

8.2 Usage of multimedia tools in teaching safety disciplines

Multimedia learning means learning from words and pictures. It was developed by Richard E Mayer, an American educational psychologist. The hypothesis from the book *Multimedia learning* stated that people learn more effectively from both words and pictures than just words (Mayer, 2009). [289] In this matter, words consist of written text, spoken text, and even verbal lecture. Pictures are divided into static (illustration and graphic) and dynamic (video and animation). The use of words and images in teaching materials is intended to enhance learning.

Multimedia learning tools are a complex of hardware and software that allow the user to use graphics, hyper-texts, sound, animation, video, etc., using a computer. Undoubtedly, multimedia is a separate type of computer technology that combines traditional static visual information (text, graphics), as well as dynamic - speech, music, video fragments, animation.

When teaching such disciplines as “Life Safety”, “Labour Protection” or “Basics of Labour Protection and Life Safety”, multimedia tools, first and foremost, should present the material in an accessible format that will not only be interesting and informative, but also form residual knowledge.

As is known, classes using multimedia can take various forms. This can be video content, presentations, games or quizzes created using Kahoot (see Fig.1), Jeopardy Labs (see Fig.2) or other similar tools.

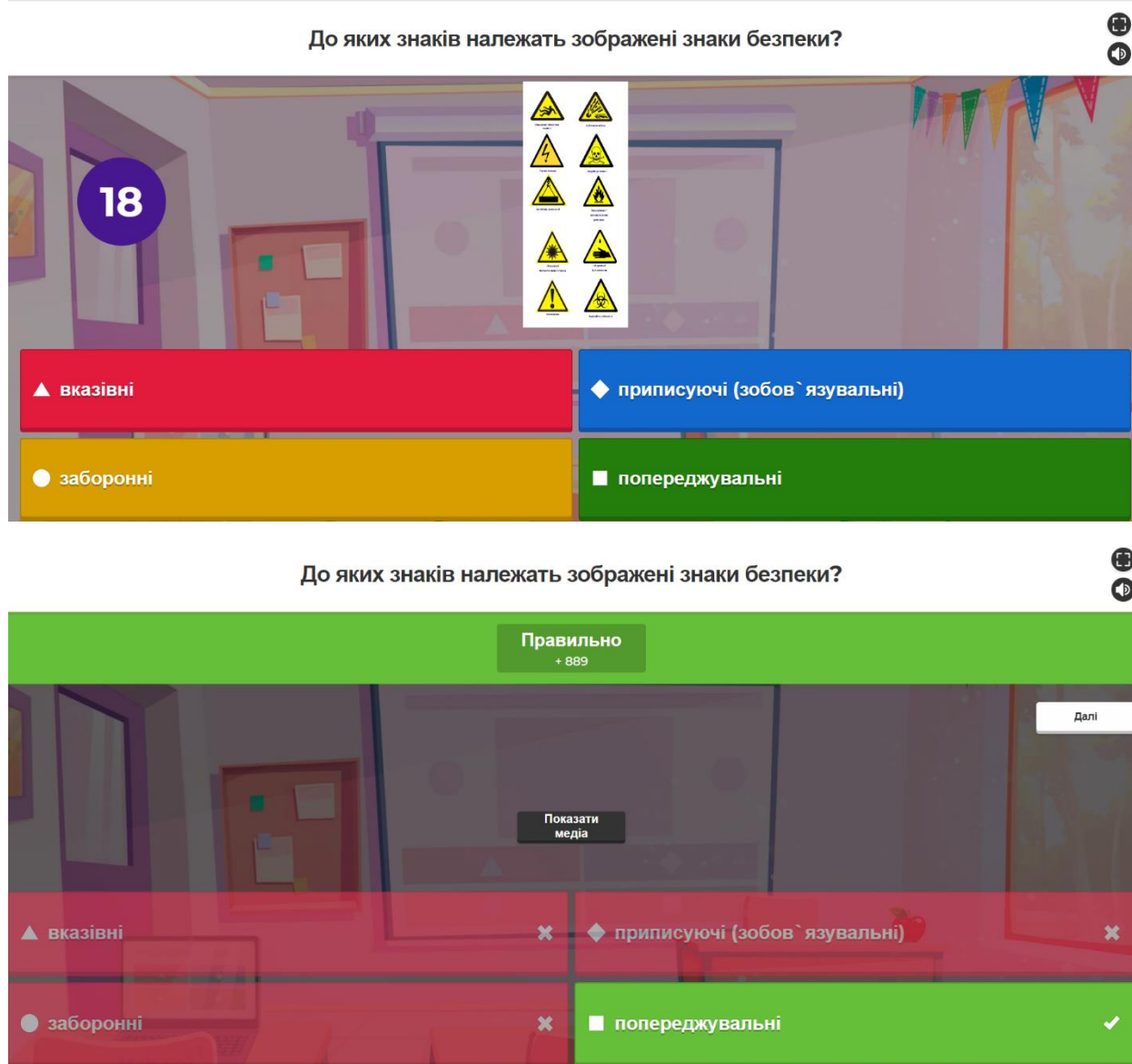


Fig.1. Example of a question and answer view in Kahoot [291]

Quizzes conducted on the Jeopardy Labs platform not only enhance knowledge acquisition but also foster teamwork. If a group of students is divided into several teams, the level of material assimilation and the ability to interact among students become evident. Express testing in Kahoot develops skills in isolating the main points from the acquired knowledge. An encouraging aspect in both cases is the opportunity for the “competition” winners to earn additional points. An important component of success in conducting classes in a game form is the development of tasks for such games directly by the lecturer, as they fully understand the material discussed in previous classes and the knowledge a student needs to successfully pass the discipline.

THE DEVELOPMENT OF TECHNICAL, AGRICULTURAL AND APPLIED SCIENCES AS THE MAIN FACTOR IN IMPROVING LIFE

