ISBN 978-989-9121-45-4
48th ISTANBUL International Conference on "Literature, Education, Humanities & Social Sciences" (LEHSS-24)
Dec. 19-20, 2024 Istanbul (Turkiye)

Digital Musical Synthesizer as a Modern Hardware and Software Complex for Training Musical Informatics

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***Abstract*:** *Musical Informatics, in conjunction with other disciplines, helps to integrate the modern musician into professional activities. The course aims to expand the professional capabilities of musicians through modern digital technologies, enhancing the creative potential of performers, composers, and music teachers. It involves mastering music computer technologies, software, and hardware used in professional music activities, and gaining experience with digitized and synthesized sound in various formats. Special opportunities for studying Musical Informatics arise through mastering a musical synthesizer, which is essentially a specialized musical computer with appropriate sound hardware and software. Introducing this discipline in children's art schools, music schools, and colleges offers a new way of teaching computer science to musicians. Over ten years, our developed methodology has demonstrated that a digital musical synthesizer can be both a tool for studying computer science and a subject in Musical Informatics. This dual role contributes to the formation and development of musicians' information competencies. The use of a digital musical synthesizer's audio hardware and software complex as both a teaching tool and an object of study creates conditions for a better understanding of computer science. This approach allows for effective assimilation of material and takes into account the professional needs of contemporary musicians, making the learning process more relevant and comprehensive.*

Keywords: *digital musical synthesizer, musical computer, musical informatics, music computer technologies*

1. Introduction

The fundamental shift in the environment as an information environment has necessitated changes in the musical and educational process, increasingly incorporating information technology in music. Changes in the educational technologies used in contemporary school music teaching are positively received by students, encouraging them to become more actively involved in the educational process. In musical practice, a new class of musical instruments, including digital musical instruments, workstations, and musical computers, has become widespread [1].

Instruments built on digital technologies have significant expressive resources, which open up broad prospects for their application in musical education [2-4].

The study of information technologies in music and their application in contemporary music education has become one of the most effective components of the educational process [5-6]. It contributes to expanding the content of education and improving the creative activities of music school students, making the learning process more high-tech and intensive. Currently, a new musical instrument has emerged in music education – the digital

musical synthesizer. To learn how to play and control this instrument, knowledge of classical music theory, harmony, and polyphony is not sufficient.

2. Key Problems of Teaching Musical Informatics

The contemporary musical synthesizer, a digital musical instrument (DMI), is a digital instrument with appropriate software, essentially a specialized computer for working with music information – a musical computer (MC). The interdependence of hardware and software in the digital musical synthesizer characterizes the sound hardware-software complex of the instrument. Therefore, there is a need to develop new abilities in musicians to work quickly and efficiently with musical information using new tools, analyzing and processing the results, and justifying the decisions made in creative activity based on the available musical information [7].

This should be taken into account while training specialists, since from the earliest stages of education, students of music schools have a practical need for knowledge about information, information processes, and basic concepts of informatics as elements of real creative activity on the synthesizer. The need for such an approach is clearly dictated by the current state of training for students and teachers in music schools. As survey results have shown, musicians' use of knowledge in computer science and their ability to apply it in creative activities are usually fragmentary; musicians do not have sufficient knowledge of the necessary level to fully master a modern musical synthesizer as a sound hardware and software complex.

These results indicate that there are problems in this area:

– The unrecognized need for intellectual and technological improvement in the musical and educational process.

– A lack of special attention to the psychological characteristics of how musical students perceive information (creative thinking, artistic perception, emotional memory, and attraction to modern types of artistic activity), which affects the difficulties in teaching computer science and the low educational motivation of music school students.

– Insufficient attention to the age-related features of teaching music school students, where children get basic ideas about music using a synthesizer.

– The lack of educational and methodological manuals on musical informatics for students and music teachers, who are able to conduct educational activities at a high professional level.

The scientific search for a solution to the problem of teaching musical informatics to music school students is aimed at resolving the following contradictions:

– The inconsistency between the level of training of students and teachers in music schools in the field of computer science education and the modern requirements for professional musicians.

– The necessity for computer science knowledge, without which it becomes impossible for a musician to understand information processes using a digital synthesizer.

– The lack of a methodology for teaching musical informatics to music school students that is coordinated with the musical and educational process.

This problem can be addressed by developing a methodology for teaching musical informatics to music school students using the sound hardware-software complex DMI (musical synthesizer).

Creation of methods for teaching informatics to music school students and the introduction of a new discipline, "Musical Informatics," at the digital departments of children's music schools and art schools, where the audio software and hardware complex (DMI) becomes a new means of teaching Informatics to musicians while also serving as an object of practical orientation in teaching.

3. A Method of Teaching Musical Informatics

The method we have developed and the educational process conducted over the past 10 years allow us to consider an electronic musical synthesizer as an instrument to study Informatics, serving:

– As an audio hardware-software complex for training Informatics students in music schools;

– As a means and object of learning Informatics, creating a learning environment that contributes to the formation and development of musicians' information competencies.

The following tasks were addressed:

1. We studied the problems and prospects of training Informatics students in music schools.

2. A method of teaching computer science using modern digital musical instruments and music computer technologies (MCT) was developed.

3. The principles for selecting the content of Informatics training for music

school students were applied.

4. The features of using DMI as a learning tool and object of study for Informatics students in music schools were identified.

5. An educational and methodical complex was developed, including a program/training course, a textbook, a creative notebook, an electronic textbook for distance education support, and audio and video materials for music school students.

