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Influence of Sound Registers on Comprehension, Memory, and Notating Music

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Abstract

The process of musical literacy in teaching Solfeggio is based on a variety of methods for teaching students to acquire diverse musical knowledge and skills. In addition, auditory and visual memory processes are involved (Vasiljević, 2000). Literature with a two-bar repetitive approach to dictating, typically via piano in the middle register, is the most common practice in Serbia (Karan & Sedlar-Dabić, 2018). The question is whether students, used to practising one-voice dictations in the middle piano register, would be affected by a change in the sound register of musical content intended for dictation. This exploratory research aimed to determine: 1) whether there are differences in musicians' achievement on the Melodic Dictation Test (MDT) depending on the register of the dictation tasks (MD); 2) whether there are differences on MDT achievements regarding sex, playing a certain instrument, school achievements, and MDT results. The sample included 62 Faculty of Music in Belgrade first-year students (65% female) from the performance, music pedagogy, and composition departments. The MDT created for this study included 3 trial tasks and 6 main tasks: 2 for each register (Low, Middle, and High) and was recorded in *Sibelius* with a synthesized piano sound. The questionnaire was used to collect general students' data. The data were analyzed using SPSS for Windows 20.0. ANOVA revealed that in MDT, participants achieved the highest scores on tasks in the Middle register, while achieving the lowest scores on those tasks in the Low register. Only the wind, poly-instrumental, and voice (WPV) departments students' MDT results differ significantly from the piano department students' MDT results for Low register tasks. Similarly, only the WPV department students' results differs significantly from the compositions and pedagogy departments students' for Middle and High register tasks. Higher Solfeggio grades correlate positively with better MDT results in all 3 registers. The findings suggest that sound register changes affect MD notation accuracy. One of the study's limitations is the small sample size. Furthermore, this research can include more in-depth work on MD in different tonal registers and its relationship to other Solfeggio skills.

Introduction

Solfeggio as a curricula course is present at all levels of music education in Serbia, from elementary music school to the Faculty of Music, i.e., music studies. In teaching Solfeggio, the process of musical literacy is based on and begins with the setting of the sound and its binding to the musical notation, which includes the process of auditory and visual memory. When teaching Solfeggio, this connection is established through work on melody, rhythm, and dictation, instructing students on understanding and writing musical text.

In Solfeggio lessons in Serbia, work on dictations includes monophonic (one-voice), polyphonic (two-voice and three-voice), melodic dictations, and rhythmic dictation.[1] This paper will focus on one-voice melodic dictations that are prevalent at all levels of music education, from elementary music school to the Faculty of Music.

Within the framework of current musical literacy practice in Serbia, the field of one-voice melodic dictation is dominated by compositions ranging in length from 8 to 16 bars, explicitly written for dictation using a two-bar repetitive dictation procedure, and most often played in the middle register of the piano (Karan & Sedlar-Dabić, 2018). This type of dic-

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[1] In addition to written dictations, there are also oral dictations that focus on the perception of tones and phrases.

tation aims to teach the student how to translate sound perception into musical notation as quickly as possible. Usually, the musical content that must be memorized is divided into two bars or smaller phrases. Due to the significance of establishing auditory and visual connections during the teaching process, instruction pertaining to dictations should be inseparable from and synchronized with the field of melody and rhythm. To achieve a successful connection of auditory perception and reception in both directions – from notation to the formation of sound (performance of musical text by singing while naming pitches which engages previously gained knowledge at Solfeggio lessons) and from sound to musical notation (perception, memory), and notating music – dictation – it can be assumed that the majority of the literature is intended for one-voice dictations, specifically within the framework of the middle register, which is closest to the vocal range. The assertion of Zorislava M. Vasiljević (2000) supports this: "The development of audio-visual memory starts at the very beginning of formal education, but primarily through the memorization of what is derived by a voice from notating music" (p. 258). Although the sound range of dictation, as it appears in most literature, may not have originated solely from the causes mentioned above, it can be assumed that it rose from the need to link dictation with work on the melody.

Looking carefully at the role of one-voice dictation, it became evident that using the piano's middle register, which also includes the range of the human voice, is the most appropriate and, in that regard, the most precise. However, considering the students' familiarity with the middle register when working on monophonic dictations, the question arises as to whether and to what extent a change in the register of the musical content intended for work on dictation would affect recognition, understanding, and notation of the melody. As far as is known from the available literature, no research studies in Serbia have been conducted on this topic.

