PEDAGOGICAL NEED FOR USING STEAM EDUCATIONAL TECHNOLOGY. INTERDISCIPLENARY METHODOLOGY, CONNECTION OF PHYSICS WITH MUSIC.

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Annotation. *The content of the article is about the advantages of STEAM education among the pedagogical technologies for improving the teaching method in education, especially in music education, specifically about the advantages of explaining the field of music performance by physical laws and the relevance of interdisciplinarity in finding a solution to the same problem from different angles.*

Keywords: *Educational technology STEAM, music and physics, overtone sound system, organ, piano.*

ПЕДАГОГИЧЕСКАЯ НЕОБХОДИМОСТЬ ИСПОЛЬЗОВАНИЯ ОБРАЗОВАТЕЛЬНОЙ ТЕХНОЛОГИИ STEAM. МЕЖДИСЦИПЛЕНАРНАЯ МЕТОДОЛОГИЯ, СВЯЗЬ ФИЗИКИ С МУЗЫКОЙ.

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Аннотация. *Статья посвящена преимуществу STEAM-образования среди педагогических технологий совершенствования метода обучения в образовании, особенно в музыкальном образовании, а именно о преимуществах объяснения области музыкального исполнительства физическими законами и актуальности междисциплинарности в поиске решение одной и той же проблемы с разных сторон.*

Ключевые слова: *Образовательная технология STEAM, музыка и физика, обертоновая система звука, орган, фортепиано.*

21st century is considered to be the age of digital technologies, if we look at our current social life, we can see that we cannot complete any tasks without them. In the last century, the "Traditional" method of teaching was the leader, but now it is no secret that its place in education is weak. A higher education system that prepares qualified personnel for music education directly requires a solid education and innovative research. Also, in the section of the concept of expanding the scope of higher education, improving the quality of training of highly educated specialists, forming the target parameters of training of highly educated specialists, taking into account the requirements of investment programs, regional and network programs, trustee boards, global technological changes, optimizing educational directions and specialties, paying special attention to the development of STEAM areas; The task of [1] is defined. Therefore, a number of pedagogical technologies were laid to improve the teaching method in education, especially in music education. Currently, one of the most popular of them is STEAM educational technology.

If we decode the STEAM acronym, we get the following information: S - natural sciences, T - technology, E - engineering, A - arts and M - mathematics. STEAM is interdisciplinary education, finding solutions based on the same idea from the perspective of different disciplines. It develops in students the qualities of cooperation, the ability to use different field experiences, and the search for solutions to real problems. Note that the demand for specialists in this field is increasing in the modern world. Therefore, today it is developing as one of the main trends in education. In the educational system - based on STEAM educational technology, it is about the direct and indirect support of digital technologies in music education, especially in the field of performance. Therefore, it is appropriate to first write about the role and benefits of STEAM in education. If the field of music performance is connected with the fields of natural sciences, technology, engineering and mathematics that form the basis of STEAM, this experience will

serve as a model for the student or student for a long time, if it shows a situational problem based on one or another topic and finds a creative solution to it. It is impossible to express in the form of an article to talk about the connection of each related field with music before the importance of the use of STEAM educational technology in the field of music performance. Therefore, let's talk about the relationship of S "natural sciences" with A "art" in the framework of this study.

Physics is a science related to most branches of natural sciences. The main instrument of the representatives of the musical field is a musical instrument, and if we pay attention to the history of the creation of a particular instrument, the sound (tone) is formed in each of them as a result of the physical condition, and due to the relations of those physicists, chemists and mechanics in their improvement over the centuries, today we enjoy the tone of musical instruments. we are According to Gleb Anfilov, "At first, people did not even know what sound was, why it appeared, and for what reasons it changed. It's a waste of time and a lot of effort to find out. "Discoveries in the field of music were made by chance, blindly, and science came to help to perfect them." [4, 18] Take the "Organ" instrument as an example.

The organ is one of the ancient musical instruments, its ancestor is the ancient (19th century BC) Babylonian pipe (volynka). It is basically an instrument made of tightly sewn cow or goat skin and filled with air to create a polyphonic tone, with one tube at the top and up to three fluted reed tubes at the bottom for blowing, keys and keys. Of course, the above definition is far from the appearance of a modern organ instrument, but the role of historical events in its improvement over centuries is incomparable. Large organs began to appear in the 4th century AD. The art of making them was developed in Italy, and from there it started to be made in France in the 9th century. The spread of the organ throughout Western Europe dates back to the 14th century. The basis of its structure consists of inflatable pipes of different lengths and diameters, a device for moving air, a remote control with keyboards, and a tractor. By the way, it was the piano, grand piano, and accordion that first appeared on the organ. Originally, the keys of the organ were about the width of a hand, and the organist pressed the keys with his fists, not with his fingers. But

gradually the keys became narrower, opening the way to show the skill of the performers. As for modern pianos and grand pianos, their current capabilities have improved due to the interplay of physical phenomena and laws.

The ancestors of the piano were the harpsichord and later invented clavichords. Their disadvantages were a fast fading tone, which in turn made it impossible to play a legato line, and a monotony of pitch that prevented one of the most desirable qualities of musical means of expression - the possibility of using dynamic markings. The modern piano mechanical system was invented by the Italian mechanic Bartolomeo Cristofori di Francesco around 1709, in his design the hammers were placed under the strings. Similar systems were developed by Marius (1716) in France and Schroeter (1717-1721) in Germany. Erar invented a double-repeat mechanism, which made it possible to produce a sound by quickly pressing a key (in earlier instruments, the hammer was slowly removed from the string).

