

# Educational Video in the University: Instruments, Technologies, Opportunities and Restrictions

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**Abstract.** The article provides an overview of theoretical and applied research on the problems of video application in the educational process. Video content is increasingly being used as an additional resource in higher education and students' independent work. The educational video can improve the quality of demonstrations, help students prepare for practical and laboratory works, and influence their interest and motivation for further learning. However, despite of the obvious advantages of educational video using, there is a problem in understanding of video's effectiveness. So, we proposed a classification of educational video content, lists of software applications and developing tools of videos of various types. The analysis of the main methodological, psychological, didactic, ergonomic and technical aspects of the development of the educational video made it possible to formulate the universal guidelines aimed at improving of the educational video quality.

**Keywords:** video content, classification of educational videos, principles of educational video developing.

## 1 Introduction

The role and authority of a university teacher as the source of knowledge is rapidly decreasing from year to year. At the same time, other possibilities are being developed to improve the educational process efficiency. It is due to the integration processes of formal, non-formal and informal education [1], as well as technological, technical, social factors, the totality of which forms the concept of an open educational environment. A large role in such an environment is given to innovative learning technologies, including information and communication technologies (ICT). ICT realize the technologies of blended learning and e-learning, the possibilities of virtual and augmented reality are expanded, various multimedia approaches are used in higher education.

The educational video plays a huge role in the modern world, it is explained by the mass character, the didactic principle of visualization, the individualization of the learning process, the focus on processes and phenomena in an accelerated or slower pace, etc. Considering the educational video in a historical context, there is its cultural, scientific and didactic value. For example, video lectures by physicists R. Feynman, W. Lewin and many other well-known experts are publicly available on the popular

YouTube video hosting site and constitute a fundamental historical heritage in the global dimension.

However, with all the obvious advantages of using video content in the educational process, there is a difficulty in understanding its effectiveness.

## **2 Related Work**

In publications [2] - [4], researchers note the key factors that influence the introduction of new learning technologies: compatibility with the learning process (matching of educational technology with existing values, needs and experiences of students); the availability of resources for the technology implementation and the attitude of the participants of the educational process to the applied technology.

Many teachers and researchers propose use the video resources more actively in the learning process with the aim of teaching technology improving. They highlight such key benefits as individual learning, learning flexibility, and structuring [5], [6].

The basic principles for developing of educational video are described in C. Brame [7], H. Meij and J. Meij [8], D. Muller [9] papers. Graphic animation and video can serve as a means of motivating, updating attention, vocation guidance [10], [11]. The video gives possibilities to supplement the classroom lectures [12], carry out laboratory works [13], [14], to simplify the essence of complex phenomena (technical, physical, natural, etc.) [15], to illustrate geometric models of three-dimensional space.

P. Guo, J. Kim, R. Robin [16] have shown that students ignore long-term educational videos, preferring shorter rollers. At the same time, Z. MacHardy and Z. Pardos [17] noticed the educational video may be ineffective at the design stage.

Understanding the types of educational videos and software for its development, systematization of the basic methodological, psychological, ergonomic, technical principles and approaches applicable to the development of educational video, will allow formulating the universal methodological recommendations.

## **3 Educational Video Classification: Analysis, Classification, Basic Concepts of its Development**

### **3.1 Educational Video Content Classification**

Video is a versatile tool that is convenient to use in the classroom, in an “inverted class” technology, in e-learning, as well as in lifelong learning. Despite the universality, a unified generalized classification of educational video has not been developed. So, V. Pisarenko made the following main criteria for classification: the form, content, educational goals implementation, the method of development, the purpose of production [18]. Yu. Bilonozhkin classified the educational video in the following categories: purpose and goals, technology of development and technology of application [19]. Many scientists proposed the educational video classification according to the style of information transmitted [20]:

- Feature films (cartoons, various feature films, fragments of performances)
- Non-fiction, journalistic (interviews, documentaries and educational films)
- Informational (advertising, news recordings, TV shows, videos)
- Video tours.

Let's consider the Internet online recordings and classified them by type of interaction of students and teacher, shown in the video - synchronous, asynchronous or combined.

