

## **AUDITORY ANALYSIS AS A METHOD OF DIAGNOSING TIMBRAL HEARING OF FUTURE PROFESSIONAL MUSICIANS**

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### **Abstract**

*The potential of the diversity of specific timbre inclusions in the music of the 20<sup>th</sup> and 21<sup>st</sup> centuries is used quite differently: this factor determines a special place of work forms for the development of timbral hearing at sol-fa lessons, namely, that of the auditory analysis. In this research, the authors have developed diagnostic music assignments for identifying the level of future professional musicians' timbral hearing on the basis of the auditory analysis.*

*During case study authors elaborated and piloted levels, indicators of development and diagnostic assignments for identifying the level of timbral hearing on the basis of different types of auditory analysis during the sol-fa lessons in a secondary music school.*

**Keywords:** *development of timbral hearing, auditory analysis, sol-fa study process, case study*

### **Introduction**

Timbre is a special component of a music sound. In music of the 20<sup>th</sup>–21<sup>st</sup> century, timbre comes to the forefront as being one of the most important means of musical expressiveness (Литвинова, 2013).

Traditionally, the problem of developing a good ear for music is considered to be one of the principal issues in music pedagogy. Effectiveness of a professional activity is related, first of all, to the process of the development of musical hearing. Contemporary researchers got actively interested in issues relating to the phenomenon of sound color – timbre, since in music of the 20<sup>th</sup>–21<sup>st</sup> century the role of timbre and other qualities of sound underwent changes (Zavadska, 2021a). This explains the close attention to the development of timbral musical hearing of musicians –professionals.

Though the research on the issues of diagnosing musical abilities is quite extensive (Тарасова, 1988; Swanwick, 1999; Adams, 2001; Campbell, 2008; Wallentin, Nielsen, Friis-Olivarius, Vuust & Vuust, 2010; Law & Zentner, 2012; McPherson &

Zimmermann, 2011; Ullen, Mosing, Holm, Eriksson & Medison, 2014; Asztalos & Csapo, 2017; Zavadska, 2021b), theoretical and methodological foundations of diagnosing and developing timbral hearing are still in the phase formation and are only recently started to be developed in pedagogical praxis.

The topicality of the issue of developing timbral hearing arises also from the fact that this problem has not been sufficiently addressed and developed on theoretical and practical levels as yet. Contemporary researchers (e. g. Siedenburg, Saitis, McAdams, Popper & Fay, 2019) maintain that timbre is a foundational aspect of hearing, and raise a lot of important questions in psychology, cognitive sciences, musical acoustics, speech, medical technique. The authors also indicate three research trends in issues of perceptions of timbre:

- Basic perceptive processes which organize processing of timbre;
- Timbre as a part of specific scenarios, including the perception of a human voice;
- The role of timbre and its impact on the quality of sound and sound design.

The development of timbre has not received yet sufficient attention in the system of music education of Latvia. However, scientists' findings (Burceva, Davidova, Kalnina, Lanka Mackevica, 2010) show that a teacher's diagnostic activity is an important part in the process of identifying the developmental level of students' abilities. According to P. Campbell (2008), diagnosing assessment may help to determine students' educational level and degree.

There is quite a solid basis of studies related to the diagnosis of musical abilities (Stumpf, 1883; Тарасова, 1988; Swanwick, 1999; Adams, 2001; Campbell, 2008; Asztalos & Csapo, 2017) as well as tests for determining them (Bennett, 1976; Davidson et al., 1988; Wallentin, Nielsen, Friis-Olivarius, Vuust & Vuust, 2010; Ullen, Mosing, Holm, Eriksson & Medison, 2014; Tkaczyk, Mills & Hui, 2021). Also, levels, indicators and diagnostic assignments for a timbral music dictation have been worked out (Zavadska, 2021a) and computer acoustic programs for developing musical hearing (Quesnel, 2009) have been developed. The timbral component of musical hearing of future professional musicians is not given a full attention to, in a way it seems to be neglected, and its development remains passive as regards to melodic one. In practice of teaching sol-fa at a secondary professional level (music school), the line of complicating pitch, mode, and harmony difficulties is sufficiently well elaborated and methodologically well-constructed. We have to note that the amount of the taught material has been reduced in respect to timbre.