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Instructions: Enter your Jeopardy game title, and category names. Click a cell to enter your question/answer (it's OK to leave some rows/columns/cells blank). When you're done, click Save and Finish. Dismiss.

Undo Redo +Add Row + Add Column Visibility: Public Save and Finish

Охорона праці та БЖД

	Правові засади та організація охорони праці	Виробнича санітарія та гігієна праці	Травматизм та техніка безпеки	Психофізіологічна діяльність	Пожежна безпека
100	Сфера дії якого закону України поширюється на всіх юридичних та фізичних осіб, які відповідно до законодавства використовують найману працю, та на всіх працюючих.	Для яких ламп характерний стробоскопічний ефект ?	Який вид порогового струму унеможливилює самостійне звільнення людини від його дії ?	Замініть твердження: "Патологічний стан, що розвивається в людини внаслідок хронічної фізичної чи психологічної перенапруги, клінічну картину якого викликають функціональні порушення в центральній нервовій системі - це...".	Скільки існує класів пожеж ?
200	Хто несе безпосередню відповідальність за порушення зазначених вимог охорони праці на підприємстві?	Скільки є розрядів зорової роботи (згідно ДБН В.2.5-28:2018) ?	Що таке крокова напруга ?	Що таке дистрес ?	Які основні показники визначають якість ліноутворювача?
300	Чи створюється служба охорони праці як окремий підрозділ, якщо на підприємстві працює 51 особа?	Що показує кратність повітрообміну ?	До якого класу належить приміщення, якщо в приміщенні температура повітря вище 35 °С та названа струмопровідна підлога?	Фактори, що впливають на нервову діяльність людини	Який тип вогнегасників використовують для гасіння електрообладнання, що знаходиться під напругою 1000 В ?
400	Який вид інструктажу проходить працівник, якщо його переводять з одного структурного підрозділу в інший?	До якої групи належать хімічні речовини, які викликають алергічні реакції?	Що буде матеріалом розслідування нещасного випадку у разі, коли нещасний випадок визначено таким, що пов'язаний з виробництвом?	Скільки існує фаз нервової діяльності ?	Від чого залежить категорія приміщень за вибухо-пожежонебезпекою (згідно ДСТУ Б В.1.1-36:2016)?
500	Хто здійснює фінансування охорони праці?	Що визначає категорію роботи за важкістю ?	Хто обов'язково входить до складу комісії з розслідування нещасних випадків, пов'язаних з виробництвом?	Які існують види віку людини ?	Що включає система організаційно-технічних заходів пожежної безпеки об'єкта?

