

T-Shaped Professionals: Music Computer Technologies in Pedagogical Higher Education

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Abstract: *The high-tech educational information environment requires searching for new approaches and fundamentally new systems of education. At present, the innovative systems in music pedagogy are closely connected with using music computer technologies (MCT) - an effective contemporary means of improving the quality of teaching music at all levels of the educational process. The article contains the analysis of the processes of informatization, this processes transform the environment of the professional activity of musicians. The authors emphasize the need for changes in the activity of the teacher-musician and the content of musical education, connected with the use of digital educational resources. The authors consider the music-computer technologies and network technologies as one of the means of forming contemporary musician's competence in Informatics. The MCT are an indispensable tool of educational process in propagating music masterpieces among the different social groups, as well as a unique technology for implementation of inclusive pedagogical process in training the people with disabilities.*

This paper outlines aspects of the approach in modern pedagogical education that prepare the students to be T-shaped professionals in contemporary musical education with using MCT

Keywords: *interdisciplinary course, music computer technologies, musical education, high-tech educational information environment*

1. Introduction

Illumination of instrumental and technological aspects of performing and computer musical creativity on electronic musical instruments, questions of evolution and formation of performing arts on electronic musical instrument, the totality of their educational potential in the modern musical and educational space-today are the topics at the forefront of the problems of formation of new types of musical performing arts. The article discusses the interdisciplinary course with the use of MCT, aimed at the development of actual competencies of modern T-shaped specialist, ready to perform interdisciplinary tasks, able to combine the functions of several specialists. Today, t-shaped people with unique competencies, broad-minded, expert knowledge in their profession are required. Active use of MCT is able to develop t-shaped skills of a contemporary specialist, his diverse knowledge and skills [3], [4], [9]. Also, the use of MCT leads to the development of new subject areas, new fields of activity of the musician and a specialist in the field of information technology (sound-timbral programming, sound synthesis, musical programming, modeling of the process of musical creativity, etc.).

2. Music Computer Technologies as a New Creative Educational Medium

The author was guided by the general principles that had been developed at the Educational and Methodical Laboratory Music Computer Technologies, Herzen State Pedagogical University of Russia (St. Petersburg). Sphere of interests of its members 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 purposes of music education and upbringing. Scientific group of the Laboratory also take part in working out the specialized software for computer music devices and in application of this software in pedagogical processes.

Research activities of the members of Laboratory including such directions as:

- MCT in professional musical 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 techno-logical profile,
- MCT in the field of digital arts,
- MCT in information technology, psychoacoustics and musical acoustics [13], [16].

Developments and researches in the field of musical pedagogics and musicology, music computer science (musical informatics), computer modeling of processes of musical creativity, timbre programming, art of performing skill and arrangement on electronic musical instruments, creative work in the field of computer music, mathematical methods in musicology, etc. – all these directions in its totality allow to work up the methodological principles and pedagogical approaches to the use of MCT in inclusive education (as part of eInclusion) for children with profound visual impairment [15].

3. Music Computer Technologies as an Educational and Creative Environment in the System of Contemporary Musical Education

The experience of understanding the historical, artistic, aesthetic, ideological and methodological foundations of the formation of music computer technologies, the processes of evolution, the penetration of the MCT into various forms and types of musical, creative and pedagogical activities should be designed as an obligatory component of music computer pedagogical education.

A new contemporary educational creative environment is being shaped of the main following components:

- music computer as a key element of hardware tools and the software for the music computer educational complex;
- methodological tools and its methodological basis, allowing to use the MCT at all stages and in all areas of the musical and educational process (let's emphasize that the MCT require the constant development of new training programs and courses adjusted to modern social needs and corresponding to the development level of these technologies);
- socio-cultural factor of comprehensive human development education.

It should be noted that the use of modern MCT in the system of contemporary musical education (general, professional, additional professional, postgraduate) is still challenging. This process is characterized by many contradictions, the main of which are:

- the gap between conceptual innovations in the fields of general pedagogy, focused on the widespread use of new information educational technologies, and academic musical pedagogy;
- the gap between the capabilities of the MCT and the real demand for them in the music education system (general as well as vocational);
- the traditional focus on the specific purpose of the music teacher and the integration of different fields of knowledge;
- incompatible programs, study plans for general education and music schools, universities and the developments of creative laboratories, etc.

