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Application of methods for developing musical hearing and rhythm in non-music students of higher education institutions

Aplicación de métodos para desarrollar la audición musical y el ritmo en estudiantes no musicales de centros de enseñanza superior

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Abstract

The aim of this study was to determine the impact of musical exercises on the development of auditory and rhythmic skills in non-music students of HEIs. Testing of auditory skills, the method a comparative analysis for comparing the results of music-related and non-music students. A questionnaire survey for assessing students' attitude to the educational process through questionnaires and feedback. The results of the study confirmed that the previous musical training of students has a significant impact on the development of their auditory skills. Students in the control group (CG), who already had many years of experience in musical activity, presented high results in tests at the very beginning of the study. They showed a significant increase in indicators. In contrast, students in the experimental group (EG), who had no previous experience working with musical material, started from a lower level. Previous musical training plays an important role in the initial indicators of students' auditory skills. The test results confirmed that the EG

achieved the greatest success in the development of musical hearing. The academic novelty of the study is the adaptation of existing methods of developing musical hearing for non-music students of HEIs.

Keywords: Musical hearing development, development methods, types of musical hearing, non-music majors, pedagogy, higher education institutions.

Resumen

El objetivo de este estudio fue determinar el impacto de los ejercicios musicales en el desarrollo de las habilidades auditivas y rítmicas en estudiantes no musicales de IES. Prueba de las habilidades auditivas, el método un análisis comparativo para comparar los resultados de los estudiantes relacionados con la música y no relacionados con la música. Un cuestionario para evaluar la actitud de los estudiantes ante el proceso educativo mediante cuestionarios y comentarios. Los resultados del estudio confirmaron que la formación musical previa de los estudiantes tiene un impacto significativo en el desarrollo de sus habilidades auditivas. Los alumnos del grupo de control (GC), que ya contaban con muchos años de experiencia en la actividad musical, presentaron resultados elevados en las pruebas realizadas al inicio del estudio. Mostraron un aumento significativo de los indicadores. Por el contrario, los alumnos del grupo experimental (EG), que no tenían experiencia previa en el trabajo con material musical, partían de un nivel inferior. La formación musical previa desempeña un papel importante en los indicadores iniciales de las habilidades auditivas de los alumnos. Los resultados de las pruebas confirmaron que el GE logró el mayor éxito en el desarrollo de la audición musical. La novedad académica del estudio es la adaptación de los métodos existentes de desarrollo de la audición musical para estudiantes no musicales de IES.

Palabras clave: Desarrollo de la audición musical, métodos de desarrollo, tipos de audición musical, carreras no musicales, pedagogía, instituciones de enseñanza superior.

Introduction

Musical hearing is an important component of music education, which provides the basis for the development of students' musical abilities and competencies. When studying at HEIs, students of various majors, even if they do not have a musical education, often face the need to learn the elements of musical literacy, which is an important component of general culture. For such students, the development of musical hearing and rhythmic skills becomes not only a part of the educational process, but also an important condition for the development of their general cognitive and creative abilities.

The relevance of the study lies in the need to adapt the methods of developing musical hearing and rhythm in the context of non-music majors of HEIs to the peculiarities of the educational process, oriented to a wide range of students. Most current studies focus on the development of these skills in specialized musical institutions, but not enough attention is paid to methods that can be effective for students of non-music majors.

The aim of this research is to study and adapt methods for developing musical hearing in non-music students of HEIs. The aim involved the fulfilment of the following research objectives:

1. Analysis of the effectiveness of using various methods for developing musical hearing and rhythm in non-music students of HEIs.

The objective was to conduct a comparative analysis of traditional methods used to develop musical hearing and rhythm, as well as to determine their effectiveness in the context of students who do not have musical training.

2. Assessment of the level of musical hearing and rhythm in students before and after specialized classes.

The objective was to conduct an experiment where non-music students are divided into CG and EG. In the EG, regular classes aimed at the development of musical hearing and rhythm are held, after which the change in the level of these skills is assessed in comparison with the control data.

3. Study the changes in the level of students' confidence in auditory perception of musical elements (intervals, chords, rhythms, tempos) in the EG and CG after completing a course on the musical hearing development. To compare the effectiveness of the course in developing auditory confidence in students of different groups, to determine whether specific methods and approaches affect the level of confidence in auditory perception.

