On Inclusive Musical Education in Russian Universities: Computer Arrangement

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ABSTRACT

In this work, we investigated the methodological foundations and content aspects of the methodology of teaching musical disciplines with using music computer technologies (MCT) for music students with deep visual impairments: the content and methodological support for teaching these disciplines were developed, and methodological approaches for implementing the educational process in the practice of teaching visually impaired music students in secondary and higher educational institutions were determined. The authors conducted a multi-stage pedagogical experiment, analyzed professionally significant aspects of teaching a number of academic disciplines with using MCTs. The study used the hypothesis that there is a stable and significant relationship between the activity of knowledge of blind students in the field of MCT and their level of professional competence and social adaptation.

The development of MCT contributes to the socialization and integration of visually impaired people into civic society. A set of academic disciplines has been developed based on the use of MCT, which is implemented in the musical and educational process of professional training of students-musicians with deep visual impairments in a number of educational institutions in Russia. The international community and the state should more actively support and develop technologies that promote the socialization and integration of visually impaired musicians into civic society.

Keywords:

music computer technologies, computer arrangement, inclusive musical education, disabled people with visual impairments.

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1. Introduction

The research findings can be of interest for musicians with profound visual impairments, blind students and their teachers, and for specialists dealing with problems of socialization and social adaptation of people having vision limitations with using music computer technologies (MCT) [1]-[5].Currently, many students use digital players, voice recorders, personal computers, laptops, tablet computers and smartphones for educational purposes [6]-[11].

When preparing for classes, most students regularly use digitally recorded audio materials, text electronic documents (synopsis, books, articles on the Internet), which are voiced using special voice synthesizers and screen access programs [12]-[44].

It was established that the study of the discipline "Computer Arrangement" based on the use of MCT is of the greatest importance for the growth of professional competencies and social adaptation of music students with deep visual impairments. The thematic range and content of these disciplines is very diverse, which allows you to form stable orientation skills in a high-tech information educational environment and helps to overcome professional and socially significant difficulties. At the beginning of the 21st century in the curriculum of some music faculties of higher and secondary educational institutions of Russia, musical schools and schools of arts began to experimentally introduce the discipline “Computer Arrangement.” The main emphasis was placed on the study of digital technologies in the field of music and work with digital sound, as

well as on the development of the most common musical programs.

Let us dwell in more detail on the peculiarities of teaching the discipline "Computer Arrangement" to musician students with severe visual impairment in secondary vocational and higher educational institutions.

2. Methods and approaches

Creative activities with the use of electronic musical instruments (EMI) [45]-[51], being initially an optional subject, subsequently formed the basis of the specialized training "Computer Arrangement" course.

Practice has shown that the introduction of the disciplines of "Musical Informatics" [52] and "Computer Arrangement" [53] contributes to a more complete mastery of such subjects as "Instrumentation and Arrangement," "Concertmastership Class," "Solfeggio," "Harmony," and many others that play an important role in vocational musical training of students with visual impairment in the secondary vocational (music) specialized educational institution the Federal State-Owned Professional Educational Institution "Kursk Music Boarding College for the Blind" of the Ministry of Labor and Social Protection of the Russian Federation (further - Kursk Music Boarding College for the Blind). These disciplines are of great interest to students with visual impairments, since the educational process is closely connected with computer technology, and this, today relatively new, form of training especially attracts students.

The "Computer Arrangement" course is based on the knowledge and skills acquired by students as a result of studying "Musical Informatics" and it is its natural continuation or addition (if classes coincide chronologically in the curriculum) [54]-[70].

The aim of the "Computer Arrangement" course is to master new opportunities that have arisen thanks to computer technology for the arrangement of a vision-disabled musician in the modern world; create prerequisites for full creative cooperation in society [71]-[72].

The objectives of the "Computer Arrangement" course are the mastery by vision-impaired musicians of arrangement techniques using MCT, specialized software and hardware (mixers, microphones, sound processing devices, professional software, etc.) by studying and mastering them with the subsequent creation of a final creative project .

The result of mastering the "Computer Arrangement" course should be the acquisition of practical skills both in the field of MCT and in the field of arrangement, as well as developing the student's diverse musical thinking, which is necessary for successful independent professional work as an artist, teacher, accompanist, and arranger.