The first piano was invented in December 1800 by the American J. Hawkins, independently of him (in January 1801) the Austrian M. Müller also created a piano instrument. The instrument has been greatly improved by the addition of pedals. The piano received its modern form only in the middle of the 19th century (cast iron frame, later - transverse strings, enriched with mechanics with lower and upper shock absorbers). How much team effort went into modern piano mechanics?! And the mechanics, founded by Cristofori, are now thought out to the smallest detail. Modern grand piano mechanics transmits this force to the strings with an almost inexhaustible key pressure. It delivers even the tiniest tremolo of a second without being "choked". The invention of piano pedals was a remarkable event, especially the right pedal, which did away with dampers that depressed the strings. A single right pedal - qualities that express music such as the duration of harmonies, their addition, enrichment of chords, change of timbre, amplification appeared.

Each new instrument was created in response to the demands of musicians and opened a new page in the art of music. Humanity, which initially had no knowledge of sound, has become so connected over time that it cannot imagine its life without the possibility of technology. Let's talk about the physical definition of sound.

Sound is a physical phenomenon that propagates through elastic waves in a gaseous, liquid, or solid medium. In a narrow sense, sound means waves (vibrations) related to perception by the senses. [9, 367] Helmholtz, one of the German scientists who searched for answers to these and similar questions, made a great contribution to the development of physiological and musical acoustics. He created the theory of acoustic resonance, solved the problem of the organ pipe and built a model of the ear, studying the effect of sound waves on it. [7, 86]

In order to understand why exactly seven notes originally formed a strong diatonic system and formed the basis of music theory, it is necessary to talk about how nature and notes are related. The reason for this is the system of sound overtones. A note is a fixed amount of some sound frequency. Any sound forms a tone system.

Let's say you hear a nightingale, the rustling of trees, the sound of people or animals. If that tone matches the frequency of a note, you can name the sound after that note. Let's say the note is A (A) (440 Hz). Now listen with all your heart and attention to sing with perfect intonation on the note of lya(A). If you listen carefully to this note for a very long time, it seems that by chance, quite unexpectedly, you also hear the note (A) an octave higher (880 Hz). Then, unexpectedly, you can also hear the note E (1318.50 Hz) - which is a fifth of an octave. (Figure 1) Don't be surprised if you hear a third overtone. These are exactly overtones - first octave, then fifth, fourth, etc. [6, 1] They can be heard in wind instruments, when sung with the throat, in the organ, in the tension "harmonica" of the electric guitar, for example, in some works for the piano by Bella Bartok.

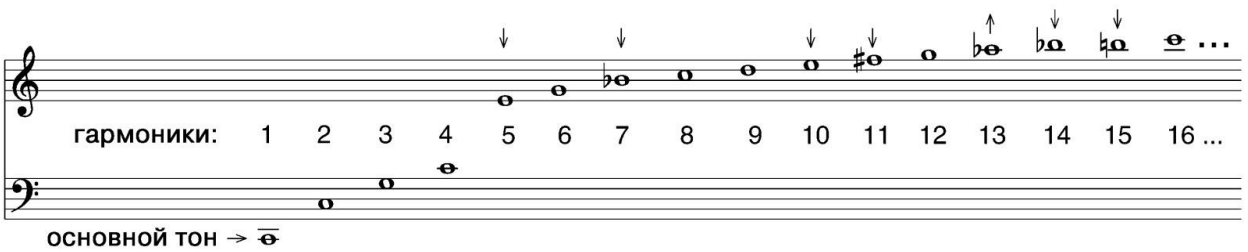


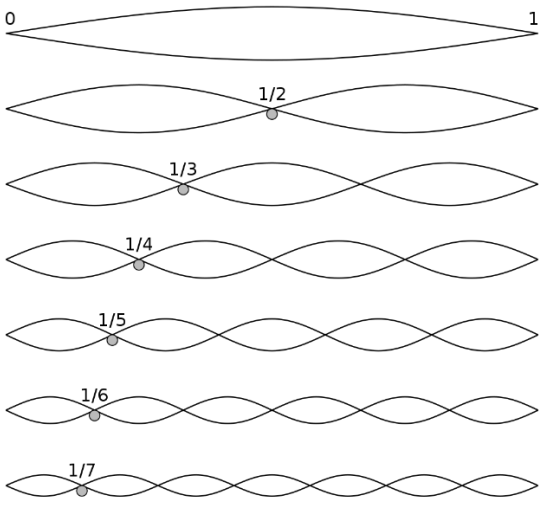
Figure 1. A sequence of intervals formed from one sound.

Any sound contains other overtones that arise as a result of natural vibrations (strings, air columns). The "small" vibrations that resonate with the main sound, producing other inaudible tones, naturally have a different frequency and corresponding pitch.

Figure 2. The sequence of divisions in the Oberton system.

I can even cite a non-musical example. On YouTube, a person threw a ping pong ball and watched the direction it took in a row, then placed kitchen pans at the right distances. After the ball was thrown, the distances got shorter, like a sonic overtone system. [11] The person who performed this experiment may have done it to develop a mechanism for hitting the ball, rather than relating the ball to the sound overtone system. But it should be noted that even the movement of the ball repeats the system of sound overtones, why do we distinguish between this physical state and the musical tone movement in education?!

In conclusion, it should be noted that the connection between the art of music and the science of physics was given by the example of the above quote and personal experiences. This was just a small amount of information on the collision



of two major industries. I think that in order to work on "quality tone", which is the basis of the field of performance, it is necessary to teach students about the physical properties of musical sound in connection with other interesting knowledge. In this case, STEAM would be a reason for researching new ideas and experiences in the use of educational technology, and it would motivate the student or student to

organize the performance of the work based on new approaches as a result of these studies, not just to perform the performance.

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