Literature Review

Digital technologies play a significant role in modern music pedagogy, helping to improve learning processes, in particular in aspects of the auditory skills development. In their study, Lu & Wang (2025) explored the impact of digital technologies on solfeggio and the pedagogy of ear and memory training. They noted that the introduction of digital tools into learning can significantly facilitate the development of musical skills, in particular in aspects of auditory memory and perception. Yan (2025) found that the integration of new technologies into the learning process can significantly improve the effectiveness of building musical skills, enabling students to work with virtual instruments, analyse musical compositions, and also train their hearing at a convenient time for them. Similar conclusions were reached by Pavlenko et al. (2024). In their study, Salim & Maulana, (2025) presented the development of an educational and training game aimed at increasing the sensitivity of hearing to musical intervals. The authors proposed an interactive approach to learning based on digital technologies, in particular, the creation of a game that enables students to train their hearing in a format that promotes greater involvement and effectiveness of learning.

Li (2024) examined the impact of listening to music on the level of students' musical literacy, in particular in the context of the use of modern online technologies for learning. The author compared the level of musical literacy of Chinese music-related and non-music students provided data indicating that the type of music that students listen to has a significant impact on the development of their musical skills, as well as on the overall level of musical literacy. The comparative analysis shows the difference in approaches to learning among students of different academic subjects and considers the role of online platforms in promoting the development of musical abilities through the latest technologies. Despite the relevance of the latest technologies for our education, Correia et al. (2022) analysed the possibilities of using digital technologies for assessing musical abilities. The results of the study showed that online assessments can be effective, but they need to be adapted and take into account a number of factors, such as acoustic conditions, platform interface and user capabilities.

In their work, Hou et al. (2024) considered the concept of bi-musicality, which combines the development of two important musical abilities: visual perception of notes and auditory perception of musical intervals, rhythms, and melodies. The authors proposed an approach in which visual and auditory training go in parallel, enabling students to develop both visual and auditory perception of music simultaneously. The researchers Balde et al. (2025) explored the relationship between musical expertise and auditory processing in a broader context. The authors focused on how the development of musical skills affects a person's ability to effectively process sound signals. The results of the study showed that musical experts have improved auditory processing abilities, which indicates a relationship between musical activity and cognitive processes of auditory perception. Stillie & Moir (2021) explored the importance of developing aural skills in the context of popular music. The authors emphasize that aural skills are one of the most important elements in music education, as they enable students to effectively recognize and interpret a variety of musical elements, such as intervals, rhythms, and chords. Their study emphasized the importance of integrating aural exercises with instruction in popular music classes, which helps students to develop both technical and creative skills.

In his study, Kimsanov (2024) considered the importance of developing students' musical abilities in children's music and art schools. The author focused on the methods and approaches used in educational institutions to develop students' auditory and performing skills. At the same time, the study of the beliefs of general education teachers and music specialists in Hungarian primary schools regarding the development of musical abilities in children conducted by Astalos (2023) found that general education teachers have a more limited understanding of the importance of music education and its impact on the students' overall development compared to music specialists. The study showed that the effective development of children's musical abilities requires supporting more interaction between general education teachers and music teachers, as well as conducting specialized trainings to raise the awareness of all teachers about the benefits of music education.

Methodology

Research design

The research design included several stages in order to systematically and consistently analyse the development of musical hearing and rhythm in students of non-music majors. At the preparatory stage, a content analysis of the methods for developing musical hearing and rhythm was conducted to systematize and evaluate the effectiveness of traditional and modern approaches. Three main methods were selected for the study: the Carl Orff method (1963), the Zoltán Kodály method (1974), and the Jacques-Dalcroze method (1921). Each of these methods contributed to the development of individual aspects of hearing, which enabled students to significantly improve their music perception skills.

The diagnostic stage involved initial testing of the participants' musical hearing and rhythm level to assess their initial skills. Test tasks were used, which included pitch determination, rhythmic exercises, and melodic repetition, to obtain initial data for further analysis of changes after the implementation of the methods. The experimental stage involved a total of twelve group musical and rhythmic trainings, which were held once a week for three months. The training programme was built on the synthesis of the three above-mentioned methods (Table 1).

Table 1.
Methods of developing musical hearing and characteristics of the exercises

Method	Type of hearing	Frequency of use	Exercises	Exercise duration
The Carl Orff, Zoltán Kodály, E. Jacques-Dalcroze methods	Melodic hearing	Once a week for 3 months	Recognizing notes, singing scales, performing simple melodies with gradual complexity, dictations, determining the pitch of notes, recognizing intervals.	20 minutes
The Carl Orff, Zoltán Kodály, E. Jacques-Dalcroze methods	Harmonic hearing	Once a week for 3 months	Recognizing harmonic consonances, singing chords, analysing harmonies, determining triads, harmonizing melodies.	20 minutes
The Carl Orff, Zoltán Kodály, E. Jacques-Dalcroze methods	Rhythmic hearing	Once a week for 3 months	Stepping to music, clapping rhythmic patterns, working with a metronome, reproducing rhythm according to a sample, reading rhythmic dictation.	15 minutes
The Carl Orff, Zoltán Kodály, E. Jacques-Dalcroze methods	Timbre hearing	Once a week for 3 months	Recognizing instrument timbres, comparing vocal timbres, electronic simulations of timbre changes, determining the instrumental composition of a work.	15 minutes
The Carl Orff, Zoltán Kodály, E. Jacques-Dalcroze methods	Pitch hearing	Once a week for 3 months	Singing chords, determining tonality, harmonic dictations, analysing folk music chords, harmonizing melodies.	20 minutes

Source: developed by the author.