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100	Закон України "Про охорону праці"	Для яких ламп характерний стробоскопічний ефект ?	Який вид порогового струму унеможливилює самостійне звільнення людини від його дії ?	Замініть твердження: "Патологічний стан, що розвивається в людини внаслідок хронічної фізичної чи психологічної перенапруги, клінічну картину якого викликають функціональні порушення в центральній нервовій системі - це...".	Скільки існує класів пожеж ?
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Fig.2. Example of a question and answer view in Jeopardy game [292]

Surveys of students and analysis of responses showed that the use of a game form of conducting classes using multimedia technologies is well received by first- and second-year students, whereas, in senior bachelor's level courses, this type of class did not find a special response: only 40% of students indicated that conducting classes in such a format is appropriate. At the same time, the use of multimedia technologies during the COVID-19 pandemic, as well as at the beginning of Russia's full-scale

invasion of Ukraine in an online format, was favorably noted in the teaching of disciplines. However, this applies primarily to typical lectures, laboratory or practical classes, where presentations and videos were presented, which allowed a more complete perception of the material that was presented in text format on other resources.

Mayer's theory aligns with contemporary thinking on effective learning, which embraces a constructivist perspective: Students learn most effectively when they have to construct their own knowledge structures and mental models. [290] As Mayer tells us, "instructional design involves not just presenting information, but also presenting it in a way that encourages learners to engage in appropriate cognitive processing." According to Mayer's assumption [289], people perceive information through a dual channel, that is, visual information is processed separately and auditory information is processed separately. Thus, by using both the verbal component and the visual one in parallel, a more complete perception of the material by students can be developed. In addition, it should be taken into account that each individual perceives the presented information differently and chooses the optimal type for its perception.

In a certain sense, each person has a limited ability to perceive and process the information that is presented to them, so it would be appropriate to optimize this process and develop those abilities that will increase the effectiveness of learning. On the one hand, the presentation of information should be interesting and stimulate the liveliness of the learning process itself, at the same time, an excess of general information will distract from the main goals of learning. That is why each teacher should choose a balance between making the lecture lively (with audience involvement) and increasing the level of knowledge of the listeners.

Observations have shown that information is poorly perceived when the visual series is duplicated by the verbal component. On the other hand, when one complements the other - the perception of such elements is more complete.

Distracting images or background music adversely affect the overall learning process when studying safety disciplines. Material is better assimilated if there are associations and cues that guide the student to the main goal.

It is advisable to exclude information that is generally available or well-known to most, as it is unfavorably perceived by the audience as a whole.

If information is presented in the form of presentations or slides, it is definitely interesting and important to use a variety of color schemes for arrows, highlights, etc., to draw the listener's attention to important information. In this case, it is advisable to make accents on important and summarizing details at the end of each section. As already mentioned, duplicating text on a slide and pronouncing it in words is not advisable, as it overloads and creates an effect of excessive information for the listener, along with this, it is necessary to take into account differences in the presentation of a certain type of material. Thus, if it is a graphic material that is on the slide, and to give specific explanations to it, then such information with text and graphics is positively perceived by students.

Let's consider some details regarding the color perception of graphics or text on the screen. Let's dwell on this in more detail, taking into account the received comments, impressions and remarks of students during the conduct of the lesson itself.

The *red color* does not always positively affect the actualization of information perception by listeners, since sometimes it is perceived as a signal of anxiety. And this is taking into account that in the context of the discipline we constantly talk about safety and dangers. On the other hand, the use of a light blue-blue color scheme, with slight inclusions of yellow or green, is positively perceived by students.

