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APPLICATION OF MODERN TECHNOLOGIES IN TEACHING THE WORKS OF THE MUSHKULOT PART OF "SHASHMAQOM" (on the example of the "Steam" educational technology)

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Abstract
This article provides information on the effectiveness of music science and the artistic level of students, its integration with music, mathematics, physics, and other subjects, as well as on the technology of teaching the complex part of Shashmaqom using art therapy using STEAM educational technology in higher educational institutions.

Keywords: Technology, aesthetic culture, music therapy, maqom, mushkulot, music, psychology, pedagogy and cultural studies, integration, reflection, interval, measure, method.

Today, one of the urgent tasks in the educational process is to expand the aesthetic worldview of students, educate them in the spirit of respect for our cultural heritage, and at the same time develop their musical abilities. In this process, the use of integrative and modern pedagogical approaches is of great importance.

The essence of "STEAM" educational technology. Each object has its own unique creation and development technology. Pedagogical technology in the educational process is a holistic process in a specific sequence, aimed at achieving a single goal, based on the needs of the student (or child), carefully planned and guaranteed results[1].

Today, the "STEAM" educational technology is being implemented as the "STEAM-education" approach, demonstrating a high level of effectiveness in the educational process. The founder of

[1] Ishmuxamedov R, Abduqodirov A, Pardayev A. “Ta’limda innovatsion texnologiyalar” т.:2008.16-bet

STEAM educational technology is the American teacher Georgetta Yakman. The implementation of "STEAM" educational technology in higher educational institutions is a requirement of today.

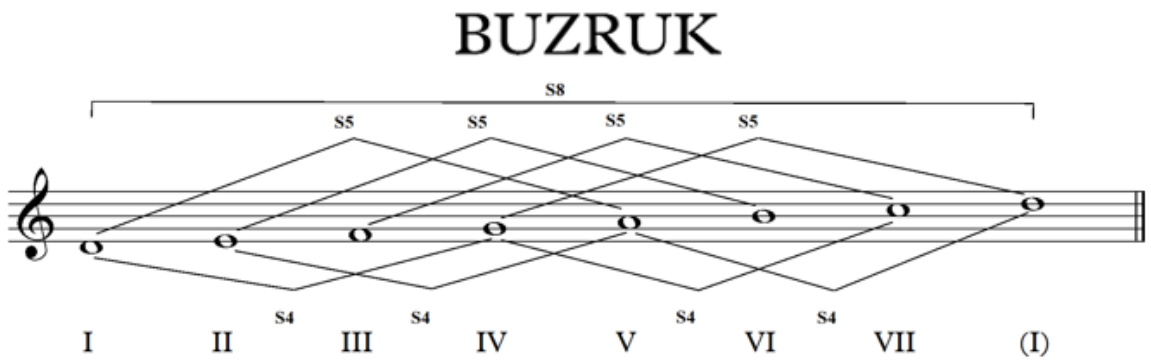
Along with the concept of technology, it is very important to dwell separately on the essence of the term integration. If we say that the main goal of traditional education is to teach knowledge and use this knowledge for thinking and creativity, then the STEAM approach teaches us to combine acquired knowledge with real skills. This allows students not only to have creative ideas, but also to apply and implement them in practice. It can be seen that, compared to traditional teaching methods, the "STEAM" approach in music education encourages students to conduct experiments, create models, independently create music and films, turn their ideas into reality, and create the final product. This educational approach allows students to effectively combine theoretical and practical skills and facilitates the subsequent learning process.

The difference between "STEAM" educational technology and other technologies lies in the fact that students, in order to successfully master various musical topics, simultaneously ensure the combination of mental activity with practical activity. In this, they follow the phrase "Wisdom and hand." In this case, students quickly see and assimilate the acquired knowledge in practical activities. The use of "STEAM" educational technology is very useful in the development of students' intellectual abilities.

The application of the STEAM methodology in music lessons of higher educational institutions allows students to develop not only musical abilities, but also creative thinking, observation skills, technical and engineering

Component	Application in music practice
S - Science	Interval systems used in maqom (the tuning of each maqom to separate intervals, the sound sequence of maqoms). Acoustic properties of tanbur, dutor, or chang instruments in ensembles.
T-Technology	Digital audio analyzers (Spectrum analyzers, DAW). Interactive status map across mobile apps
E-Engineering	Equipping traditional musical instruments with touch systems (MIDI converter).Creation of an ensemble pedagogical laboratory in a virtual or real environment.
A - Art	Creative interpretation: reflection of the maqom melody in the form of multimedia (video, animation). Visualization and graphic design: showing the structure of maqom through a diagram.
M-Mathematics	Rhythmic measures in maqoms and their combinatorial analysis. Interval ratios and their graphical representation.

S - Science. Interval systems used in maqom (the tuning of each maqom to separate intervals and the sound sequence of maqoms).



T-Technology. Digital audio analyzers (Spectrum analyzers, DAW). Formation of an interactive map of statuses through mobile applications.

The rule is used for in-depth scientific and practical analysis of musical works:

Spectrum analyzers: Shows the voice spectrum in real time, helps to see pitches, timbre changes, amplification or decrease in the status.

DAW (Digital Audio Workstation): For example, in musical programs such as Ableton Live, Logic Pro, Cubase, FL Studio, it is possible to analyze, visualize, segment, and determine tempo changes in the works of the Mushkulot section of "Shashmaqom."

With the help of these means, microtonal features, rhythmic complexities, ornamentation, and other subtle aspects of maqom performance are studied graphically. This creates an interactive style for students that combines listening to the status and theoretical analysis.

E-Engineering. Equipping traditional musical instruments with touch systems (MIDI converter). Creation of an ensemble pedagogical laboratory in a virtual or real environment.