3. Computer Arrangement

The Content Of The Discipline "Computer Arrangement"

Introduction

Introduction to the music computer software and hardware complex. Configuration and functional purpose of hardware components. Placement and switching of devices: MIDI keyboard, sound cards, external sound blocks, mixing console (multitracker), audio frequency amplifier, sound speakers. Technical features and brief characteristics.

Students should know:

- all components of the music and computer software and hardware complex;
- the general scheme of connection;
- purpose and functions of each component;
- the most general technical characteristics.

Students should be able to:

- turn hardware components on and off in the correct order;
- find the location of controls;

- boot and shut down the computer.

SECTION I. Working in Windows with the Support of the Speech Support Program Jaws for Windows.

Topic 1. Basic techniques for working in Windows.

Repeating and pinning the main actions in a modern operating system: viewing the desktop, start menu. Opening folders and files. Selecting objects. Moving between Windows. Application startup. The completion of the work, etc.

Students should know:

- basic techniques for working in the Windows operating system.

Students should be able to:

- download the speech support program;
- open disks and folders and view objects;
- launch Windows applications;
- to move around the directory tree;
- to shut down the system.

Topic 2. Resource management of the sound card.

Launch the sound card management program. Configuring latency and buffer with using ASIO drivers. Control the sound card mixer.

Students should know:

- main parameters of sound cards in General;
- the purpose of Windows and controls;
- assignment of the inputs and outputs of the virtual mixers.

Students should be able to:

- launch the sound card management program;
- to change the size of the delay and buffer;
- manage the inputs and outputs of the virtual mixer.

SECTION II. Working in the Sequencer.

Topic 1. View of the main program window.

Program start. Menus, menu items, and their purpose. Menu items File, Options. File download. Setting up the metronome.

Students should know:

- assign menu items.

Students should be able to:

- launch the program;
- enter the menu and find the necessary items;
- to configure the schema of the metronome;
- open a MIDI file.

Topic 2. Tracks window.

Track parameters: track number, name, instrument, port, bank, volume, panorama, transposition, time shift. Setting parameters in the tracks window and through the track settings window. Track selection features. The positioning of the counter. Moves the position of the status cursor. Fast time transition.

Students should know:

- all control functions of the track;
- time transition control commands.

Students should be able to:

- select a track;
- to specify the settings of the track;
- move the counter cursor;
- arbitrarily move the value over time.

Topic 3. Port i/o program.

Sources and receivers of MIDI information. Output ports: FM, wave, and virtual synthesizers. External synthesizers. Download of virtual synths. Assign a port to a track.

Students should know:

- types of synthesizers;
- connection types for different types of synthesizers;

- the main features of synthesizers are supplied with the program
- principles of operation of various types of synthesizers.

Students should be able to:

- connect virtual synthesizers to the Host program;
- to work with the Synth Rack window;
- assign input and output ports in the tracks window.

Topic 4. Standard operations for editing a MIDI file.

Record a clip of a track. Recording mode. Erase, copy, cut, paste. Quantize. Processing dynamics. Setting and changing the tempo and size.

Students should know:

- main recording modes;
- functions for editing MIDI information;
- the concept of quantization and dynamics;
- numbering of MIDI controllers and their parameters.

Students should be able to:

- register a track;
- to change recording modes;
- to quantitywith;
- erase, cut, copy, and paste MIDI events in a track;
- edit dynamics;
- set and change the size, tempo

Topic 5. Event List.

Event list window view. Time and type of event. Parameter 1 and parameter 2 values for different types of events. The sound of music. Editing each parameter.

Students should know:

- cell assignments in the Event List window.
- numbering of MIDI controllers and their parameters.

Students should be able to:

- navigate in the event window;
- voice individual events;
- make corrections to any window variable.

SECTION III. Working on the Soundtrack.

Option A. Recording an arrangement of a popular play (song).

Option B. Arrangement of the musical score.

Option D. Creating an arrangement of your own work.

Topic 1. Analysis of the form, instruments, and style.

The genre of the project. Shape, scale, and meter. Features of rhythm and harmonic language. Used instruments of the ensemble (orchestra).