The subject of this exploratory study is one-voice melodic dictation, focusing on the success of translating sound into the musical notation of composed melodic examples in different registers based on classical music style melodic lines. As such, the subject of the study also refers to the length of students' work on one-voice melodic dictations during their prior musical education, achievements in Solfeggio and musical instruments measured by academic grades as well as their self-estimated success in mastering this skill.

Aims

The exploratory study aimed to:
1) examine the relationship between the sound register and the accuracy of notating music through musical dictation, i.e., Melodic Dictation Test (MDT), and
2) explore whether there are connections between respondents' sex, playing a particular musical instrument, prior music teachers' pedagogical practice in MD, musical academic achievements, Self-evaluation in MD, and MDT scores.

The first hypothesis is that as a result of learning and primarily using the piano's middle register in working on melodic dictations during previous music education, the accuracy of notating dictations will be higher in the middle register. The second hypothesis is that students with higher marks in prior music education will be more successful in notating dictation in different registers. The third hypothesis is that male respondents may be better at notating dictations in the low register since it is within their voice range.

Method

Sample

The convenience sample comprises 62 first-year students from the Faculty of Music in Belgrade. The total sample has 65% female and 35% male respondents. The respondents were grouped according to the department: the piano department (34%), the string department

(27%), the wind, poly-instrumental, and voice departments (WPV; 21%), and the music pedagogy and composition departments (23%).

Variables

Variables were categorized as follows:
- General students' data (sex, department, musical instrument);
- Solfege teachers' pedagogical practice – which concerns the music high school solfege teachers' methods employed in working with melodic dictations with students;
- Educational achievements (music high school final year grades in Solfeggio and Instrument);
- Self-evaluation of one-voice melodic dictation writing skill;
- MDT achievements in Low, Middle, and High registers.

Instruments

The measuring instruments used are:
1) The Melodic Dictation Test (MDT),
2) Questionnaire for gathering general and educational data and Self-evaluation.

The MDT was created for this exploratory research; it consists of 6 tasks – 2 tasks for each register (Low, Middle, and High). The test tasks were unified as to the level of melodic-rhythmic difficulty and parameters: 2/4 time signature, major tonality (D major), and an 8-bar length. The uniformity of the task difficulty, as well as the meter, tonality, and duration, were intended to emphasize and isolate the register influence on notating accuracy.

The scoring method is designed to give 2 points for a correctly written bar, resulting in a maximum of 16 points per task, i.e., 32 points on both tasks in one register. The total number of points obtainable for the MDT is 96. In addition to the main tasks, 3 four-bar trial tasks were created based on the same parameters as the test's main tasks. They were not scored. The MDT tasks were recorded and played to fully enable identical sound source conditions for all subjects. The MDT tasks were recorded using a synthesized piano sound in the *Sibelius* program. Randomization was used to determine the order of tasks in the test, including trial tasks.

A questionnaire for gathering general, educational data and self/evaluation was designed for the purposes of this study. The Questionnaire included 12 questions: 3 general questions – sex (question 1), department and instrument (questions 2 and 3), 3 questions related to academic success during earlier music education – grade in Solfeggio and Instrument at the end of music high school, and during university studies (questions 4, 5 and 6). Four questions (Likert rating scale from 1 to 5), which refer to teachers' work on dictations during prior music education (frequency of one-voice MD), music instrument used by a teacher, the registers usually used to perform the MD tasks (questions 7, 8, 10, and 11), and Self-evaluation of success in notating one-voice melodic dictations (question 12). One open-ended question was referring whether the dictations were played on other musical instruments during the previous education (question number 9).

Procedure

The study was conducted at the Faculty of Music during regular Solfeggio classes from March to May 2022. Students filled in the questionnaire on general, academic and self-evaluation data, and then filled in the MDT trial tasks, and main tasks, consecutively. In total, the answering these questions took, approximately, 45 minutes. Before the MDT main tasks, the students were played 3 trial, introductory tasks in all 3 tonal registers (Low, Middle, and High) as preparation for the test's main tasks. The students were given 2 bars of beat and pitch before each task, including the test tasks.