The final stage involved testing to compare the level of musical skills before and after the experiment. Along with the testing, a questionnaire survey was conducted among students, consisting of 10 closed questions regarding the level of their musical training, ability to recognize rhythmic structures, difficulty in perceiving musical material, use of methods for developing musical hearing, and rhythm during learning, as well as their motivation to study musical subjects.

Research methods

To obtain relevant data, a set of methods was used that provide a comprehensive analysis of the effectiveness of the used approaches. Content analysis made it possible to study existing methods for the development of musical hearing and rhythm and identified the most effective approaches for their adaptation to non-music majors.

Testing was used to objectively measure the level of musical hearing and rhythm before and after the experiment, as quantitative data enable assessing the dynamics of skill development. It included tasks for pitch recognition, rhythmic exercises, and melodic repetition. The questionnaire survey supplemented quantitative indicators with qualitative analysis – it was aimed at studying students' attitudes towards musical exercises, their comfort when performing rhythmic tasks and self-assessment of auditory skills, which is important for assessing motivation and subjective perception of the educational process. Comparative analysis of testing was used to evaluate the effectiveness of the applied methods for the development of musical hearing and rhythm in music and non-music students.

Sample

The research sample was formed in such a way as to provide a wide range of data for the analysis of the development of musical hearing and rhythm among students of different academic fields. The selection of three HEIs from different regions of Ukraine allowed obtaining a representative sample of students studying in different programmes and in different conditions:

1) Educational and Research Institute of Arts of Luhansk Taras Shevchenko National University (Department of Musical Art and Choreography);
2) Khmelnytskyi Humanitarian-Pedagogical Academy (Faculty of the Humanities, Department of Vocal, Conducting and Choral Subjects);
3) The National University of Life and Environmental Sciences of Ukraine (Department of Culturology).

A total of 50 students were selected for the study from a total sample of 90 people. The selection was based on the principle of voluntary participation and compliance with previously defined criteria: the level of musical training, the presence or absence of formal musical education, as well as the willingness to complete the full course of the experiment. The participants were divided into two groups: the CG (25 students of music-related majors, mainly 2nd-year students) and the EG (25 students of non-music majors, 1st– and 2nd–year students). This division allowed for a comparison between those who already have basic musical knowledge and skills and those who study music as part of general education. The gender balance in the groups was close to equal, with a slight predominance of women (approximately 55%). Such a sample is critically important for assessing the impact of methods for developing musical hearing and rhythm, as it allows analysing the effectiveness of these methods among students without specialized musical training compared to those who already have certain skills in this area.

Instruments

Before starting the development of hearing in students of non-music majors, they were provided with the basics of musical literacy and the necessary materials for effective learning. The materials included recognizing notes on the staff, knowing the names of notes and their location on the staff. In addition, before starting the development of hearing, students had to acquire knowledge about the durations of notes

and pauses; basic musical sizes (4/4, 3/4, 2/4, etc.); alteration signs; the concepts of tone and semitone; degrees of scales; names, structure and types of intervals (prime (pure), second (minor, major), third (minor, major), fourth (pure), fifth (pure), sixth (minor, major), seventh (minor, major), octave (pure)); the structure of scales and their types (major (natural, harmonic, melodic), minor (natural, harmonic, melodic)); accents and dynamic changes; types of tempos; types of timbres and other basic musical notation. Special attention during the trainings was paid to consolidating theoretical knowledge and basic skills of musical literacy, which is necessary for the further development of hearing.

The research employed the methods of Carl Orff, Zoltán Kodály and Jacques-Dalcroze. SPSS and Google Forms were used to analyse the survey results, which allowed the systematization and statistical processing of the responses.

Results

Previous musical training plays a key role in the development of auditory skills, which confirms the results of the survey of students in both groups. The CG consisted mainly of participants who had experience in music education (Figure 1).