The **synchronous video** is recordings of classroom activities (lecture, master class, training, workshop, demonstrations, etc.), individual and group consultations, a real-time online broadcast (webinar, teleconference, web consultation). This type of recording fixes the simultaneous work (activity) of the teacher (leader, coach) and the listener.

**Asynchronous video** is not fixed by simultaneous (synchronous) interaction of the subjects of the educational process. There are a studio activity (lecture, demonstration, etc.), professional education lessons (work on the machine, makeup technique, technique of hair clipping, etc.), screenshots, video illustrations, slide presentations, video scribing, video blogs, educational films, documentary, debatable and animated films, interactive videos, element of augmented reality, etc.

The **combined video** is the combination of both types of records in one educational video with the help of editing programs.

Videos of classroom activities have a methodical interest. They allow seeing the organization of students' activities, teaching methods, techniques, demonstrations for attention rising. At viewing such records, the effect of presence in the audience is created. Such a video can be captured by a single camera (general view) and with two cameras (lecturer, board, general audience plan). It allows making the dynamic plans (distant, general, medium, and large). However, the shooting itself can be accompanied by various unforeseen problems - technical, outsider noise, questions from the audience etc.

Recording of seminars will help demonstrate the discussion and decision-making processes. Video recording of the consultations will allow viewers to get answers to typical questions related to difficulties at a certain educational task.

Many platforms are designed to organize broadcasts in real-time using Internet technologies (webinar, teleconference, web consultation), allow making a video recording of the event. If this option is not provided, the webinar is recorded from the screen using special software. However, there are some special features. From one side, the emotional impact on students is achieved through non-verbal means of communication (gestures, facial expressions, intonation). On the other hand, a talking head will quickly tire the viewer. Therefore, experienced teachers avoid monologue, organize surveys and contribute to the active activity of students in the virtual classroom [21].

Opposite to the classroom activity, a "studio" recording is carried out using a set of professional equipment - a video camera, a teleprompter, a vision mixer, a control monitor, and lighting devices (filling, drawing, contrast light). The chroma key technology may be used; it allows "deleting" the background, and adding an image or back grounding video instead. Chroma key is a monochrome screen, against which a lecturer is shot. It is also possible to overlay slide presentations, dynamic visual effects, animations on the main video stream using non-linear video editing software.

Videos of educational experiments have the considerable value, especially if they are technically complex and require special equipment or a long time to prepare and conduct them. Special attention is given to video demonstrations of natural phenomena, for example, the formation of crystals in nature. It is advisable to slow down or speed up the captured video to display changes over time, for example, a demonstration of the capillary effect.

Screencast technology allows recording images and all the actions taking place on the screen of a computer or smartphone (slides, drawing, and work in the software application) and simultaneously make an audio track with voice comments and explanations [22]. The screencasts are widely used to teach application software, make slide video presentations, and design a video in the style of Khan. Screencast is developed using the special programs such as Atomi ActivePresenter, Ezvid Video Maker, Movavi Screen Capture Studio, Screencast-O-Matic, Camtasia Studio, etc. For Android operating system, there are DU Recorder, Filmit Pro, AZ Screen Recorder etc.

Typical slide presentation videos have alternating slides, including text, pictures, photographs, a narration voice, or other sound. The use of animated objects helps to highlight key points and keep the audience interested. Applications such as GoAnimate and Moovly are used to create animated video presentations.

Another type of video is video scribing - the visualization of developing of the certain graphic symbols and text, accompanied by a narration [23]. For example, the movement of a hand with a pencil helps to accentuate important points and complement the oral narration. The cross-platform program VideoScribe (from Sparkol) allows developing such videos.

The next type of video is a video blog. Educational video blogs have been distributing since 2005 [24], [25]. They are cheap in developing, person-oriented and an attractive to raise the student's interest.