**Research aim:** to develop and pilot levels, indicators and diagnostic assignments for identifying the level of timbral hearing of future professional musicians on the basis of auditory analysis.

## **Methods and Sample**

Methods of research applied in this research are as follows:

- The analysis of methodological and theoretical literature on the problem under study;
- Modeling of levels and indicators for the development of musician's timbral hearing;
- Piloting of levels, indicators and diagnostic assignments for identifying the developmental level of timbral hearing of future professional musicians in the frames of case study.

The participants of pilot research in the frames of case study were 18 third-year students (3 groups) from Daugavpils Stanislavs Broks Secondary Music School. And from them, one was an accordionist, one – a drummer, two – pianists, two – choir conductors, three – brass band players (two – saxophonists, one – flautist), four – string instrument players (two – viola players and two – violinists), two – theoreticians and three – vocalists.

The sample for diagnostics is not highly representative, but it comprises participants from all music school specialisations. Students perceive timbre by ear specifically: it depends on their specialisations. For instance, pianists have a well-developed textural, register hearing; string and brass instrumentalists have a more developed melodic hearing; while choir conductors – harmonious hearing, but for theoreticians – the instrumental timbre takes the first position in the hierarchy of their expression means (Zavadska, 2021b). This is why at developing the timbral hearing, both strong and less developed sides of students' timbral perceiving have to be taken into account. The sounding of timbre of one's own instrument makes the perception easier for students of all specialisations.

## **Diagnostics of Timbral Hearing on the Basis of Auditory Analysis**

Timbre is an essential means for achieving expressiveness in performance. Together with nuances, articulation, dynamics and tempo, timbre allows a performer to implement different variants of performing the composition. The development of the ability of hearing to perceive the expressive meaning of a timbral sounding is a vital condition for a musician to achieve professionalism in musical-performing activity. Perceiving different timbres evokes multiform associations.

Due to the changes of the role of timbre and other sound qualities in music of the 20<sup>th</sup>–21<sup>st</sup> century, researches' attention was focused more frequently on issues pertaining to the phenomenon of sound color – timbre (Zavadska, 2021a). Sounds produced at the same pitch and loudness but performed on different instruments, by different voices or on one instrument but by different techniques of performing are distinguished one from another by their timbres (McLachlan, Marco & Wilson, 2013). Other authors define timbre as the time-varying pattern of spectral components by which sound may be recognized (Handel, 1995; Handel & Erickson, 2004).

Timbre is a specific component of a music sound, and this factor determines the special place of work forms for the development of timbral hearing, namely – auditory analysis, at the lessons of sol-fa. If timbre and its interaction with other expressive means become the object of analysis, such type of auditory analysis is called timbral by T Litvinova (Литвинова, 2013). R. Quesnei interprets timbre as a parameter of sound quality which to a great extent depends on the spectral balance (Quesnei, 2009).

In turn, B. Teplov (1947) distinguishes three basic groups of features which are especially frequently used to characterize timbre:

- a) Light characteristics: light, dark, shining, tarnished etc.
- b) Tactile characteristics: soft, rough, sharp, dry etc.
- c) Spatial-volumetric characteristics: full, empty, wide, massive etc.

The basic forms of work on the development of hearing (dictation and analysis by ear) are implemented under mono-timbral conditions – the piano (Zavadska, 2021b).

T. Litvinova (2013) mentions the diversity of timbral hearing and defines its different sides:

- timbral-articulative;
- timbral-register;
- timbral-harmonious;
- timbral-textural;
- timbral-dynamic;
- timbral-rhythmic.

This is why it is important to develop all components of timbral hearing as a complex. If the analysis by ear is chosen as a work form at sol-fa lessons, the attention should be paid to the analysis of different techniques used for a timbral-color exposition of the melody rather than to sound-pitch means of musical expressiveness.

The problem of diagnosing musical abilities is one of the most acute problems in music pedagogy. K. Stumpf (1883) – one of the founders of music psychology – was the first who seriously focused on issues of the individual differences of musical abilities and tried to work out experimental tests for diagnosing them. Since that time, the whole history of psychology has been actually related to testing musical abilities, which became a leading direction in the research on these abilities. The second direction – research on isolated cases of a striking musical giftedness – also pertains to it. However, diagnosing of musical abilities, like any other kind of diagnosing, may become a basis for exploring the possibilities of further development.