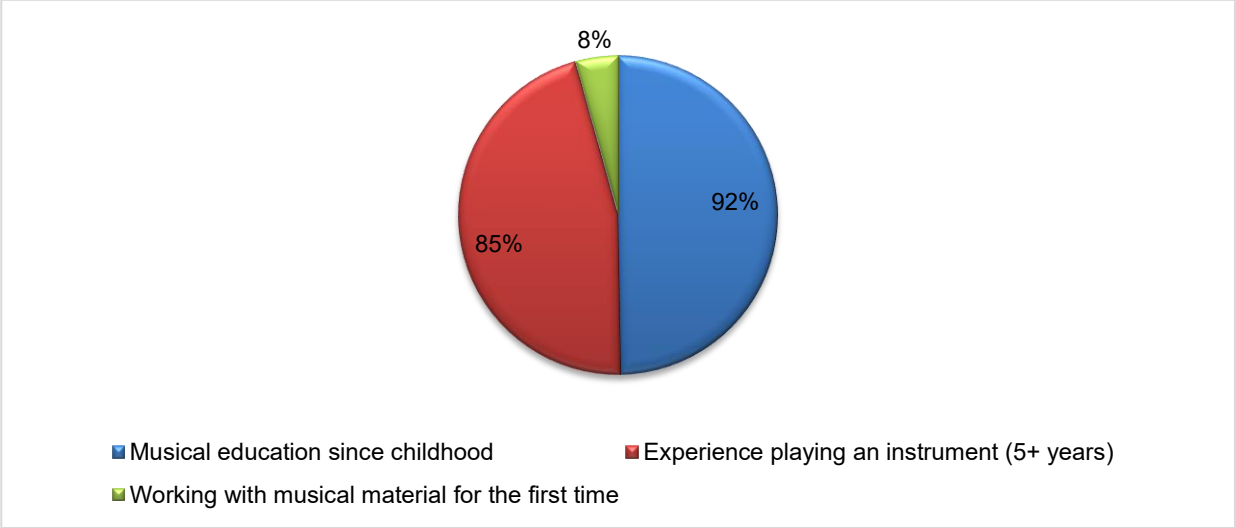

Figure 1. Musical experience before the start of the study of the CG students
Source: developed by the author

The CG consisted mainly of participants who had received musical education since childhood (92%) and had experience playing a musical instrument for more than 5 years (85%). Only 8% of respondents worked with musical material for the first time, which indicates a high level of preparation of the majority of participants. This was taken into account when analysing the results of the study, as previous musical experience could affect the development of auditory and rhythmic skills.

In contrast, the EG students in most cases worked with musical material in this format for the first time (Figure 2).

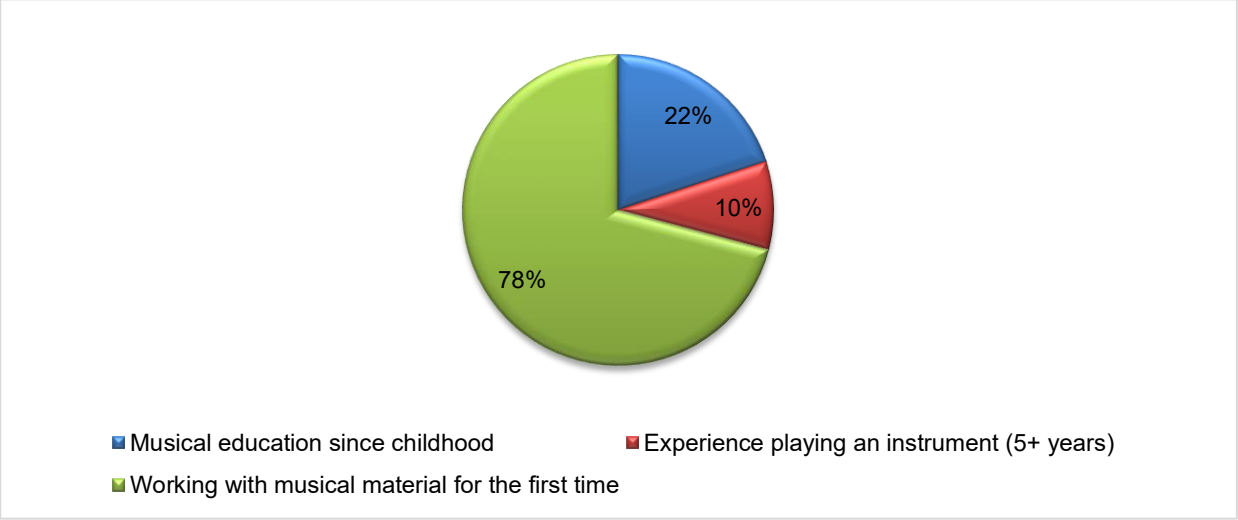

Figure 2. Musical experience of the EG students before the study
Source: developed by the author

The EG differed significantly from the CG in terms of their previous musical experience. Figure 2 shows that only 22% of participants had received musical education since childhood, and only 10% of respondents had more than 5 years of experience playing a musical instrument. In contrast, 78% of the EG students in worked with musical material for the first time, which indicates a low level of previous musical training of the participants, which is an important factor in analysing the effectiveness of the applied methods for developing musical hearing and rhythm.