The lack of scientifically based methodological and psychological analysis of the existing MCT use experience and the prospects of their development in general and vocational music education requires working out the appropriate methods and forms of training. Therefore, the search for effective educational systems taking into account the capabilities of the MCT is promising and reasonable.

The musical activity evolution in terms of both artistic practice and its research development is based on the correlation method of primary and secondary sign systems - material forms of musical and artistic phenomena. We are talking either about recording composer's creative ideas in the standard musical notation (=secondary sign system) or musical text voicing (=primary symbolic system) during performing, or the establishment of the musical art development concept (the correlation of the primary and the secondary sign systems) in the musicologists activities. The digitized music text and sound material could allow to include the electronic technologies in all spheres of musical activity, and apply the system of traditional musical knowledge in the implementation of musicology and musical practice by means of IT.

The author analyzes the activities of the Educational and Methodical Laboratory "Music Computer Technologies", established in the Herzen State Pedagogical University of Russia in 2002 as a functional structure for the formation of a new professional educational concept. One of the main tasks set for the Laboratory was the development of contemporary educational direction – MCT as an educational and creative environment in general and special music studies, as well as the introduction of IT in the music educational process.

In this regard, the experience of creating and implementing of the music computer pedagogical education concept in the Educational and Methodical Laboratory 'Music Computer Technologies' of the Herzen State Pedagogical University of Russia is extremely valuable. The music computer education concept consists of the development of higher musical pedagogical education on the basis of MCT (Bachelor and Master programs "Music Computer Technologies" and "Music Computer Technologies in Education"), as well as the implementation of professional retraining programs, including "Teaching Musical Disciplines with Using Music Computer Technologies" and "Teaching Electronic Keyboard Synthesizer".

4. Music Computer

In the process of establishing a music computer there are two main prerequisites for its development. The first is the musicians' aspiration to enrich their music art. The second one is related to the historical improvement of musical tools, based on the modern achievements of science and technology in the field of sound production design-wise. It is important to note the evolution of musical synthesizers, including automated musical instruments from the moment of their genesis to the present days.

Musical instruments or synthesizers, widely used as generators of sounds, are controlled by various methods (mechanical, electrical, optical, etc. effects), as well as various methods of concentration and amplification of sound. The development of electronic musical instruments (EMI; more detailed information see: [1], [13]) has boosted the creation of electronic musical synthesizers, where on one hand, previously used methods of sound synthesis have found their further development, and on the other hand, fundamentally new methods have been introduced. An electronic musical synthesizer is an instrument that electronically generates and modifies sound, using a computer (digital musical synthesizer) or without it (analog musical synthesizer). Electronic synthesizers are used to create music (electronic music) and perform lives.

A musician playing a synthesizer, in addition to the possibility of traditional music-making, considers his instrument as a set of elements that he configures to create the desired timbre and the performance manner. This process is often referred to as "programming" or patching, and it can occur both before and during music performance. In general, the modern keyboard synthesizer can be described as an electronic-digital keyboard interactive musical instrument intended for use as a standalone instrument or a sound source in the system of electroacoustic musical hardware.

Over the course of our research work, the functional stages of a musical computer establishment, the evolution of electronic musical composition in interaction with a computer, a musical computer as a new multi-functional poly-timbral instrument of a musician were addressed.

The term "music computer" means a class of electronic instruments optimized for solving specific tasks in the field of musical activity - a professional instrument in the field of music and education.

Summarizing the main musician's activities, where the music computer equipped with several sound sources (synthesizers, samplers, MIDI-keyboards or MIDI-controllers) plays an increasing role, we emphasize the highlights. First of all, these are sheet music publishing, phonograms production, arrangements and original compositions using sequencer programs, sound engineering, electronic sound synthesis, old records restoration, electronic music, interactive performance systems of algorithmic music, real-time score management systems, creation and use of musicological databases; as well as teaching music with the help of a musical computer in secondary schools, learning the arrangement and composition via the music computer as a part of the system of musicians professional training, the development of creative and performing skills, musical computer use in live performances, and many more [7-8], [21-23], [29].