Students should know:

- main genres of popular and academic music;
- instruments for ensembles and orchestras;
- stylistic features of music of different styles.

Students should be able to:

- determine the genre of the selected project and its tools;
- analyze the shape of the future composition;
- identify stylistic features within your competence;
- make the necessary assignments in the program: size, tempo, set of tools.

Topic 2. General rules of arrangement.

The pitch distribution of voices is similar to the natural sound order. Groups of instruments: rhythm group, woodwinds, brass, strings, and their interaction. Release of the soloist's tessitura range. Timbre combinations. Specific features of synthesizer arrangements: using rhythm machines

to create drum parts, arpeggiators, virtual guitars, etc.

Students should know:

- basic rules for vertical distribution of votes;
- principles of interaction between orchestral groups and instruments of different timbres;
- features of accompaniment;
- ranges and principles of sound production of instruments used in the arrangement;
- the capabilities of the synths.

Students should be able to:

- to distribute the voices of the orchestra (ensemble) at their tessitura features;
- use the available controllers to convey the realism (or achieve a special effect) of the instrument's sound.

Topic 3. Features recording percussion instruments.

The composition, names, and location of the drum kit instruments on the keyboard. Additional and percussion instruments. the role of channel 10 when working in GM, GS, and XG formats. track distribution. Recording a period (Loop) drums with subsequent copying.

Students should know:

- main structure of the drum kit;
- location of the main and additional percussion instruments on the keyboard in the GM standard;
- stylistic features of playing percussion instruments in different genres.

Students should be able to:

- detect the sound of drum kit and percussion instruments by ear;
- to analyze and reproduce the average complexity of rhythmic patterns of percussion instruments on the keyboard of synthesizer;
- to assign a channel;
- to distribute the track.

Topic 4. The creation of arrangements in the software of the sequencer.

Assign the necessary project parameters. Assign parameters to each track. Reproducing or composing rhythmic drum patterns, bass lines, harmonic support, melodies, and sub-voices.

Students should know:

- location of the main controls of the sequencer program;
- track management parameters;
- types of bass voice recognition;
- harmonic and rhythmic specifics of the accompanying group;
- basic rhythmic drum figures in various musical styles.

Students should be able to:

- assign all necessary parameters for the project;
- reproduce by ear, record from notes, or compose and record the parts of all the project's instruments;
- find and fix errors;
- enter the necessary dynamic processing automatically or manually using the appropriate operations and Windows;
- find, open, and save the project file.

Topic 5. The use of controllers.

The main controllers: volume, panorama, right pedal, joystick (wheel) – pitch and vibrato. The span adjustment changes the pitch. Prescribing controllers manually in the event window and automatically using the insert series command.

Students should know:

- purpose and codes of the main controllers.

Students should be able to:

- prescribe the necessary controllers in manual and automatic modes.

Topic 6. The final version of the MIDI file.

Acoustic balance between instruments. Foreground, middle, and background sound. Distribution of the sound of instruments in space. The differences between dynamics and loudness.

Students should know:

- the principles of the distribution of sound plans;
- the principles of spatial distribution of tools;
- the differences between dynamics and loudness.

Students should be able to:

- distribute instruments along the front and depth using the appropriate parameters of the track window or using controllers.

Topic 7. Working with audio files in the Cakewalk Sonar program.

Uploading audio files. Sampling frequency and bit depth of digital audio. Synchronization. Selecting and editing objects are standard functions of the program. Record multi-channel audio. Export the processed material to an audio file.

Students should know:

- techniques for working with a multitracker program;
- concepts of mono and stereo sound;
- audio file editing tools;
- basic parameters of digital audio.

Students should be able to:

- import audio files to the project;
- sync audio and MIDI tracks;
- to edit audio tracks;
- configure tracks for audio recording;
- to export the project.

Topic 8. Sound effects and their application.

Devices for dynamic, frequency and spatial processing. Psychoacoustics. Special sound effects. Plug-ins.

Students should know:

- the names of the devices of sound processing and specifics of their application;
- principles for connecting devices of different groups;
- the differences between connection types.

Students should be able to:

- connect virtual audio effects (Plug-ins);
- correctly apply processing devices depending on the task being performed.