The influence of this factor was manifested in the initial testing results, where the CG had a significant advantage. However, the effectiveness of the applied teaching methods enabled students without previous experience to achieve significant progress, which confirms the plasticity of musical hearing and the possibility of its development regardless of the initial level.

Analysis of the dynamics of musical ear development among the EG and CG students revealed significant differences in the learning process and final results. It is expected that the CG music-related students (*Department of Musical Art and Choreography*) show significantly higher indicators in tests for melodic, harmonic, rhythmic and timbre hearing from the very beginning. However, the relative increase in skills among non-music students is of particular interest.

Statistical analysis showed that the average increase in scores in the CG was 5-10% from the initial level, while this indicator reached 15-20% in the EG. So, despite the lower final level, the non-music students showed greater efficiency in learning the material, which indicates high adaptability to new methods of developing musical hearing (Figure 3).

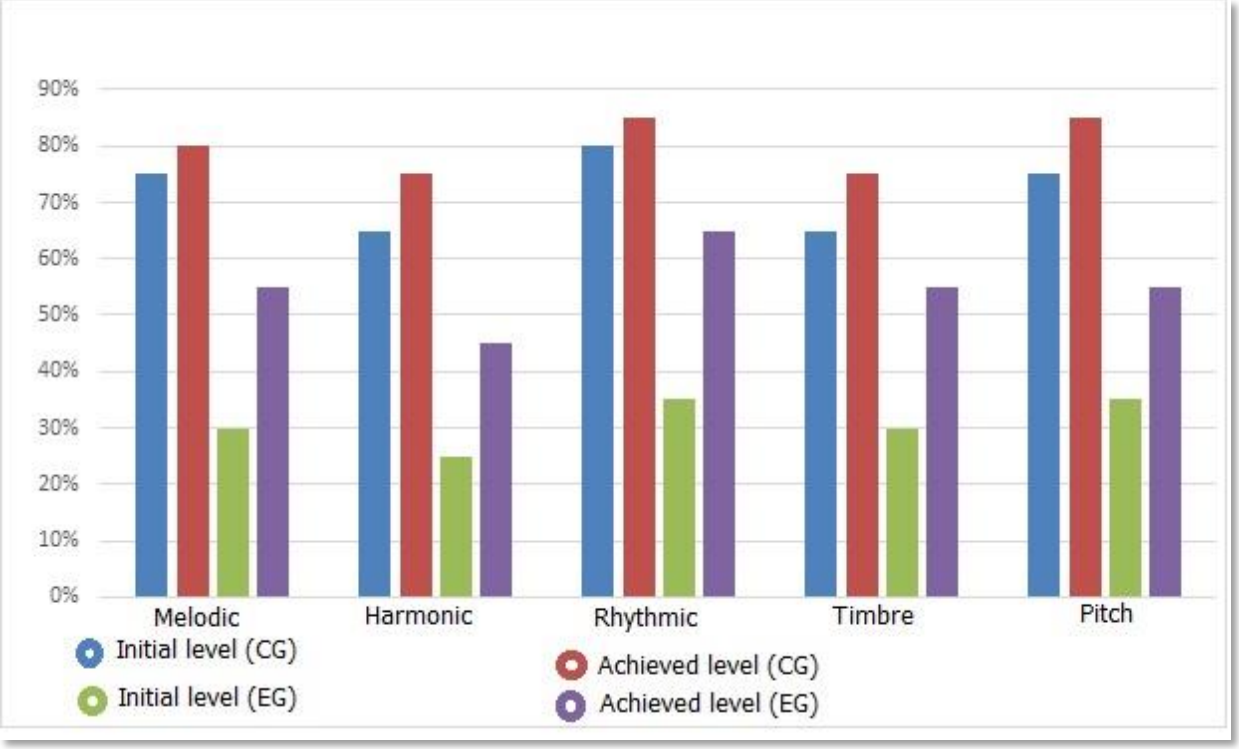

Figure 3. Results of testing before and after training in the CG and EG
Source: developed by the author