Shades of *purple, orange or pink* are not perceived positively, as such slide colors are perceived as entertainment information or something secondary.

It was noticed that when presenting a video sequence, it is advisable to give voice-over comments from the speaker, and not just present the video information directly with comments or voice acting, which is directly provided in the video information by the author of the clip. Since such an approach can be perceived as unimportant information or distancing the speaker from the presented material. Even if the teacher uses personal video files where his voice sounds off-screen, you still need to pause when showing the video and supplement with comments "live". In this way,

the integrity of the perception of what is heard and seen is achieved and the effect of the presence of the teacher throughout the entire time is achieved.

If it is not a specific video, but only animated pictures, then they were perceived by students, especially senior courses, as unimportant information, or as a pleasant addition, so in subsequent classes, preference was given to static images that reflected the educational material, along with this, the color scheme of each subtopic changed in order to delineate the main concepts in their presentation.

As experience shows, breaking up homogeneous material into certain blocks is more advisable than presenting it on one slide and in full. So, for example, presenting information about types of responsibility for violation of labor protection and safety requirements, it is advisable to first present a slide with a list of these types of responsibility, and then separately consider each type of irresponsibility on separate slides. In this way, the information is perceived as more understandable and structured.

The use of multimedia content requires a reminder of general knowledge, key terms or concepts that will be discussed in a particular lesson. Otherwise, students who missed something or were inattentive in previous classes will quickly lose interest and be distracted by extraneous matters.

At the same time, it is advisable to remind about the necessary skills that are needed to master a particular material, in this case, even those who for some reason missed the previous material, can later return to it and more fully perceive the received information at a particular lesson.

It was noted a good perception of information by the audience, if the presented drawings did not have specific captions, but were accompanied by explanations from the speaker, what exactly the students see on a specific slide, otherwise - attention was focused on the headings and tried to figure out the presented material faster than the speaker conveys it.

If multimedia content is used directly in the classroom, the manner of information delivery can be traditional, that is, academic. However, when teaching in a remote format (online), such language sounds more rigid and is not perceived by students. They quickly lose interest, feel a communication barrier, in contrast, informal

speech activates the learning process in the online format and creates a relaxed atmosphere.

Using phrases such as “please pay attention”, “let’s consider together” during such classes significantly encourages students to work and collective interaction.

When conducting classes in online mode, adding an image or video image of the speaker does not always positively affect the perception of information. Sometimes it is perceived as a distracting moment or animated image, so sometimes it is more advisable for the teacher not to be directly present in the frame, but to be the so-called “voice-over”. On the other hand, when there is an online conversation with students and the speaker’s image is spread across the entire screen without any other accompaniment, such perception gives the listeners a sense of classroom presence and direct interaction with the teacher.

When using multimedia content, it would be good for the teacher to work with the listeners in advance without its use. In this way, the main accents, the main types of interaction and information delivery are tracked, which can be taken into account in subsequent classes, so as not to create an effect of low or high level of knowledge, and (as a result) exclude from the educational process students who do not fall under certain categories.

If we lean towards Mayer’s theory, then according to his statement, multimedia learning is a sense-making activity in which the student seeks to build a sequential mental representation of the presented material [289].

However, in such perception, there may be certain disagreements, since each person has different ways of perceiving what they see, hear or feel.

It has been over five years since the world has felt changes in education, the first step towards this was a global pandemic that touched the whole world and the education system itself underwent changes that generally changed approaches to learning as a whole. University online learning required the teacher to use other means and approaches, there was no traditional academic perception of the material, there was no lecturer in the center who reported and the audience who listened and took notes of the material. It was necessary to change and adapt known teaching methods, as well as

teaching materials for conducting such virtual classes [292,293]. Different platforms, including Zoom, MS Teams, Google Meet, Big Blue Button, etc., gave a somewhat different presentation of the material and it quickly became clear that it was necessary to develop educational slides and other materials for conducting classes online in a short time. In particular, in addition to traditional presentations or presentation of other files by spreading information on the screen, it was necessary to shoot video content for conducting laboratory classes, so that students have the effect of presence directly in the laboratory class, so it was necessary to form and explain the material on the one hand – just as it was done live, on the other – to provide additional information, so that students can more fully comprehend what they can only see visually, and will not be involved in the process of execution directly physically.

