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# Interdisciplinary Teaching of Sound Phenomena in the Course of Physics

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*Alizhanov Dilmurod Azamzhon ugli*

*a lecturer, Department of Physics, Namangan State University*

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**Annotation:** This article is devoted to teaching sound phenomena in the physics course of the sixth grades of general secondary education schools, and contains methodological recommendations for the development of pupils' interest, as well as improving the quality of education through interdisciplinary connections and connections between themes.

**Keywords:** sound, sound phenomena, noise, human health, pupil.

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We live in a world filled with different sounds. We receive sounds through our ears. When people talk, birds sing, music sounds, the sounds vibrate in air and are reverberated in ears.

Who would not like to watch a movie or a sports program on TV while communicating with family; while walking down the street listening to interesting music on the radio; talking on the phone with a loved one at a long distance? It brings people joy and fun.

Why can we tell if a particular voice is familiar or unfamiliar to us when we are talking on the phone? Why do we determine whether sounds coming from musical instruments are pleasant or unpleasant? Why don't we like some (noises) sounds? We can ask ourselves a lot of similar questions. In order to answer these questions, we must have a good knowledge of sound phenomena in the course of physics. In addition, today, the science of acoustics has developed to such an extent that its achievements are widely used in the study of the underwater world, the creation of new music, the development of communication systems, the propagation and reception of electromagnetic waves, landscape design, the construction of roads and residential buildings, and also in the production of vehicles.

In general education schools, sound phenomena are studied in the 6th grade physics course [1].

When teaching them using two methods we examined the level of knowledge of pupils and the quality of education in the study of sound phenomena. The first method is connection between themes. The second method is interdisciplinary connection.

**The first method.** In the physics textbook of the 6th grade on the topic "Electrical devices. Saving electrical energy" it is said that to save electrical energy, it is not necessary to leave the TV turned on with a loud sound. At the same time, attention is focused here not only on saving electrical energy, but also on preventing noise. It is important to note the following: at this stage, it is imperative to inform pupils about pleasant and unpleasant sounds, that noise is included in the group of unpleasant sounds (loud sound of the TV), focus on the fact that you should not leave the TV with a loud sound.

It is reasonable to explain that noise is an unpleasant sound, not of a musical nature. Therefore, it interferes with work and does not allow a person to rest. It reduces labor productivity and efficiency, strains the nerves and the cardiovascular system, causes

headaches, insomnia, accelerates the heartbeat, and causes adverse physiological changes in the human body.

In settlements, noise occurs as a result of the activities of air, rail and road transport, industrial enterprises, construction equipment, public services, as well as the loud sound of radio and television.

By giving some information related to sound at this stage of training, specifically mentioning that sound is also harmful to health, focusing on the Chapter "Initial information about sound phenomena", which will be studied in subsequent classes, we increase pupils' satisfaction with the lesson, increase their interest in future lessons, and also allow students to realize that physics will be of great help, increases enthusiasm for exploring the world in more detail. Also here we apply the method of connection between themes in practice.

**The second method.** In the Chapter "Initial information about sound phenomena", we provide information about noise when studying sound phenomena.

We note that an increase in noise also leads to a deterioration in human health. Therefore, noise control is an integral part of nature protection.

The noise level is measured in decibels (dB). Noise of one decibel is the smallest and difficult to distinguish. Noise is divided into 4 groups depending on the level and nature [2].

1. A noise level of 30-60 dB is considered normal. These include the rustling of trees in the wind, the ticking of a clock, and the sound of normal music.
2. If the noise level is 60-90 dB, then it is an unpleasant sound, which includes street noise, the sounds of a vacuum cleaner and a washing machine.
3. A noise level of 100-120 dB is considered harmful and has a negative impact on human health. It includes the sounds of machine tools, cars, motorcycles, trams, rail transport, agricultural and construction equipment, as well as the sound of loud music.
4. A noise level of 130-200 dB is considered dangerous. These include the sound of a fire truck, the sound of a jet plane, the sound of an explosion, and much more.

After that, you can provide the following table, which makes it possible to compare the level of various noises.

The source of sound	The pitch of the sound (decibels)
The ticking of the clock	20
Quiet conversation	40
Medium volume speech	60
Noise	80
Fortissimo of the Grand orchestra	100
Pain perception	120

According to existing data, when the noise level exceeds 130 dB, sudden changes in the human body can lead to illness or even death.

The city center is part of a group of areas with a high level of noise. With an average vehicle traffic speed of 2000-3000 per hour, the maximum noise level reaches 90-95 dB [4].

The noise level on the streets depends on the traffic intensity and speed of transport, the width of the road, the density and height of roadside structures, landscaping on the road, and the presence of green plants and trees. Each of them can reduce the noise level up to 10 dB.

Noise affects the human body primarily through the hearing organs. Noise analyzers are

constantly working hard. 70 dB noise interferes with speech fluency. A person begins to hear loud sounds poorly, and gradually loses his hearing. But, noise does not affect everyone alone. Some people quickly lose their hearing due to loud noise, and some people retain it for a long time. The gradual impact of noise on the human body leads not only to hearing loss, but also to dizziness, headaches, tinnitus and rapid fatigue. Older people are more sensitive to noise. For example, 46.3% of people under the age of 27, 57.0% of people aged 28-37, 62.4% of those aged 38-57, and 72% of those aged 58 and older are more sensitive to noise [4-7].

Urban noise is more likely to affect a person's circulatory system, increase cholesterol levels, and worsen heart function. This also leads to pancreatic dysfunction and decreased brain activity.

We believe that the information given above will strengthen pupils' knowledge of physics and improve their understanding of the environment. In this article, we have provided information about sound phenomena related mainly in the fields of anatomy, music, ecology, and medicine. The theme can also be related to many other areas. In addition, given that sound events are an integral part of people's social interaction and their activities in society, pupils' interest in physics is further enhanced by the connection of themes in the field of interest. This is an important factor in achieving the goal set by the teacher, that is, the quality and effectiveness of education.

Naturally, there may be questions such as "Should the pupil study the theme at a certain time, or can you distract the pupil by filling in information outside the theme? There are ten more themes (after one chapter) for moving on to sound phenomena, so why should we partially cover this theme in a different theme than in the allotted time?" In our opinion, if one theme has aspects related to the next, it will be useful to give a brief description of this, that is, fill it out in future lessons. The pupil in the process of studying the subject (when he does not fully understand this theme) knowing that the knowledge gained will be repeated in the future (if the teacher can direct the student methodologically correctly), he pays attention to such phenomena, while also paying attention to similar phenomena in the events surrounding him.

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