Movies are also successfully used in the educational process. They were made in film labs of research institutes and educational institutions. With the development of ICT and the availability of material and technical base, the teacher is able to design a plot, a script, record video and editing it. It is quite difficult to do this qualitatively and in full length. Different software can be used for making / editing video, for example, Adobe Premiere, Corel VideoStudio, Pinnacle Studio, VEGAS Movie Studio, Windows Movie Maker. Additional programs can be used for creating video effects, for example, Imagineer's Mocha Pro, Adobe After Effects, and Silhouette.

Cognitive and developmental role is given by documentaries, discussion and animated films. Cartoons can have two-dimensional animation (Toon Boom, CrazyTalk, Anime Studio), or three-dimensional rendering (examples of 3D graphics editors - Autodesk Maya, MODO).

The drawn stories - comics. The usage of educational comics in higher educational institutions is based on the ideology of interaction and motivation of students [26]. Earlier, it was necessary to have drawing skills to develop comics, now there are special applications (MakeBeliefsComix, ToonDoo, Comic Master, Chogger, Write Comics, Witty Comics). In video comics developing, the program PowToon is used.

An interactive educational video is a video that supports interaction with a student. Over the past few years, a number of interactive video technologies have been developed - with active clickable elements, polls and questions, computer games (quests) [27], [28]. For example, with the help of YouTube, there is a possibility to add clickable slides, screensavers, contacts, watermarking, etc.

Video may be an element of the augmented reality. One of the existing approaches defines augmented reality as a technology of imposing of digital information on a visible object (marker) in real time using appropriate hardware and software [29]. The approach of the online course implementation as a poster with pictures is described in the literature. At putting the smartphone on individual elements of the poster, learning modules with video and other components appear [30]. You can create, manage and share augmented reality events through a browser using the HP Reveal Studio web application.

### **3.2 Main video Distribution Channels**

Video available through the Internet is an excellent opportunity to catch up the learning material for students who have missed classroom lessons, as well as the opportunity to re-review difficult moments of classes, to study independently recommendations for seminars, practical and laboratory classes. This approach is designed to reduce the number of students' questions in the classroom.

Educational videos can be distributed through file sharing services (for example, GoogleDrive, OneDrive, Box), websites, CMS, video platforms and video hosting sites (for example, YouTube, Vimeo, Rutube, Daily), educational applications (for example, iTunes U), platforms for online education (for example, OpenCourseWare, Coursera, Khan Academy, TED Talk, TED Ed, Open University of Maidan), open online courses (LMS, MOOC).

The most popular video hosting service at the moment is YouTube, it is showed by statistics [31]: 1) monthly attendance of about two billion users, 2) every minute more than 300 hours of video is loaded, 3) YouTube attracts more than 1/3 of Internet users. High indexes, availability, the ability to embed videos on other sites using html code, make YouTube attractive in the education field.

### **3.3 Methodological, Psychological, Didactic, Ergonomic Aspects of Video Content Development as a Condition of the Educational Process Improving**

There is an opinion that an educational video developing is very simple - it is enough to record the teacher's lectures and post them on the university's website, YouTube channel, or in the online course. However, the development of educational video is a multidimensional process, it requires careful planning, as well as taking into account many aspects - methodological, psychological, didactic, ergonomic, technical.

Educational videos effectiveness should be based on the theory of cognitive load J. Sweller, R. Meyer's cognitive theory of multimedia learning and taxonomy of educational objectives (B. Bloom or L. Anderson, D. Krathwohl and etc.).

The **cognitive load theory** is the learning theory, developed by the Australian neurophysiologist J. Sweller<sup>1</sup>. It is based on the human information processing model presented by R. Atkinson and R. Shiffrin<sup>2</sup> in 1968. This model includes three memory structures: sensory, working (short-term) and long-term.

Sensory memory is the memory, fixed at the level of the sense organs. It is extremely short-term. Information stays for some time, and then it is replaced by new information. Information from the sensory memory can be selected in the working memory.

Working memory is a buffer between sensory and long-term memory. It is used at a certain moment for processing and temporary storage of information. J. Miller showed the working memory capacity is  $7 \pm 2$  objects [32], so a student can operate with a limited amount of information at a time. The brain is selective about information in the sensory memory. Therefore, many researchers recommend not putting background information in the educational video, excessive information, unnecessary repetitions, overly contrasting background pictures, ambiguous expressions, inappropriate jokes, loud background music, etc.