The development of musical hearing in students of the CG (music related majors) and EG (non-music majors) was studied in terms of melodic, harmonic, rhythmic, timbre, and pitch hearing. The improvement of melodic hearing in non-music students is accompanied by problems associated with insufficient differentiation of pitch relations. The indicators of melodic hearing in the CG increased from 75% to 80%, and in the EG — from 30% to 55%. The difference between the groups shows a different level of hearing development depending on previous training. The EG demonstrated high plasticity of auditory perception, but significant results require more repetitions and time to consolidate skills. The level of harmonic hearing in the CG increased from 65% to 75%, and in the non-music group — from 25% to 45%. Non-music students have difficulty recognizing complex harmonic structures because of lack of auditory experience. The development of rhythmic hearing in non-music students is complicated by the correct reproduction of complex rhythms. In the CG, the increase was 5% (80% → 85%), and in the EG — 30% (35% → 65%), which confirms the effectiveness of the methods. Timbre hearing in the CG improved from 65% to 75%, and in the non-specialist group — from 30% to 60%. Recognition of instrument timbres is difficult for non-music students because of their lack of experience. The level of pitch hearing in the CG increased from 75% to 85%, and in the EG — from 35% to 55%, which indicates the effectiveness of auditory exercises in non-music students.

The results of the survey of the EG and CG participants, which was conducted after the completion of the hearing development course, show a significant difference in the change in hearing skills between the groups (Table 2) (Table 3).

Table 2.
Results of the survey of the CG participants

Item No.	Question	Yes (%)	No (%)
1	Do you often have difficulty recognizing the pitch of notes?	55	45
2	Do you have difficulty distinguishing between different intervals in music?	20	80
3	Do you feel confident in your auditory perception?	70	30
4	Do you rate your ability to perceive melodies by ear as high?	60	40
5	Do you easily perceive complex musical intervals?	80	20
6	Can you easily determine the tempo of music?	65	35
7	Do you often have difficulty recognizing chords by ear?	30	70
8	Do you perceive music emotionally and with an understanding of structure?	60	40
9	Has your confidence in performing musical tasks increased?	85	15
10	Have you become more interested in studying music after this course?	60	40

Source: developed by the author

The analysis of the results of the CG survey shows that in general their ability to distinguish intervals, chords and pitch remains limited. Most participants note that they have difficulty distinguishing intervals, and they also encounter difficulties in identifying chords by ear. At the same time, although there is some confidence in their own auditory perception, the difficulty in perceiving complex musical elements, such as intervals and chords, remained unchanged after completing the course (according to the results of testing). Therefore, it can be stated that the classes held during the research did not lead to significant changes in the level of auditory skills of this group, and their difficulties remain relevant.

Table 3.
Results of the survey of the EG participants

Item No.	Question	Yes (%)	No (%)
1	Do you often have difficulty recognizing the pitch of notes?	65	35
2	Do you have difficulty distinguishing between different intervals in music?	70	30
3	Do you feel confident in your auditory perception?	50	50
4	Do you rate your ability to perceive melodies by ear as high?	40	60
5	Do you easily perceive complex musical intervals?	65	35
6	Can you easily determine the tempo of music?	65	35
7	Do you often have difficulty recognizing chords by ear?	60	40
8	Do you perceive music emotionally and with an understanding of structure?	65	35
9	Has your confidence in performing musical tasks increased?	85	15
10	Have you become more interested in studying music after this course?	90	20

Source: developed by the author

As for the EG, the results also present difficulties in recognizing the pitch of notes and intervals, but the difference is that these participants (according to the testing results) became more knowledgeable in the perception of musical components, in particular, in recognizing intervals and chords, as well as in the emotional perception of music. It is also important that a larger number (90%) of respondents noted an increased interest in studying music after the course, which evidences the training programme effectiveness.

According to the obtained data, the CG's level of interest in music after the course is 60%, while this figure reaches 90% in the EG. This difference in results indicates that the EG participants experienced a more significant increase in interest in music as a result of the course. It can be assumed that the specific techniques and exercises used in the EG helped to stimulate greater interest in musical learning and practice.

Regarding confidence in auditory perception, this figure in the CG is 70% after the course, and in the EG — 85%. A significant difference is also observed here, indicating greater progress of the EG participants in developing their auditory skills. This result may indicate a more effective application of the techniques and methods in the course aimed at improving auditory perception (Figure 4).