Preparing a presentation for conducting a lecture course required a certain structuring and in some similarity of information delivery. In particular, adherence to classical techniques, such as indicating the topic, purpose, list of main issues to be considered and a brief reminder of the material that was presented earlier. For example, combining the presentation of information on the Moodle platform in pdf or docx files for preliminary familiarization or consolidation of materials, as well as creating a glossary there and methodological support for the possibility of preliminary familiarization with the material that will be in laboratory or practical classes positively contributed to the conduct of such classes.

Furthermore, it was noted that conducting classes using multimedia technologies requires involving students in specific tasks. Particularly positive is the possession of information about specific students who are present at the lesson, for example, surname, name, etc.

When presenting material in slide mode, it is not always advisable to output all the information at once. Information that is displayed on the slide in certain blocks as the lecturer talks about certain concepts is well received. In this way, the main focus is on what the speaker wants to draw attention to or emphasize. At the same time, filling the slide completely in the end result gives a holistic perception of the information that was previously presented or submitted.

Otherwise, these principles work if you use presentations, video files, and the like directly in the audience, as the lecturer can observe the direct reaction and emotional state of those present and adjust their actions or change the emphasis using the voice, taking into account the audience's reaction to certain concepts that are directly displayed in front of the audience, choose to track the reaction so to speak "control group" among those present, to focus primarily on the pace of the lesson. Unfortunately, such contact in online format is inaccessible.

The speech and voice when in the audience is better to use, as mentioned above, a more formal academic speech format, whereas in online mode informal voice explanation is more appropriate and causes a higher level of trust in the audience when viewing, in particular, materials on the screen.

Thus, the use of multimedia tools in online teaching plays a more significant role than in classroom learning, as the transmission of material using text images and voice contributes to significant online learning and is a basic requirement for the design of materials and their presentation in the form of a presentation directly during classes. The only point to pay special attention to is that when conducting practical classes, it is necessary to use an online board to interact directly with the audience, so that students can supplement the concepts that the teacher writes or enter the necessary information. Due to this approach, there is a moment of presence and participation in the lesson directly, unfortunately, the negative point is that in such a format people who are shy or have communication problems feel bad.

Therefore, it is important to select screen materials so that they are not only visually attractive and attract the attention of the viewer and listener, but also contribute to the assimilation of especially difficult or significant concepts that the lecturer explains. However, it is necessary to take into account that the main disadvantage of online learning is the absence of a certain level of discipline: not all students can self-discipline. Therefore, access to materials of already conducted classes for students who had problems with Internet access at a specific point in time or want to review the lesson again is a very important point. This approach is facilitated by the MS Teams platform, which directly allows you to leave video recordings on the platform and does

not require additional efforts from both the lecturer and the students, promotes long-term memorization of information in a remote period of life.

The use of multimedia technologies during the educational process significantly increases the amount of educational information perceived by students. Currently, not all information is assimilated, some of it does not find its place in the logical structures of the educational subject (or its fragment).

The conducted analysis allows us to highlight some features of modern multimedia technologies, namely: first, information saturation, that is, the possibility of providing information in various forms (video, sound, text, etc.); secondly, the possibility of showing phenomena in development, as well as the possibility of using various techniques for presenting information in fragments.

Thus, the use of multimedia technologies in the process of studying security disciplines, on the one hand, expands the possibilities of providing information, on the other hand, it requires a certain level of training from both the teacher and students to perceive and process the information that is available. However, many problems related to the use of multimedia technologies are closely related to general difficulties, such as: the speed of the Internet, the possibility of access to means of communication, and the hardware design of the educational process.