In the area of musical tests, D. Hargreaves (2012) isolated three main forms of tests on achievement, attitude and ability. The last one is designed to assess musical aptitude regardless of previous musical learning or experience.

Contemporary researchers (e. g. Tkaszyk, Mills & S. Hui, 2021) are engaged in developing specific tests on art, education and communication. Together, they demonstrate that testing as such has become an enduring and wide-ranging cultural

technique in the modern period, one that is situated between histories of scientific experimentation and many fields of application.

This research is concerned with designing diagnostic music assignments for identifying the level of future professional musicians' timbral hearing on the basis of auditory analysis, and explores the possibilities of employing these tests in a pedagogical practice during the sol-fa lessons in a secondary music school.

### **The Procedure of Identifying the Developmental Level of Student's Timbral Hearing on the Basis of Auditory Analysis**

The research data were collected from 22<sup>nd</sup> February till 27<sup>th</sup> April 2021, and students did the assignments during the sol-fa lessons in a secondary music school. The second-year students have two sol-fa lessons a week, each 40 minutes long. Assignments were done during two weeks. Doing assignments took about 10 minutes from the total time of a sol-fa lesson, and this appeared enough for students to fulfil diagnostic assignments.

To maintain the quality of music fragments offered for listening, audio-recordings were made as separate files which were played several times depending on the complexity of the assignment.

Auditory timbral analysis is oriented towards perceiving timbre in its interrelation with rhythm, articulation, register, dynamics and texture. Objects of auditory attention may be timbers of instruments, their simultaneous or successive sounding, and also peculiarities of the articulation used, as well as the position of register. For the timbral analysis by ear, music fragments of different styles were used: baroque (the 18<sup>th</sup> century), classical (the 18<sup>th</sup> century), romantic (the 19<sup>th</sup> century), and contemporary (the 20–21<sup>st</sup> centuries).

During the process of diagnosing, it was essential to identify the developmental level of every student's timbral hearing. Comparison and generalization of the outcomes of diagnostic studies will make it possible to design the strategy for developing professional musicians' timbral hearing in future.

Diagnostic assignments were based on the comparative-timbral analysis of different type:

- To identify the timbre of the instrument during the sounding of different music material;
- To identify the timbre of instrument(s) during the sounding of identical music material (timbral modification);
- To compare the piano variant with the original variant of performing one and the same melody.

Assignments were distributed according to the growing complexity:

- a) First, there sounded various music materials performed by some solo instrument;
- b) Then, the melody was preserved but the timbre of the instrument changed, and a timbral modification took place;
- c) After that, the comparison of the piano variant with the original performance of the melody was made.

In all cases, students were given partly completed diagnostic assignments, and some of them had “prompts-supports”.

### ***A. Sounding of a Solo Instrument with the Orchestra***

Listening to melodies of different character performed on different instruments helps to identify the timbral peculiarities of every instrument and enables having a broad conception about its expressive possibilities. During the timbral auditory analysis, the conception about timbre in a wider sense of the word as about the sounding on the whole is implemented. It strongly resembles the integrated analysis during which the interaction of the timbre with other means of expression and their influence on the general character of sounding are revealed. During this process, a definite complex of means of expression for creating various imagery spheres in music might be identified: meditative, joyful, fantastical etc. In comparison with the complex of expressive means, it is vital to give the attention to striking unexpected individual approaches to embodying images of different type. The differentiation by ear of a definite timbre within a musical fabric is the field of the timbral auditory analytical assignment of this type. At distinguishing instruments, the main thing is to identify the instrument.

In music fragments given below (see Table 1), students were offered to identify and write into the table the solo instrument and the group to which the solo instrument belongs.