Long-term memory is a memory in which a large amount of information can be stored during all the life.

The **cognitive learning theory** by R. Mayer [33] is based on four components:

- Dual-coding theory
- Limited capacity of human working memory
- Active-processing
- Information transfer.

The dual coding theory<sup>3</sup> assumes that verbal and visual information is processed by two channels separately, but simultaneously in working memory.

Although each channel has limited processing capacity, their simultaneous use can increase the working memory capacity. It happens at implementation of the principle of Reducing Extraneous Processing - any of the channels is not cognitively processed.

Learning is an active process. R. Mayer proposes the use of the pretraining principle and the segmenting **principle in multimedia content development** [34]. The **pre-training** principle is for a preliminary explanation of new terms that may cause difficulties in understanding, as well as explaining the connection of the new educational material with the previous video lesson. **Segmentation** can be achieved either by making shorter videos or by adding interactive chronological clickable tags with thematic sections into a long video.

Another important principle is the principle of **signaling**, it is the use of on-screen text (two or three keywords) [35], [36], symbols, geometric shapes, a change in color

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<sup>1</sup> Sweller, J.: Cognitive load during problem solving: Effects on learning. *Cognitive Science*, 12, pp. 257-285 (1988)

<sup>2</sup> Atkinson, R.C., Shiffrin, R.M.: Human memory: A proposed system and its control processes. In: Spence, K.W., Spence, J.T. *The psychology of learning and motivation*, vol. 2, pp. 89-195. New York, Academic Press (1968)

<sup>3</sup> The dual coding theory was first described by A. Paivio in 1986

or contrast in a specific area of the screen [37], scaling (magnifier). Signaling is necessary to highlight the important information and attract students' attention to certain elements and further processing of this material in the working memory. R. Mayer, R. Moreno, B. deKoning, H. Tabbers et al. showed that this principle is applied to animation and video [37], [38].

The American psychologist R. Gagne, using the applied psychology in the study of the problem of learning effectiveness, developed nine **events of instruction** [39]. In our opinion, these events are applicable to the effective instructional video development (Table 1).

**Table 1.** Gagné's nine events of instruction

<b>№</b>	<b>Events of instruction</b>	<b>Educational video interpretation</b>
1	Gain attention of the students	motivation for further video viewing, informal and emotional narration, elements of humor
2	Inform students about the objectives	informing the student about the learning goals and objectives, the formation of the level of expectations from watching videos
3	Stimulate recall of prior learning	access to existing knowledge, connection with previous video lessons, the formation of associations
4	Present the content	organize the most logically material presentation and efficiently using different learning styles
5	Provide learning guidance	given analogies, examples, questions, animations, pictures and demonstrations, should provide semantic coding for storage in long-term memory
6	Elicit performance (practice)	ask questions at material explanation aimed at thinking
7	Provide feedback	provide the ability to make comments on the video
8	Assess performance	appeal to the knowledge through testing or using elements of interactivity, gamification
9	Enhance retention and transfer to the job	generalization of the material and post reflection, description of the problem situation, practical tasks that need to be solved

Researchers D. Zhang, L. Zhou, R. Briggs, J. Nunamaker conclude the presence of **interactive components** in the educational video contributes to greater student satisfaction and better learning outcomes [40].

Practical interest has the publication [16], in which P. Guo, J. Kim, R. Robin based on the statistical analysis of big data came to the following conclusions:

- The lecturers, accompanying the records on the board by the voice explanation, have a low speed speech
- Students' interaction with the video is higher in those video lessons where lecturers use high-speed speech
- The high speed of speech, accompanied by a presentation of slides, does not cause problems with understanding
- Decreasing of speed of lecturer's speech will make the explanations less emotional.
- Short videos require more careful planning
- The average time of the educational video watching of any length does not exceed 6 minutes.