The research was carried out in accordance with the University of Arts in Belgrade's Code of Ethics for Scientific Research.

Data Analysis

The quantitative method of data analysis was used (program package SPSS for Windows 20.0); descriptive analysis was performed, the significance of group differences was calculated (*t*-test of comparative samples and ANOVA), and Pearson's correlation.

Results

The findings indicated that students performed the best on the MDT tasks in the Middle register and the worse on the Low register task (Table 1).

Table 1. Descriptive statistics of the MDT results for Low, Middle, and High registers (*N* = 62).

Melodic Dictation Test's task	*M*	*SD*
Low register tasks	7.61	10.16
Middle register tasks	21.53	10.37
High register tasks	12.45	12.43

The ANOVA test for repeated measures with post hoc tests was applied to analyze the average scores on the MDT tasks, in each of the 3 registers. It was found that the average scores for all 3 registers differed significantly, $F(2) = 66.29$, $p < .001$, $\eta^2 = .69$, with the results for the Middle register being significantly higher than the average values for the High register and the Low register (see Table 1). In order to determine wether there is statistically significant difference

between average achievements on pairs of tasks in different registers (Low-Medium; Low-High; Medium-High), the Tukey post hoc test was applied. Given that in case of each of stated pairs *p* < .001 was obtained, it was confirmed that a significant difference exists between achievements on all registers individually.

Students' MDT Achievements In Relation to Departments

A one-factor ANOVA was used to analyze the participants from different study departments results of the MDT, on each of the 3 registers. For all 3 registers, it was determined that there are statistically significant differences in achievements of students enrolled in different study departments (see ANOVA statistics in Table 2).

The Tukey post hoc test was used to determine which departments differed significantly in scoring on tasks for each register (Table 2). It was determined that the Low register marks a significant difference only between the WPV and piano department (*p* < .001), while on the Middle (*p* < .05) and High registers (*p* < .05) a significant difference emerged only between the WPV and music pedagogy/composition department students. Graphic representations of students from different departments' average achievement on each of the MDT registers, separately, are shown in Figures 1, 2, and 3.

Table 2. ANOVA statistics for the participants from different study departments' MDT scores in Low, Middle, and High registers.

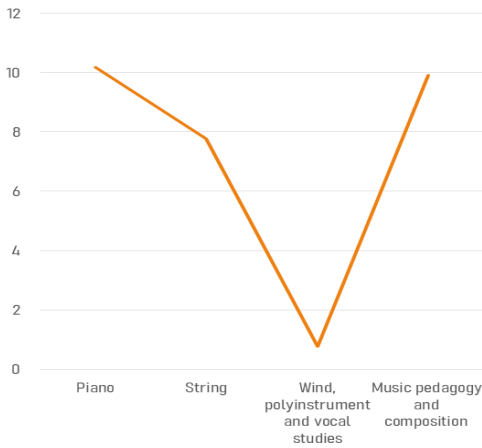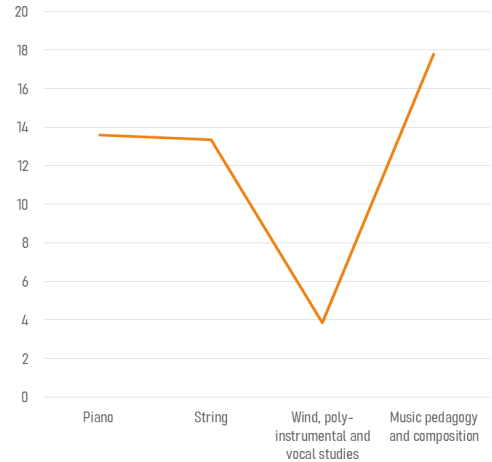|	Study department(s)									
Register	ANOVA			Piano department		String department		Wind, poly-instrumental & voice departments		Music pedagogy & composition departments	
	F	*df*	*p*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Low	2.91	3. 58	.04	10.19	11.7	7.79	11.50	.77	1.65	9.93	9.72
Middle	3.32	3. 58	.03	20.71	10.38	23.36	8.20	15.23	12.65	26.79	7.10
High	3.38	3. 58	.02	13.62	11.59	13.36	14.02	3.85	9.33	17.79	11.16