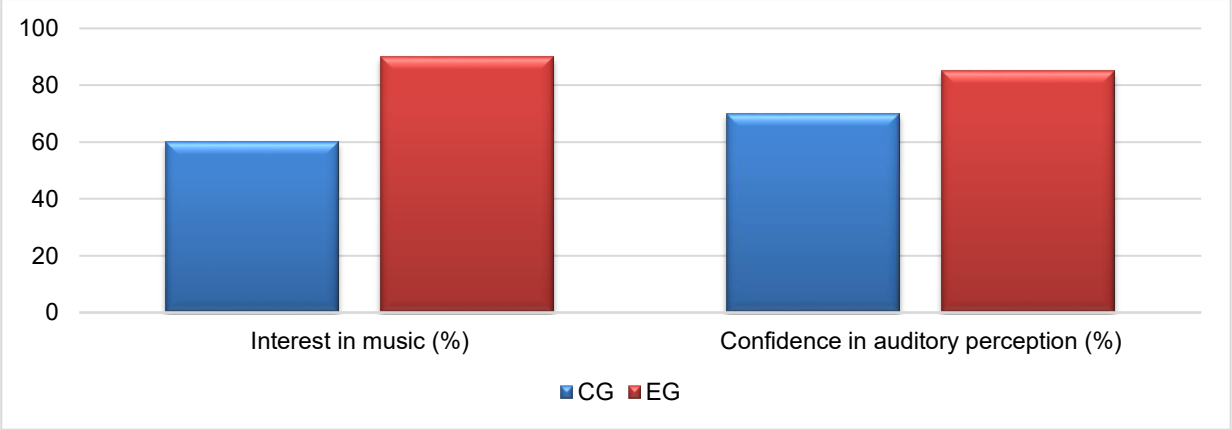

Figure 4. Comparison of the average level of confidence and interest in music in the CG and EG after the auditory skills development course
Source: developed by the author

A comparison between the two groups after the course shows that the EG participants achieved significantly better results in both the level of interest in music and confidence in auditory perception, which confirms that the specialized teaching methods used in the EG had a positive effect on the development of auditory skills and motivation to study music.

Such results can be explained by the inclusion of more intensive and adapted methods of developing musical hearing in the course for the EG, which enabled the participants not only to improve their auditory skills, but also to increase their confidence in their abilities. At the same time, the CG participants did not receive such a level of intensive training that could limit their progress.

Discussion

The effectiveness of the Kodály method in music education was studied by Kutlimuratovich (2024). The author noted that an important aspect of this approach is the integration of music education into the overall development of students' personalities, which allows for a deeper understanding of music through interaction with other types of art. Furthermore, the author concluded that the use of the Kodály method contributes to the creation of a positive atmosphere in music lessons, thereby helping students to develop both musical technique and self-expression. This study is consistent with the results of the application of the Kodály method for the development of musical hearing in non-music students.

The same conclusions were reached by Coughlan (2024). In their study, Tkatchova et al. (2023) analysed the influence of the methods of famous teachers on the development of music education in China. They examine how the creative achievements of Orff, Kodály, and Jacques-Dalcroze are integrated into Chinese pedagogical practice, particularly in the context of using these methods to develop children's musical abilities. The authors emphasized that these methods, despite their Western origin, are able to find application in the Chinese educational system due to their universality and emphasis on the creative development of the individual. They believed that Chinese teachers were able to achieve significant progress in music education through the use of musical games (Orff method), the development of auditory perception through singing (Kodály method), and motor practices (Jacques-Dalcroze method). Similarly, before the study of the development of musical hearing in non-music students, the authors concluded that

these methods contribute not only to the development of students' technical skills, but also to the development of their emotional sensitivity to music, helping to integrate art into everyday life and culture.

The methodology for developing musical hearing based on the Orff method was studied by Bigl (2022). The author focused on the fact that Orff created a learning system that includes various aspects – movement, singing, playing instruments – that helps students to better learn musical elements through active involvement. The article examines how the Orff method enables the creation of classes that are not only educational, but also highly interactive, where students can directly influence the learning process through playing in-class instruments. The author noted that children learn to listen to music as participants in the creative process in such conditions, which helps them to develop an inner sense of rhythm, harmony, and musical context. The Orff method is also relevant due to it music-based therapeutic elements. Senkal & Mukhtar (2021) concluded that the Orff method is an effective tool for improving auditory skills in children with intellectual disabilities, as it promotes the active involvement of children in the process, thereby helping them to develop not only auditory attention, but also other cognitive and emotional functions. This makes it easier for children to adapt to social situations and express their emotions through music, which is important for their overall development.

Zhang et al. (2024) reached the same conclusions. These studies are consistent with the results of adapting methods for developing musical hearing in non-music students. In his study, Colwell, (2022) investigated the experience of using the Orff method in music therapy among different groups of participants: students, clinicians, and teachers. The author noted that the Orff method has great potential for the development of music therapy and recommends its integration into curricula for students and clinicians. These results are comparable with research on the development of musical hearing in non-music students. Valasi (2023) studied the importance of rhythm as a key element in the Carl Orff method. The author emphasized that rhythm not only develops children's musical sensitivity, but also has an important role in the development of cognitive and social skills. All these studies emphasized the relevance and versatility of the Orff method, therefore, its use for the development of hearing in non-music students contributed to the acceleration of the process of improving various types of musical hearing, in particular: rhythmic, melodic, pitch, and timbre (Jones et al., 2013).