6. The effectiveness of using DMI and MCT in teaching computer science to music school students was experimentally tested.

The following are some of the topics of the training course "Musical Informatics," which is based on aligning the requirements for knowledge of secondary school students from the course "Informatics" with those of music school students mastering software and hardware DMI.

Classes in "Musical Informatics" include the study of the following topics (the main objectives of the lessons in musical informatics are):

– To study the basic concepts related to the receipt and use of information, both in school and everyday life.

– To acquire skills in working with a computer and various peripherals.

In the training course, it is intended to study the basic concepts and acquire the skills included in the existing Informatics programs, taking into account that all tasks in Informatics are based on materials related to music. Teaching materials for Informatics include:

– A set of materials for the teacher;

– A set of computer tasks for the student;

– A set of tasks in workbooks;

– A set of tasks for active logical and creative games using musical material.

4. A Training Course Summary

Below a brief summary of the training course is given. It consists of the following building blocks:

1. DMI and keyboard synthesizer as an independent discipline of the educational cycle. Instrument design, familiarity, and basic principles of keyboard synthesizers. The main functions of the digital keyboard synthesizer and their role in creating a musical image.

2. Performing apparatus. Two variants of execution on DMI: sitting and standing. Specifics of playing conditions and movements of the left hand in the mode of auto accompaniment (Single, Finger, Fingered).

3. Features of working with timbre. Multitimbral possibilities as the main difference between DMI and other musical instruments. Classification of voices in the banks. Selecting a timbre for creating an artistic image.

4. Technical parameters of the instrument. The possibility of dividing the keyboard (Split). Auto accompaniment panel (Start/Stop, Synchronic Start, Intro, Ending, A, B, C, D). Registration control panel. Effects (delay, chorus, reverb, harmony, flanger, phaser, echo, distortion). Buttons for Tempo, Mode, Function, etc. Working with the drive.

5. Creating arrangements in the process of selecting instrument settings.

6. Harmonizing melodies digitally in the mode of auto accompaniment. The concept of "digitalization." Compilation of chord letters.

7. Working with a multi-track sequencer for DMI. Recording mode. Drafting arrangements. Adjustment. Implementation in practice.

8. Attending seminars. Concerts as demonstrations of prepared creative works.

Section 1. Classification of DMIs from different top-level companies ('Casio', 'Roland', 'Yamaha') and their specifications. Demonstration of the artistic and performing abilities of the synthesizers. Children's concert with the extensive use of the given devices.

Section 2. The construction of DMI tools and basic principles of operation. Familiarity with the instrument. Demonstration of the synthesizer's performance capabilities.

Section 3. DMI's performing apparatus. Modes of playing the synthesizer: Normal, Split. Possibility of the keyboard split. The specifics of left-hand performance. Musical timbres and principles of their use. A set of timbres. Multitimbral possibilities as the main difference between the synthesizer and other instruments. Technical parameters of the instrument. Auto-accompaniment panels. Modes of auto accompaniment. The ability to automatically turn on using the buttons Intro, Start, Synchronic Start. Multi Pad panel (music phrases, patterns, effects). The transforming function of the Registration memory.

Section 4. Harmonization of melodies in the auto-accompaniment mode. Drafting arrangements. Establishing arrangements during the selection process of the settings tool. Working with a disk drive and floppy disks. Recording modes: fast, multi-track. The basic of the sequencer. Working with a multi-track sequencer. Recording music on the sequencer (for creating soundtracks). Arrangements for the synthesizer based on pieces written for other instruments and vocal works. Repertoire.

Section 5. Methods of teaching DMI. Forms, techniques, and methods of keyboard synthesizer usage in the curriculum of instrumental and choral departments in children's music schools and children's art schools. Practical course.

Section 6. Musical computer in DMI class. Familiarizing children with the possibilities of recording and editing music on an MC using the music editors Steinberg Cubase / Steinberg Nuendo. Making arrangements on a computer using music programs Band-in-a-Box and Steinberg Cubase / Steinberg Nuendo.

Section 7. Introduction to computer music languages. Basics of Csound language [8-10]. Timbre programming. Csound communication with the DMI using MIDI.

Section 8. Round table. Presentation of the students' works.

5. Conclusion

1. Teaching musical informatics to students in music schools and children's art schools is a necessary and important part of training contemporary professional musicians. The main objectives of computer science training are the following:

– Developing creative thinking and artistic potential through the sound world of digital technology.

– Forming skills in elementary information activities related to obtaining, transforming, accumulating, and transmitting musical information.

– Developing competencies (cognitive, informational, professional) that allow students to successfully apply the sound hardware and software complex in creative activities based on acquired knowledge, with a focus on independence, activity, and responsibility.

2. The method of teaching Informatics to music school students is based on an integrative-contextual approach, considering the specialization of the musicians:

– The selection of training content is presented as a transformation of educational and cognitive activities into practical ones through interdisciplinary integration, actively involving students in solving creative problems (where the assimilation of one discipline is based on the knowledge of another).

– Emphasis on active learning methods (problem-based, developmental, research, project-based) to engage students in educational and cognitive activities.

– Contemporary forms of training organization (creative work, educational games, problem-based and interactive learning) provide students not

only with ready-made knowledge but also with the experience of discovering knowledge through creative activities on the musical synthesizer.

– The use of the audio software and hardware complex (DMI), as both a learning tool and the object of computer science study, creates conditions for a better understanding and effective assimilation of the material in computer science. This approach also allows for consideration of the professional needs and interests of music school students.

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