Figure 1. Average achievement of students from different study departments on MDT's Low register performance tasks.
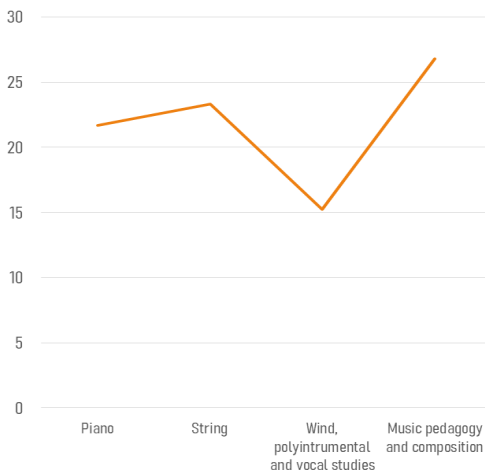

Figure 2. Average achievement of students from different study departments on MDT's Middle register performance tasks.

It can be concluded (from Figures 1, 2, and 3) that noticeably the lowest results were produced by the wind, poly-instrumental, and voice departments students.

Figure 3. Average achievement of students from different study departments on MDT's High register performance tasks.

Relationship Between MDT Achievements and Solfeggio Teachers' Pedagogical Practice During Prior Music Education

Descriptive analysis of Solfeggio teacher's pedagogical practice during students' prior music education showed the following results: the average occurrence of working on monophonic melodic dictations ($M = 4.03$, $SD = 1.08$) in the previous educational level of students, the average occurrence of Dictations played on the piano ($M = 4.91$, $SD = 0.37$), and Dictations played in the middle register ($M = 4.59$, $SD = 0.94$). For the analysis of the relationship between achievements at the MDT according to registers and Solfeggio teachers' pedagogical practice during prior music education, the of Pearson's linear correlation coefficient was calculated (Table 3).

Table 3. Pearson's correlation coeficients between MDT performance tasks for different registers and previous experience with melodic dictation.

Previous education	Register		
	Low	Middle	High
One-voice melodic dictation frequency	.25*	.36**	.25*
Dictations played on the piano	.15	.02	.01
Dictations played in the middle register	.09	.02	.05

*p < .05; **p < .001

Results point out a statistically significant correlation of moderate strength between the monophonic melodic dictation frequency during previous education in relation to achievements in MDT tasks in all 3 registers, Low, Middle, and High. In other words, the greater the frequency of dictation work, the higher the proficiency in all 3 register tasks is.

Relationship Between MDT Performance Tasks and Academic Achievement in Solfeggio and Instrument

To analyze the relationship between students' MDT achievements by registers and previous academic achievement presented through Solfeggio final grades at the end of the music high school ($M = 4.72$, $SD = 0.60$) and Instrument final grades at the end of the music high school ($M = 4.88$, $SD = 0.36$), the linear correlation method was used, i.e., the value of the Pearson's linear correlation coefficient was interpreted (Table 4).

Table 4. Correlation between the MDT achievements for Low, Middle, and High registers and Academic achievements at the end of the music high school.

Music high school final year grades	Register		
	Low	Middle	High
Solfeggio grade	.27*	.43**	.26*
Instrument grade	.16	.06	.09

*p < .05; **p < .001

Results show the statistically significant correlation of moderate strength between Solfeggio final grades at the end of music high school and MTD achievements in all 3 registers. There is a positive correlation in all 3 registers, i.e., with an increase in the solfege score from high school, the values related to the registers also increase.

These results indicate that independently of previous educational practice in melodic dictation (played on piano or not, or preferred register), students with high Solfeggio grades at the end of the secondary music education master MDT tasks well, nevertheless register.

Relationship Between the MTD Achievements for Low, Middle, and High Registers and Self-evaluation of One-voice Melodic Dictation Writing Skill

For the analysis of the correlation between achievements on the MDT in all 3 registers and Self-evaluation of one-voice melodic dictation writing skill ($M = 3.41$, $SD = 1.47$), the method of linear correlation was applied, that is, the value of the Pearson's correlation coefficient was interpreted (Table 5).

Table 5. Correlation between the MTD achievements for Low, Middle, and High registers and Self-evaluation of one-voice melodic dictation writing skill.

