

# T-Shaped Professionals: Music Computer Technologies and Music Education

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**Abstract:** The high-tech educational 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. It should also be noted that the MCT is an indispensable tool of the educational process in the promotion of musical art among various social groups, as well as a unique technology for the implementation of an inclusive pedagogical process in the training of people with disabilities. The author emphasizes the need to change the content of music education associated with the use of digital educational resources and the formation of a new type of specialist i. e. T-shaped professional. The author considers the MCT and network technologies as a means of forming the competence of contemporary musicians in the field of information technology. Some researchers identify specialists in the field of MCT as T-shaped specialists that are specialists of a new generation with deep knowledge in their core area and additional knowledge in related fields. This paper outlines aspects of the approach in modern education that prepare the students to be T-shaped professionals in contemporary education with using MCT.

## 1. Introduction

The author was guided by the general principles that had been developed at the Educational and Methodical Laboratory Music Computer Technologies of the 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 music education (as a means to expand creative opportunities),
- MCT in general music 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 musical Informatics,
- MCT in interdisciplinary Informatics course
- MCT in information technology, psychoacoustics and musical acoustics [1], [2].

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 [3], [4].

## 2. Music Computer Technologies as a New Creative Educational Medium

Complex innovative educational system “Music Computer Technologies in Education of Music Teacher“, developed in Educational and Methodical Laboratory *Music Computer Technologies* of the Herzen State Pedagogical University of Russia (St. Petersburg) relies on the best traditions of national classical music education, innovative foreign experience and contemporary MCT and develops both musical and information technology education, and the effects of the social aspects of the informatization process of art education in general. The principles underlying the creation of the methodological system are the basis for formation of a new subject area in music and pedagogical education, the possibility of which is due to the emergence and development of the MCT. Their existence is the foundation for the types of professional activity formed at the present stage, both by musicians working with the MCT (sound engineering, digital recording, sound design, sound production, performance on synthesizers and MIDI-instruments, etc.) and by programmers-developers in the field of electronic musical systems.

The methodical system is based on using the MCT, specialized software and a specially organized class, as well as on the implementation of the innovative form and method of group creative form of classes, it has been developed, licensed and introduced in educational process of vocational and educational profile for Bachelors of Art Education “Music Computer Technologies“, which in 2004 carried out a set of entrants in different regions and educational institutions of Russia. For students studying at music faculties of various universities in Russia, classes are conducted in the following disciplines: “Computer Music“, “History of Electronic Music“, “Technology and Methods of Teaching (on Subjects of Profile Training)“, “Architectonics of Sound“, “Basic Course of Studio Recording“, “Information Technology in Music“, “Technology of Musical Styles“, “Basis of Composition, Instrumentation and Computer Arrangement“, “Traditional and Computer Orchestration“, “Studio Recording Technology“, “Methods and Practice of Teaching Electronic Composition and Arrangement“, “Methods of Teaching the Performing Art on Electronic Musical Instruments“, “Standard Software of Professional Activities of a Musician“, “Traditional and Electronic Instrumentation“, “Music Computer“, “Basic Electronic Musical Instrument“, “Additional Electronic Musical Instrument“, “Electronic Synthesizer“, “Electronic Ensemble“, “Music Computer Workshop“, etc.

The Master degree program “Music Computer Technologies in Education“ was developed and implemented, which in 2006 carried out a set of entrants in different regions and educational institutions of Russia.

Classes on the program cycle of disciplines “Music Computer Technologies of Rehabilitation of People with Hearing Disabilities“, “Music Computer Technologies of Rehabilitation of People with Visual Disabilities“, etc. were developed and conducted for the students of the faculty of correctional pedagogics.

Implementation of the innovative educational system “Music Computer Technologies“ is carried out through the system of additional education: retraining programs advanced training programs and courses.

The following professional retraining programs have been developed:

- “Teaching Music Disciplines Using Music Computer Technologies“;
- “Teaching Electronic Musical Instruments“;
- “Information Technology in Music and Music Education“.

On the basis of the offered methodical system in Educational and Methodical Laboratory *Music computer technologies* the following programs of professional development were created:

For teachers of children’s musical schools and children’s schools of arts and music teachers at general educational schools:

“Music Computer Technologies“, “Methods of Teaching Musical Disciplines with Using Music Computer Technologies“, “Musical Creative Work with Computer“, “Methods of Teaching Electronic Musical Instruments“, “Music Arrangement for Electronic Musical Instruments“,

“Distance Musical Education”, “Information Technology in Music”, “Music Computer as a New Tool for Musicians”, “Teaching of Musical Disciplines with Using Synthesizer and Computer in Music Schools and Schools Arts”, “Information Technology in Music Education”, “Music Computer at the Children's Musical Schools”, “Sound Design”, “Applied Sound Engineering”, “Fundamentals of Musical Programming”, “Contemporary Methods of Teaching Musical Disciplines Using Information Technology”, “Methodology of Teaching Music for People with Disabilities (Visual/Hearing) Using Music Computer Technologies”, “Interactive Network Technologies of Music Learning», “Electronic Musical Instruments”, “Art of Performing and Arranging on a Keyboard Synthesizer”, etc.

For music teachers at pre-school institutions:

“Innovative Methods and Technologies of Musical Development of Pre-School Children on the Basis of Music Computer Technologies”.

This is a reflection on the training course aimed at developing the creative potential of music students, expanding their musical instruments, familiarity with the applied potential of information technology in the field of musical art.

Prepared training and educational manuals provide methodological support of the learning process.

## **2.1. Music Computer Technologies as an Educational and Creative Environment in Pedagogical Practice**

The experience of understanding the historical, artistic, aesthetic, ideological and methodological foundations of the formation of MCT, 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 [5-10]. Therefore, the search for effective educational systems taking into account the capabilities of the MCT is promising and reasonable.

The musical activities 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 [11-14]. 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 analyses 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 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”.

## **2.2. Music Computer**

In the process of creating 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 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, [15-16]) 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 the 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 music computer establishment, the evolution of electronic musical composition in interaction with a computer, a music computer as a new multi-functional poly-tembral 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 music 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, music computer use in live performances, and many more [16-22].

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 [23-24], electronic musical instruments, acoustics, and musical informatics, students also learn, through Max/MSP, a number of information technology basic concepts including object-oriented programming principles [25-32].

Interdisciplinary courses with using MCT are 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 [33]. 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 [34-36]. 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.).

MCT-courses regarding the orientation of professionals in current information technology possessing the necessary preconditions for the future musical activities [37]. 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. 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 [38, p. 92].

### **3. Conclusion**

At our University, we strive to influence the process of training specialists of the future. And MCT is our vehicle to make it. MCT is a University connector that helps professors, students and musicians in projects that require creativity. 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.

Methodological developments in the field of the new IT use in the musical disciplines training process, including MCT, have been tested for 17 years in process of holding 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.

T-shaped people are specialists of a new generation with deep knowledge in their core area and additional knowledge in related fields. Such people are in demand in a variety of professional areas that require the use of music content of various levels and specifics.

Graduates from the Educational and Methodical Laboratory Music Computer Technologies at the Herzen State Pedagogical University of Russia find employment in diverse fields ranging from music to information technology.

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