***Table 1. Diagnosing assignment on identifying the sounding of the solo instrument***

| <b>Composer and title of the work<br/>(partly or completely)</b> | <b>Solo<br/>instrument</b> | <b>Instrument<br/>group</b> |
|--|----------------------------|-----------------------------|
| 1. Pyotr Tchaikovsky, Symphony No. 5, 2 movement                 |                            |                             |
| 2. Antonín Dvořák, Symphony No. 9, 2 movement                    |                            |                             |
| 3. Jānis Ivanovs, Čello koncerts 2. daļa                         |                            |                             |
| 4. J. S. Bach, Violin Concerto in D minor,<br>1 movement         |                            |                             |
| 5. W.A. Mozart, Flute Concerto No. 2, 1 movement                 |                            |                             |
| 6. Jorge Salgueiro, Concerto                                     |                            |                             |
| 7. Edward Elgar, <i>Sospiri</i>                                  |                            |                             |
| 8. Ennio Morricone, <i>The Mission</i>                           |                            |                             |
| 9. Nei Rozauro, Concerto   |                            |                             |

### B. Timbral Modification

During the process of timbral modification, the auditory analysis presupposes listening to the theme played several times as well as identifying timbral changes. This type of analysis ensures full attention to the timbral side and preserves sound pitch as an invariant when the coloristic aspect changes. For a diagnostic analysis on timbral modification, fragments from two compositions were chosen: “Bolero” by Maurice Ravel and Symphony No. 7, 1<sup>st</sup> movement, episode of theme by Dimitry Shostakovich.

Besides, the correct variant of some instruments was already written in the assignment as “a prompt” to indicate to the students the right direction the assignment has to be done (see Table 2).

**Table 2. Diagnostic assignment on timbral modification**

| Composer and title of the work  | Music fragment number | Solo instrument/instruments |
|---|-----------------------|-----------------------------|
| Maurice Ravel, <i>Bolero</i>  | 1 Music fragment      |                             |
|   | 2 Music fragment      |                             |
|   | 3 Music fragment      |                             |
| Dmitry Shostakovich, <i>Symphony No 7</i> ,<br>1 movement (episode theme) | 1 Music fragment      | ?/violas                    |
|   | 2 Music fragment      |                             |
|   | 3 Music fragment      | flutes/?                    |
|   | 4 Music fragment      | oboe/?                      |

### C. Comparative timbral analysis

For a comparative timbral auditory analysis and diagnostic assignments, two fragments from two compositions were selected:

- 1) The theme of promenade from the suite by M. Musorgsky in its original piano interpretation and in the variant re-interpreted by M. Ravel;
- 2) “Melancholic Waltz” by E. Dārziņš in a piano interpretation and the original orchestral variant of the composer.

During the process of timbral auditory analysis, after students had listened to the piano variant, they were asked to write down the melody first and then, without diverting the attention for writing down a sound pitch, focus on the sounding of orchestral timbres (see Table 3). A peculiar sounding of the *Promenade* theme by M. Musorgsky cannot be heard when it is performed on the piano, though the timbre of just this instrument is the “visiting card” of the timbre of this theme.

**Table 3. Diagnostic assignment on timbral analysis**

| <b>Level/<br/>Number of points</b> | <b>Indicators</b>  |
|------------------------------------|--|
| Low /1 point                       | Less than 50% of a auditory timbre analysis are written correctly  |
| Average/ 2 points                  | a) 60% – 80% of a auditory timbre analysis are written correctly;<br>b) Some mistakes in lengths and writing notes are permissible                           |
| High /3 points                     | a) 80% – 100% of a auditory timbre analysis are written almost without mistakes;<br>b) Insignificant inaccuracies are permissible in writing notes or rhythm |

During the process of a diagnostic research, on the basis of the developed levels and indicators, the results of future professional musicians' timbral hearing were analyzed and assessed on the basis of auditory analysis of different type.

## Study Results

### *A. The results of the diagnostic research*

After completing the first assignment – *Sounding of a solo instrument with the orchestra* – the results were as follows (the highest number of possible points – 54):

- Seven students reached the highest level (among them two theoreticians, two pianists, two string instrumentalists and one choir conductor);
- Seven students achieved the average level;
- Four students' works were assessed as written on a low level.