Success rate	Register		
	Low	Middle	High
Self-assessment of success in writing one-voice dictations	.38**	.57**	.43**

*p < .05; **p < .001

By interpreting the Pearson's correlation coefficient, it was determined that there is a statistically significant correlation of moderate to strong strength between the Self-evaluation of success in writing monophonic dictations and achievements on MDT in all 3 registers. In all three instances, 3 is a positive correlation between the Self-evaluated achievement in writing one-voice dictations and the values associated with the registers.

MDT Achievements for Low, Middle, and High Registers and Sex Differences

The MDT achievements in 3 registers tasks were analyzed in relation to the respondents' gender using the *t*-test for independent samples (Table 6).

Table 6. MDT achievements for Low, Middle, and High registers and gender differences.

Register	*t*-test for independent samples			Sex	
	t	*df*	*p*	Male (*M*)	Female (*M*)
Low	.64	59	.52	8.90	7.12
Middle	.45	59	.65	20.86	22.12
High	.32	59	.75	11.90	12.98

Using the Student's *t*-test for independent samples, as can be seen in Table 6, it was found that there is no statistically significant difference between the Melodic Dictation Test tasks performance of males and females for all 3 registers.

Discussion

The results from this exploratory research indicate that the registers of melodic lines intended for melodic dictation are related to the achievements in the Melodic Dictation Test. The tasks in the Middle register were significantly better done by students, with superior outcomes. Students' MDT achievements in relation to Departments have shown that the Low register tasks mark a significant difference only between the wind, poly-instrumental, and voice departments and piano department, while the Middle and High register tasks show a significant difference only between the wind, poly-instrumental, and voice departments and music pedagogy/composition department. These findings leave open questions for further research opportunities.

No correlation was observed between the use of the piano middle register in playing the dictation during the students' previous education and their success in writing down the dictation on the MDT. This finding was significant because the assumption that as a result of learning and primarily using the piano middle register in working on melodic dictations during previous music education, the accuracy of notating dictations will be higher in the Middle register, was relatively injured: the obtained findings indicated that on MDT students performed the best on the tasks in the Middle register, leaving open questions for further research opportunities.

On the other hand, frequent and continuous work on melodic dictation during previous music education demonstrated a significant correlation with students' success on the MDT in all 3 tonal register tasks.

The correlation between academic achievement in Solfeggio (grade), students' self-evaluation of one-voice melodic dictation writing skill, and students' achievement on the MDT in all 3 tonal registers was significant. The assumption that students with higher grades in prior music education will be more successful in notating melodic dictations in different registers was confirmed but also specified to refer to Solfeggio grades. Final examination achievements for the Instrument in prior music education did not correlate with students' achievements on MDT.

The correlation between the sex of students and their success in writing down dictation in 3 registers was not demonstrated; therefore, the assumption that male students may be more successful in the Low register (within the range of the human voice) was not confirmed.

Conclusion

Examining the obtained results within the context of current pedagogical practise, it is possible to conclude that frequent and continuous work on melodic dictations plays a significant role in the success in this area of Solfeggio as a teaching subject. The high correlation between school achievement in Solfeggio and success in tasks in all 3 tonal registers indicates

that success in melodic dictation writing skill is related to and inseparable from success in the other areas that Solfeggio deals with (melody and rhythm) and that the synchronization connection of work in all areas during the teaching process is very important.

Suppose we return to the fundamental principle of the Solfeggio teaching methods, which is based on connecting sound with musical notation and musical notation with sound by establishing auditory-visual connections. In that case, we can assume that the frequency of working on monophonic, one-voice melodic dictations in different tonal registers contributed to the success of notating melodic dictations in all tonal registers.

Thus, the current emphasis on the middle tonal register when working on melodic dictations, which prevails in present pedagogical practice in Serbia, could be extended to the entire audible spectrum in the music. This would contribute to the overall auditory and visual perception of various tonal registers, thereby completing the process of comprehending, remembering, and notating music.

The primary limitation of this study is the relatively small sample size, particularly in the proportion of respondents who play different instruments.

Due to the limitation above, the respondents in this study were organized by department. In this context, it is planned to extend this research in other Higher music education institutions in Serbia. Moreover, this research can be substantially expanded on multiple parameters. This refers to additional research on musical dictations in the field of various tonal registers. Also, it refers to additional research on the relationship between working on musical dictations in various tonal registers and other aspects of Solfeggio as a teaching subject and musical-pedagogical discipline.

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