Interdisciplinary course with using MCT is aimed at the development of current competencies of contemporary T-shaped specialist, ready to perform interdisciplinary tasks, able to combine the functions of several specialists [12]. Today, t-shaped people with unique competencies, broad-minded, expert knowledge in their profession are required. Active use of MCT is able to develop t-shaped skills of a contemporary specialist, his diverse knowledge and skills [3], [4], [9]. Also, the use of MCT leads to the development of new subject areas, new fields of activity of the musician and a specialist in the field of information technology (sound-timbral programming, sound synthesis, musical programming, modeling of the process of musical creativity, etc.).

One of the main technological platforms used in MCT programs at the Herzen State Pedagogical University of Russia is Max/MSP. In addition to deep learning Max/MSP [6], electronic musical instruments, acoustics, students also learn, through Max/MSP, a number of information technology basic concepts including object-oriented programming principles [10-11], [17], [24-28].

Interdisciplinary course regarding the orientation of professionals in current information technology possessing the necessary preconditions for the future musical activities. Researchers identify specialists in the field of MCT professionals as T-shaped professionals. "T-shaped professionals possess deep skills and knowledge in one discipline and one system, but also have broad skills and knowledge in many related disciplines and systems [19-20]. More importantly, the T-shaped professional possesses transdisciplinary competencies, such as programming, communication, problem solving, analytical thinking, Agile/Scrum, and creativity/ideation, which allow them to cogently integrate their deep skill/knowledge sets with other disciplines, in the pursuit of solving complex problems", write Jeremy Baguyos and Seth Shafer in their paper T-Shaped Music Tech Curriculums: Preparing Music Technology Students for the 21st-century Creative and Technology Workforce.

5. Conclusion

Methodological developments in the field of the new IT use in the musical disciplines training process, including MCT, have been tested for 17 years at the courses at the Herzen State Pedagogical University of Russia conducted by author of the article. Professional retraining course for specialists with the higher and secondary vocational education "Teaching of Musical Disciplines with Use of Music Computer Technologies" has been introduced, the professional and educational discipline "Music Computer Technologies" within the "Art education" educational direction, master course "Music Computer Technologies in Education", advanced training and course training for musicians have been developed on the basis of long-term pedagogical practice.

The study was conducted on the basis of 175 educational institutions from St. Petersburg and the Leningrad Region, Moscow and the Moscow Region, Murmansk and the Murmansk Region, Perm and Perm Territory (Land), Yakutsk and the Republic of Sakha (Yakutia), Primorye Territory and Far East, the Sverdlovsk Region, Pskov Region, Republic of Komi, Republic of Karelia, Chuvash Republic, Krasnodar Land, Stavropol Land, Krasnoyarsk Land, Khabarovsk and Khabarovsk Land and other regions. More than 2000 teachers of musical disciplines from more than 100 Russian cities have been taught at the Music Computer Technologies Laboratory and received the Diplomas of specialists in the new professional sphere (T-shape professionals). Among the

graduates at our laboratory there are also specialists from Belarus (Minsk, Mogilev), Estonia (Sillamäe), Latvia (Riga), Azerbaijan (Baku), Kazakhstan (Nur-Sultan, Alma-Ata and others), Israel (Arad), the Netherlands (Utrecht), France (Paris, Lion), Armenia (Erevan), Ukraine (Kiev, Lugansk), Germany (Quedlinburg), a. o.

In our University, we aim to make an impact on the process of training specialists of the future. And technology is our vehicle to do it. MCT is a university-wide connector, helping professors, students and musicians with projects that require a creative touch. There is no school in the country like Educational and Methodical Laboratory Music Computer Technologies of the Herzen State Pedagogical University of Russia, poised to become a national leader in T-shaped professionals in pedagogical higher education with using MCT.

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