This will allow connecting Uzbek national instruments (dutar, gijak, tanbur, dutor, doira, and others) to modern digital platforms.

Key points:

Piezo sensors, touch sensors, or optical sensors are installed on musical instruments. These sensors convert parameters such as the pitch, power, and impact rate of the sound being played into MIDI signals. MIDI signals are sent to a computer, DAW, synthesizer, virtual instrument, or visualization programs. As a result, the student or performer plays with a real instrument, but this is analyzed, recorded, or performed in real time in collaboration with others in a digital environment.

In this case, the student, along with learning the traditional instrument, also masters digital technologies. The program automatically displays errors such as volume, tempo, and intonation. In art therapy or ensemble classes, the possibility of digital analysis of performance technique and emotional expression is created.

Creating an ensemble pedagogical laboratory in a virtual or real environment is a very relevant and widely applicable project. In a virtual environment, students or performers simultaneously perform maqom ensemble pieces from different locations on an online platform. In the real world, there is a specially equipped classroom or studio - traditional instruments, MIDI systems, a digital mixer, monitors, and DAW.

A - Art. Creative interpretation: reflection of the maqom melody in the form of multimedia (video, animation). Visualization and graphic design: showing the structure of maqom through a diagram.

When teaching the traditional art of maqom in higher educational institutions, it is important to express maqom works in various multimedia tools to increase students' interest and harmonize their auditory, visual, and sensory abilities. These are:

Video projects. Students or teachers create a short video for a maqom piece (for example, parts such as "Tasnif," "Tarje," "Gardun" in the Mushkulot section). Along with music, it demonstrates the historical context, the performance process, musical instruments, and the spiritual and moral impact of music.

Animation. The melodic development, repetition, and modulation processes of Shashmaqom can be demonstrated using simple diagrams or digital animation. The fact that the student performs this process independently or in a group strengthens creative thinking.

Audio-visual collage. Expressing the melodic direction and rhythmic structure, which are the basis of "Shashmaqom," through color, movement, and imagery.

This approach creates a deep understanding of the musical text, a connection between the music heard and the images seen. Thus, the student participates not only as a listener, but also as a creator and analyst.

Visualization and Graphic Design. In this case, the structure of the maqom is shown through a diagram. The use of graphic design and diagrams to explain to students the complex structure of maqom music (form, sections, melodic development, cadences) is very effective.

This method facilitates the understanding of the status, forms a comprehensive approach based on sight and hearing, and develops the student's analytical thinking. The process of studying maqom occurs not only by hearing, but also by "seeing" and "creating." With the help of multimedia and design, traditional music will become closer and more interesting for young people.

M-Mathematics. Rhythmic Measures in Maqoms and their Combinatorial Analysis. Interval ratios and their graphical representation.

Although mathematics and music may seem like two unrelated fields at first glance, there is a deep and mysterious connection between them. Both areas are based on clearly structured systems, and each requires a logical, structural approach. The integration of music and mathematics has a great influence on the cognitive development of students, since the connection between these areas not only expands knowledge, but also develops students' creative and analytical thinking skills.

Studying the connection between mathematics and music provides a deep understanding of their interrelationships. Music embodies mathematics, especially through rhythm, melodic structures, clear, logical structures of chords and intervals. For example:

The measure of rhythm, meter, and tempo (speed of movement): In music, the measure of time, for example, the first, fourth, or eighth sections, is based on the proportions that are repeated in rhythm. These ratios can be expressed by mathematical formulas. Thus, students understand mathematical relationships when studying the rhythmic structure of music.

Intervals and chords: In music, intervals (e.g., second, third, fourth, etc.) and chords are based on precise mathematical relationships. The distance between each interval, or interval length, is denoted by letters (e.g., C-D, C-E). These intervals, as musical structures, can be analyzed with mathematical calculations.

Sound and vibrations: Physical phenomena play an important role in the creation of music. For example, the frequency of sound waves and their mathematical measurements allow for the study of mathematical concepts in the process of creating and listening to music. The frequencies, length, and amplitude of sound waves are also analyzed mathematically.

Applying mathematics in the study of music helps students deeply understand the basic principles of musical structures. When mathematics is integrated with various aspects of music education, students acquire the following basic knowledge:

Analysis of rhythm and timbre: Students understand the process of creating music by studying the rhythmic elements of music and mathematically calculating the time measurements of each section. This process is used to analyze rhythm using mathematical formulas and to precisely construct it.

Analysis of chords and intervals: Chords and intervals in music are built on many mathematical relationships in music theory. For example, the formation of chords, the distances between intervals, and the relationships between them are governed by rules. Students understand these ratios using mathematical analysis.

Lesson objectives in the integration of music and mathematics: - broadening students' worldview; - identifying general laws in music and mathematics; - fostering interest in the subjects being studied. The level of implementation of interdisciplinary connections varies, which depends on the content of the lesson.

In conclusion, it can be said that the science of music is connected with other sciences. The effectiveness of the lesson, as well as the artistic level of students, their interest in music, mathematics, physics, and other subjects, will be further enhanced if the subjects are integrated with music.

Works such as the Mushkulot section of Shashmaqom are built on complex rhythmic meters. For example: Tasnif or Gardun methods There may be measures such as 2/4 or 3/4. Calculate the combinations of different rhythmic figures (for example, long, quarter, eighth) within the same meter in the maqom. Determining the total number of different options: for example, in a 4-section measure, there can be a combination of strong and weak (slow) strikes.

Students write and listen to these combinations and analyze which one fits the maqom style better. As a result, they will be able to understand the rhythmic measure not only by ear, but also through a mathematical model.

The melodic basis of maqom music is considered to be intervals and their system. In maqoms, interval proportions are often manifested in the form of a microtonal (half, quarter, half-note).

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