mf f*
5	A. *mf f p*	B. *p f mf*	C.*p mf f*

Missä kuulet melodian kulkevan ?
Ympyröi oikea vaihtoehto.

6.	A. Matalalla	B. Korkealla	C. Molemmissa
7.	A. Matalalla	B. Korkealla	C. Molemmissa
8.	A. Matalalla	B. Korkealla	C. Molemmissa
9.	A. Matalalla	B. Korkealla	C. Molemmissa
10	A. Matalalla	B. Korkealla	C. Molemmissa

Kiitos paljon! ☺Miltä testi tuntui?

Tosi helppo☐Helppo☐Siltä väliltä☐Vaikea☐Tosi vaikea☐

Appendix III

Followed-up interview from the teacher of the experimental group

"The listening test wasn´t familiar to pupils (i don´t quite REMEMBER the test, so much time has passed.... and much, much has happened since)What I remember, part of it was difficult, even for a teacher. Don´t ask what part.

Pictures and symbols were very good and they made the test more concrete to understand.

No differences have been noticed. We have only one hour music/week. We haven´t learned this issue since January. We´ve been playing instruments and doing presentations of the music pupils listen on their leisure"

Followed-up interview from the teacher of the control group

"Usually we play instruments in the lession. Mainly the fipple flute, but also the guitars, little bit the drums and percussions. Then we have some music theory and singing. We also listen to classical music.

I think that the pupils thought your lessions we different and exotic. I felt the teaching was clear and systematic and the nivaeu was just the right. For some of the students it might have been a little easy, but for the most of the class it was just all right. In some parts they had to consider and think a lot to choose the right alternation. Visually it was clear and interesting. I did not notice any differences from students between the lessions. Of course they learned the dynamics during them."