Control Requirements

The current control of knowledge and skills is carried out at each lesson in the form of checking independent work, as well as an oral survey on the material passed and identifying skills directly in the classroom.

The final control is carried out in the form of an audition and an open test – a creative project of students.

4. Types Of Creative Work Using Music Computer Technologies Offered To A Student With Visual Impairment

This study discusses questions associated with the creation and development of new techniques of teaching people with visual impairments, rethinking the methods of teaching traditional disciplines in the education system. The development of computer technology, and especially the emergence of screen readers, has led to the creation and development of new forms of teaching music to people with visual impairments, rethinking the teaching methods of both traditional disciplines and the emergence of new subjects related to the introduction of MCTs in the musical educational process.

Today, a lot of technical information exists not only in print, but also as training videos and audio podcasts on the Internet. Therefore, part of the technical content can be offered for independent study, which will give more time for the development of students' creative abilities and their practical implementation in the classroom.

First of all, during the interview, from which the first lesson begins, it is necessary to identify the general level of knowledge: in the field of using a PC in general and MCT in particular. Next is a practical verification of musical data: hearing (melodic, harmonic, timbre, modal, and extra-modal); mastering a musical instrument (first of all, the piano and keyboard electronic musical instrument (EMI)); piano keyboard orientation (asking to play a chord sequence, a melodic phrase in different keys and the like). Alternatively, you can have a simple song or instrumental composition to identify playing by ear skills. Testing knowledge in the field of music theory will help to choose the best language for communication in the future depending on the student's competencies. The information received will be the starting point to begin the practical training.

There are several types of creative work offered to the student, revealing his technical knowledge and musical abilities:

- making arrangement (backing track) for the finished original composition;
- instrumentation of a work presented in musical notation;
- remix (cover, remake) of an existing composition;
- making arrangement of music of one's own composition, or written (played, sung) by another author, but not previously adapted.

There are no many main types, but the forms of their implementation are varied. This is the recording of accompaniment using just one instrument, arranging classical works, and the creation of an orchestra or choral score in the musical notation program, etc.

It does not matter whether it is a vocal or instrumental composition, it is important that the content is offered by the student himself or selected based on his musical taste and wishes. This will ensure sustained interest and provide an incentive to work.

5. Conclusion

Methodical bases are developed and the substantive aspects of methods of teaching musical disciplines, using musical computer technologies (MCT) for music students with profound visual impairment: developed the contents and methodical maintenance of teaching of these disciplines, the methodical approaches to the implementation of the educational process in the practice of teaching visually impaired music students in secondary and higher educational institutions.

The authors conducted a multi-stage pedagogical experiment, analyzed professionally significant aspects of teaching a number of academic disciplines with using MCT. The study used the hypothesis that there is a stable and significant relationship between the activity of knowledge of blind students in the field of MCT and their level of professional competence and social adaptation.

A set of academic disciplines has been developed based on the use of MCT, which is implemented in the musical and educational process of professional training of students-musicians with deep visual impairments in a number of educational institutions in Russia.

The development of MCT contributes to the socialization and integration of visually impaired people into civil society. The international community and the state should more actively support and develop technologies that promote the socialization and integration of visually impaired musicians into civil society.

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She was on a number of business trips abroad, among them working trip to the USA (1999); lecturing and giving research and practice seminars in Hungury (2003, 2005, 2015, 2017); business trip to the UK (2016, 2019); business trip to Ireland (2019), etc. Work experience; 1990 – 2010 - Associate Professor, Professor of the Department of Information Technology of the Herzen State Pedagogical University of Russia, St. Petersburg; 2010 - present - Full Professor of the Department of Digital Education, Institute Information Technology and Technological Education of the Herzen State Pedagogical University of Russia, St. Petersburg; 2002 – present – Head and Chief Researcher of the Education and Methods Laboratory *Music Computer Technologies* of the Herzen State Pedagogical University of Russia, St. Petersburg. She has more than 400 scientific publications, among them are monographs: *Music Computer Technologies: Historical-Theoretical and Practical Aspects* (2007) and *Music Computer Technologies: The Problem of Modeling the Process of Musical Creativity*, compiled with participation of S. V. Chibirev (2012), *Musical Synthesizers (2018)*; course books: *Information Technology in Music*, vol. 1 – 4: vol. 1, *Architectonics of musical sound* (2009), vol. 2, *Musical Synthesizers* (2010), vol. 3, *Musical Computer* (2011), *Music, Mathematics and Computer Science,* vol. 4, compiled with participation of M. S. Zalivadny (2013), *Musical Sound Engineering*, compiled with participation of M.I. Karpets, G.G. Belov (2020). Her research activities include such directions as: MCT in professional music education (as a means to expand creative opportunities); MCT in general musical education (as one of the means of education); MCT as a means of rehabilitation of people with disabilities; MCT as the new direction in preparation of specialists of humanitarian and technological profile; MCT in the field of digital arts; MCT in information technology, psychoacoustics and musical acoustics; system of training arrangements and the art of performing skills on electronic musical instruments. Her circle of interests also includes the problems of interrelation of natural and technical sciences and humanities, as well as the possibilities of applying the results of such interrelation for the