The analysis of timbral modification produced such results (the highest number of possible points 21):

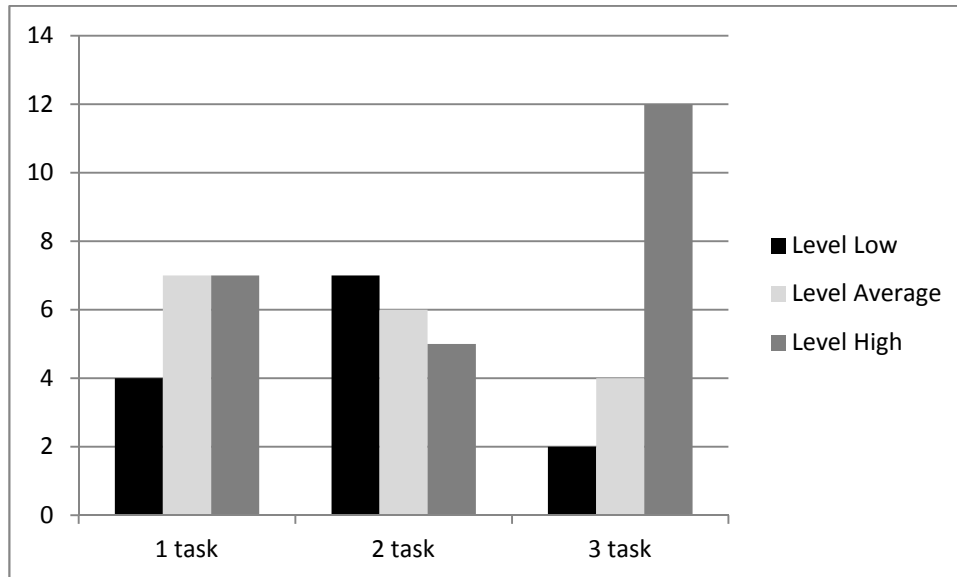
- Five students reached the highest level (among them one pianist, one wind instrumentalist, one choir conductor, one string instrumentalist and one theoretician);
- Six students achieved the average level;
- Seven students received the lowest number of points.

After the completion of the third assignment the results were as follows (the highest number of possible points –12):

- The majority of students – 12 people – did the assignment correctly (among them two theoreticians, two pianists, two string instrumentalists, two wind instrumentalists, two choir conductors, one drummer and one accordionist);
- Four students reached the average level;
- Two students received the lowest number of points.

General results of the diagnostic research by levels are given in Figure 1:





**Figure 1. Results of the diagnostic research by levels**

The analysis of the results obtained from the diagnostic research allows drawing the following conclusions:

1. The third assignment – comparative timbral analysis – has produced the best results. Though the assignment was not easy, many students coped with it excellently. The change of timbres at perceiving and analyzing music did not affect the quality of fulfilling the assignment: this can be attributed to the fact that music by P. Tchaikovsky and E. Dārziņš is quite popular and these compositions are listed as compulsory for listening in courses on music literature at a music school.
2. The assignment on identifying the solo instrument in the orchestral composition was also carried out relatively well: this indicator testifies to the fact that students are fairly competent in groups of instruments and within the orchestral texture can identify by ear a solo upper voice.
3. Complexities arose in the assignment on timbral modification: this type of timbral auditory analysis is novel. It is a well-known fact that to distinguish by ear melodic lines in the low or middle voices is much more difficult than to do it in the upper voice, and just the latter was presented in music fragments under the analysis. At timbral modification, the timbre of melody alters and independent voices undergo timbral changes. Timbral modification is one of the basic methods of the development in the orchestral music and requires a detailed exploration. The differentiation of a melodic line and identification of instruments must be done on the basis of distinguishing by ear a definite timbre within the context of music. This students' skill is not yet developed.
4. Low indicators of completing the diagnostic assignment were shown by vocalists. To our regret, the present educational praxis does not offer to future singers the opportunity to sing with the orchestra, and consequently the process of training vocalists takes place in mono-timbral conditions – accompanied on the piano. Therefore students-vocalists do not sufficiently acquire practical skills of interacting directly with other instruments.

5. The pedagogical strategy for the development and improvement of future professional musicians' timbral hearing has to take into account diagnostic indicators and be oriented towards learning to perceive by ear subtle timbral modifications.

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