Studying the question of the educational video effectiveness, let's consider the author of this paper **video channel** "voronkinalex". It was developed in 2011 on YouTube video hosting. It was used to support the author's open online course "Introduction to the Physics of Sound", which was held from October 29 to December 30, 2011. The webinars on the WizIq platform had the video fragments of physical experiments by relaying from the YouTube channel. Subsequently, video fragments began to play an important role in Physics teaching. The author of the article wanted to show some physical experiments. However, their preparation and conducting in the classroom took a lot of time on the lesson. So, the idea to record video during off-hours with enthusiastic student assistants was arisen, and then, the video duration was processed and edited to 4-15 minutes.

For example, the video "Newton's rings" (<https://youtu.be/r0Sa4b11fNM>) lasts 6 minutes, was recorded in a dark audience on the example of a soap bubble. The selection of lighting modes (monochrome and bright white LED illumination) made it possible to achieve high contrast of interference rings, and the video effect of time dilation allowed studying the formation of interference maxima and minima in a soap film. In 2018, 17 educational videos were recorded, including: "Demonstrational experiments on "Ultraviolet radiation. Value in nature and use in technics and art", "Spectral Analysis of Musical Signals", "Analysis and Synthesis of Speech Sounds", "Demonstration of Capillary Action", "Liquefied Natural Gas and Fog". It is convenient to demonstrate such videos at face-to-face classes, and those students who, for various reasons, missed the lesson, were able to watch the experiments at home at any time. For example, there is the video of the mechanical movement of material bodies for the purpose of subsequent analysis of the kinematic characteristics in the Tracker program<sup>4</sup>. Such videos are placed on the channel and allowed students to explore the movement of a material point in a circle, the motion of a ball thrown with an angle to the horizon, oscillations of pendulums, cycloids, collisions of radio control machines, etc. as part of laboratory work.

The video on the channel is open for viewing by everyone on the Internet and divided into groups of 8 playlists: STEM-lessons; program imitation of acoustic signals; video recording for Tracker; news; reports of STEM school sessions; conferences repots;

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<sup>4</sup> Tracker is a free video analysis and modeling tool built on the Open Source Physics Java framework. <https://physlets.org/tracker>, last accessed 2019/01/1



acoustics' material. The automatic analysis in YouTube Analytics allows setting such statistics for the period 2011 - 2019:

- View time - 248579 minutes
- The total number of views of all videos on the channel - 171820
- The average duration of watching all the videos published on the channel is 1 minute 44 seconds
- Popularity of playlists by browsing time. The most popular is 5 playlists, namely: STEM-lessons (54.5%); news (32.3%); another (8.7%); program imitation of acoustic signals (2.5%), video records for Tracker (1.6%)
- The average duration of watching video increases with the rising in the age of the viewer from 18 to 64 years old from 1 minute 22 seconds to 2 minutes 6 seconds (Table 2)
- According to Table. 3 the videos are mainly viewed from a computer, mobile phone and tablet
- The ways and channels through which viewers and students share links to videos are displayed in the Table 4

**Table 2.** Average duration of all videos viewing on the channel (Oct 2011 – Jan 2019)

<b>Viewer age, years</b>	<b>Views, %</b>	<b>Average viewing time, minutes</b>
18-24	10.8	1:22
25-34	62.6	1:29
35-44	20.9	1:44
45-54	4.4	1:48
55-64	0.5	2:06
65 and older	0.7	1:53

**Table 3.** Devices for videos viewing (Jan 2013 – Jan 2019)

<b>Devices type</b>	<b>Viewing time (minutes / %)</b>
PC	181181 / 72.9
Mobile Phone	38830 / 15.6
Tablet PC	16646 / 6.7
TV	1712 / 0.7
Game console	106 / 0.0

**Table 4.** Main methods and channels of video distribution (Jan 2013 – Jan 2019)

<b>Sharing service</b>	<b>Shares (number / %)</b>
Copy to clipboard	335 / 54.7
Vkontakte	113 / 18.5
Other distribution channels	82 / 13.4
Facebook	21 / 3.4
WhatsApp	20 / 3.3
Odnoklassniki	18 / 2.9

Facebook Messenger	5 / 0.8
Twitter	4 / 0.7
E-mail	4 / 0.7
Distribution through Google+	3 / 0.5
Reddit	2 / 0.3
Gmail	2 / 0.3
Text Message	2 / 0.3
Blogger	1 / 0.2

So, the average time of the educational video viewing does not exceed **2 minutes**. Channel viewers mainly watch videos from a computer, mobile phone and tablet. Most often, **links to videos** are **copied** to the clipboard, and then sent to them via **social networks** and **messengers for smartphones**.