The Jacques-Dalcroze method was investigated in the study of Van der Merwe (2025). The author concluded that eurythmy, as a method, has the potential not only to develop physical and rhythmic skills, but also to improve the psycho-emotional state of the participants, making the process of learning music more joyful and satisfying. Elements of music therapy make this method relevant for teaching students who constantly face with stress because of learning and growing up. Iaddings (2024) studied the eurythmy of Dalcroze, its historical roots and development, as well as the possibilities of applying this method in choral programmes.

Apaydın (2023) explored the application of the Dalcroze method and rhythm in music education in Turkey. The author focused on the impact of this method on the development of musical skills of school and higher school students, emphasizing the importance of integrating movement and rhythm into learning. In his study, Daly (2022) concluded that eurythmy not only improves rhythmic perception and coordination, but also contributes to the development of personal autonomy in musical learning. This method allows students to actively engage in the musical process through movement, which helps to create unique, individualized forms of expression. Therefore, this study emphasizes the relevance of using the Jacques-Dalcroze method for the development of hearing in non-music students.

In his work, de Oliveira Honório (2023) examined the decision-making processes of undergraduate non-music students regarding the choice of classes in string instruments and orchestral subjects. The study emphasized that students are interested in developing personal skills, in particular creativity and teamwork, as well as the opportunity to gain new experiences, even if their studies are not directly related to music. Immerzeel et al. (2024) reached similar conclusions, but in addition to music, the author investigated sports and compared intrinsic and extrinsic types of motivation. Similarly, our study emphasizes the importance

of developing auditory skills and their impact on the overall learning process, especially among non-music students. Our study also emphasizes how developing musical hearing helps to improve the perception and performance of musical works, which, in turn, supports motivation to participate in music courses, even if their main studies are not directly related to music.

The importance of interpreting and studying musical settings in the context of music therapy and pedagogical training of students was emphasized by Sabadi, (2021). The author focused on the role of musical settings, which allow students not only to develop their musical skills, but also to become more aware of their own emotional experiences, which is an essential aspect in the pedagogical and therapeutic process. However, teaching music therapy to non-music students is impossible without a basic understanding of how music works. So, it is necessary to improve the students' auditory skills first. Therefore, the development of musical hearing and perception of music is important for non-music students, and especially for those who plan to obtain the music therapist skills.

Limitations

A limitation of the study was that the small sample size and short-term follow-up period did not allow for the assessment of long-term effects on musical hearing development. Moreover, individual differences among participants may create variation in the results, making their interpretation difficult.

Recommendations

Recommendations for further research include expanding the sample of participants to include students from different educational institutions, which would allow for more generalizable results. It is also worth conducting research over a longer period to assess the sustainability of the effects of musical hearing development. It is recommended to include additional assessment methods, such as interviews or surveys, for a deeper analysis of motivation and individual aspects of musical hearing development.

Conclusions

The study found that musical hearing development methods (Carl Orff, Zoltán Kodály and E. Jacques-Dalcroze) have a significant impact on students, even if they are not musicians by profession, which emphasizes the importance of including music education in general education. Even basic knowledge and skills in the field of music can have a positive impact on overall intellectual development, creativity and the ability to perceive and analyse complex sounds and sound structures.

The study showed the important role of prior musical training in the development of students' auditory skills. According to the results of testing and questionnaire surveys, the CG, which consisted mainly of participants with many years of experience playing musical instruments, had a significant advantage in the initial stages of the study compared to the EG, which indicates that prior musical training is an important factor in the speed of developing auditory skills. However, despite the initial difference in the level of training, the applied musical hearing development methods demonstrated high effectiveness in the EG students who had no prior experience of learning music. This result indicates a high potential for adaptation of auditory skills even in those students who start with minimal musical experience.

Analysis of the dynamics of changes in hearing indicators showed that non-music students, although they achieved a lower final level compared to the CG, had a greater increase in the development of auditory skills. The increase in test results in the CG was 5-10%, and in the EG — 15-20%. The obtained data indicate a greater effectiveness of the methods for non-music students, who showed high plasticity of auditory perception and the ability to assimilate the material, even when the initial level was low.

Despite the difficulties in recognizing complex harmonic structures and intervals, non-specialist students managed to achieve significant improvements through constant training, which confirms the plasticity of auditory skills even in the absence of previous musical experience. Tables and graphs of test and survey

results confirmed that, although the CG had higher initial indicators, the EG students managed to significantly improve their auditory skills thanks to specially designed techniques. In particular, a post-course survey showed that the EG students experienced a significant improvement in their ability to perceive and distinguish music by ear.

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