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Prof. Dr. Gorbunova is Chairman of the Organizing Committee of the International Research and Practical Conference *Contemporary Musical Education*, Chairman of the Organizing Committee of the International Research and Practical Conference *Music Computer Technologies in the System of Contemporary Education*. Dr. Gorbunova is a member of the jury of national and international competitions of musical creative works, including *Bridge of Friendship* (Dortmund, Germany), *Electronic Palette* (St. Petersburg, Russia), *Music and Electronics* (Moscow), *Music of the 21th Century* (Moscow / St. Petersburg), International Festivals and Competitions *Musical Electronics and Multimedia* (Moscow / St. Petersburg), *CLARINE of the 21th Century* (St. Petersburg), *The World of Art without Borders* (St. Petersburg, Russia - Szeged, Hungary), All-Russian Competition of Electroacoustic Music *DEMO* (St. Petersburg). She is a member of Editorial Boards of international journals: *Music Scholarship* (Web of Science/Scopus), *The World of Science, Culture, Education*, *Bulletin of the International Centre of Art and Education*, *The journal «Art and Education»*, and Electronic Research Journal *Mediamusic*. Prof. Dr. Gorbunova developed the first-ever Bachelor Course "Music Computer Technologies" (2004) and Master Course "Music Computer Technologies in Education" (2006), which is being implemented at educational institutions in various regions of Russia. Prof. Dr. Gorbunova supervises a number of doctoral and post-doctoral students (more than 30) and lectures on “Music Computer Technologies” and “Information Technology in Music”. She supervises research in various directions, among them: theory and history of culture; music art; information system and processes; theory and methodology of professional education; mathematical modelling, calculation methods and program systems; theory and methods of education and upbringing (in the fields of music, informatics, and natural sciences). The research results of Prof. Gorbunova were published in over 400 refereed publications including 48 books and 255 papers in journals and conference proceedings. Awards and honors: 2003 - Gold Medal of the All-Russian Exhibition Centre (former Exhibition of Achievements of the National Economy); 2005 - Silver Medal of the All-Russian Exhibition Centre; 2009 - Gold Medal of the All-Russian Exhibition Centre; 2009 - Diploma of the winner in the nomination «New educational technologies in ICT environment» of the All-Russian creative contest of scientific-technical solutions, educational products and services in the field of informatization of the innovative-educational complex «Music computer technologies in the system of modern education»; 2010 - Grand Prix of International Congress-exhibition «Global Education - Education Without Borders»; 2010 - Diploma of the 11th All-Russian Forum *Educational environment - 2010* for the project «Digital educational resources «Music computer technologies in education» in nomination of «Creative Competition of scientific developments, innovative solutions and programs in the field of higher vocational education» and many others; 2011 - Laureate of the Prize of the Government «For Outstanding Achievements in the Field of Higher and Secondary Professional Education»; 2013 - Honorary Worker of Higher Professional Education of the Russian Federation.

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Education:

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3d Class Badge "For Services to the All-Russian Society of the Blind."

Developed author's work programs, funds of evaluation funds, calendar and thematic plans, educational and methodological complexes, tasks in test form, the content of control tasks in the disciplines "Musical Informatics" and "Computer Arrangement" for specialties: instrumental performance (by the type of instrument), choral conducting, advanced vocal training.