### 3.4 Methodical Guidelines for Educational Video Content Development

The analysis of literary sources [7]-[9], [32]-[42], as well as the author's experience in video content development, allows summarizing, systematizing and formulating the **universal methodical guidelines**. They will help improve the efficiency of development and the quality of educational video content. Let's consider them.

#### Methodological aspects

1. Scenario. At the planning stage, it is necessary to select the type of the educational video, develop a preliminary logical plot, corresponding to the learning goal, as well as a speech plan and timing. After shooting, changes may be made to the script; they are taken into account at video editing.
2. Video duration. The video should be carefully planned as a set of short logically completed and concise segments (the optimal duration is from 2 to 10 minutes) [43]. Students ignore the video more than 45 minutes. It is recommended to make the interactive chronological bookmarks on thematic sections.
3. Synchronization in time. All actions in the frame and voice should be synchronized. Announcer's voice, synchronous with the video image, leads to a better understanding of information than the same words, submitted by the text against the background of the image. Concise text can complement the demonstration, animation, graphics. If the text is used, then he should be well read on the background of the video (it is important to remember that a student can watch videos from a smartphone).
4. Dynamics. The lecturer's performance should be combined with dynamic plans (different cameras, presentation slides, demonstrations, etc.). However, this should not weaken the attention of students. The use of the "picture in picture" method (for example, a lecturer on the background of slides) is allowed.

#### Background music. Legal aspect

5. Copyright. If a background sound should be used in the educational video, do not forget about copyright. Free music for general use and music distributed under the

free Creative Commons license can be found on many web services, for example, Free music archive, YouTube audio library, Audionautix.

#### **Psychological aspects**

6. Cognitive overload. A video can cause cognitive overload if it contains a lot of unnecessary information, for example - noise, complex long sentences, a large number of objects in the frame. It is also recommended to filter extraneous information that is not focused on the learning goal.
7. Fatigue of students and “talking head”. On the one hand, a voice-over in a video can tire students out of the absence of eye contact with a lecturer (his face, gestures, and facial expressions are not visible). On the other hand, if a “talking head” is visible in the frame, defocusing also occurs. It is logical to combine these two options.
8. Speech speed. The speech speed also affects the perception of the educational video. It is advisable to use the average speed. In some cases, it is possible to increase the intervals between sentences from 2 to 5 seconds in order to create an additional pause for understanding.
9. Emotional speech. The monotony of speech reduces the students’ attention. The use of a polite and less formal tone of the announcer’s voice leads to a deeper understanding of the material, especially for students with a low knowledge level [44], [45].

#### **Didactic aspects**

10. The learning purposes and results. Bloom’s taxonomy can be used to facilitate the goals of the video lesson. As known this original taxonomy (1956) includes six learning categories (knowledge, comprehension, application, analysis, synthesis, evaluation).
11. Interesting style of explanation and personalization. The student should feel that the narrator (off-screen, cartoon character or lecturer) speaks directly to him. It is necessary to remind the previous lesson topic, show the links to them, suggest the analogies, and life examples. It is logical to ask make one wonder questions at new material explanation.
12. Actualization of attention. It can be difficult for students to understand what animation or picture shows. In the educational video, it is desirable to highlight the main ideas using the signaling principle - keywords, pointers, scaling, freeze frames, as well as by highlighting part of the screen. For example, a magnifier (as an imitation of a magnifying glass) is used to improve readability.
13. Accompany video on the Internet. The video title is what students see first. It is desirable the title is clearly understandable. The first frame of the video should reflect the plot and compositional nature and at the same time attract attention. This can be a fascinating episode in the form of an image or photo and a large text title. Educational video can be started with the announcement of the issues addressed. A brief text summary and keywords to the video also increase the video availability. The teacher should not forget to respond the comments and feedback from viewers, and students’ questions.

#### **Ergonomic aspects**

14. Chroma key or rotoscoping. The chroma key technology is used to change a real background of the image to another image (wide range of frames). Rotoscoping techniques used help create a mask around the object that needs to be added to another background of the image.
15. Animation techniques. Computer animation are designed to increase an interest in knowledge and skills improving, and motivation for further learning. The use of animated characters has a positive effect on the students' involvement; in the case the visual effects are harmoniously distributed.
16. Subtitles. The educational video on the Internet can be watched by a wide variety of viewers, people with impaired hearing. It is advisable to add subtitles to increase material availability.
17. Interactivity. The use of interactive elements (thematic bookmarks), questions, tests and QR codes in educational video increase interest in interacting with video.

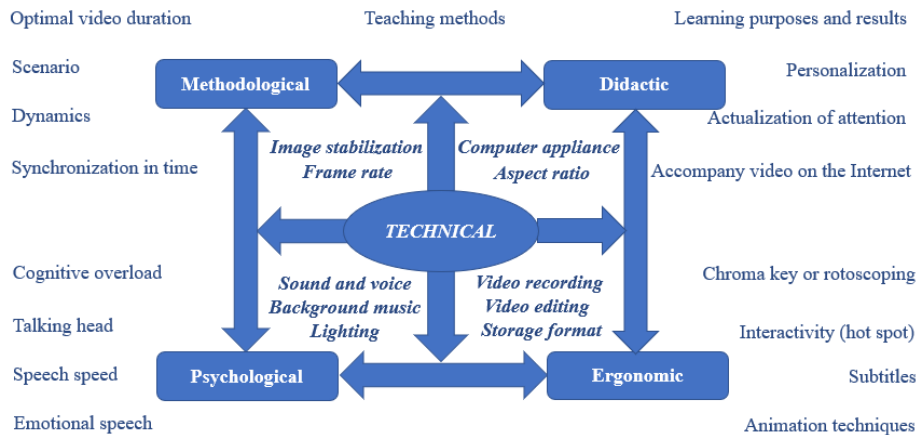
#### **Technical aspects**

18. Aspect ratio. Recording an educational video with several video cameras, it is necessary to take into account the aspect ratio of video frame for each of them. Typical formats are standard 4:3 and widescreen - 16:9.
19. Frame rate. As a rule, video is shot at a frequency of 24 to 30 frames per second. If it is necessary to use the slow-motion effect (for example, a demonstration of free-fall of ball); this value should be increased to 60 frames per second. It should be noticed, in the automatic mode at shooting video on a smartphone (tablet), the frame frequency varies with the light (as the light level decreases, the frame frequency decreases).
20. Prevention of image blurs. At making videos, it is necessary to prevent of tremor and image blurring at shaking. It also contributes to cognitive overload. Image stabilization is used or video is carried out using a tripod.
21. Sound and voice. The sound should be of high quality, it is better to use an external microphone. Built-in microphones capture background noise and record reverberation, it reduces speech clarity. In large classrooms, the lavalier microphone (also known as a lav, lapel mic, clip mic, body mic, collar mic, neck mic or personal mic) - a miniature microphone on clothing is used to free up the teachers' hands. It is recommended to use wind noise reducer at filming outdoor.
22. Lighting. In the absence of special lighting devices, filming in the audience should be carried out in the daytime with natural ambient lighting. In a darkened room, the additional light should be used. The increasing of the sensor sensitivity to light (ISO) will cause graininess and digital noise on the video. This will contribute to the cognitive overload of the student.

## **4 Conclusions**

Video is one of the forms of educational content presentation in full-time leaning, blended or e-learning. Analysis of the main methodological, psychological, didactic, ergonomic aspects of the development of educational videos showed that they are

closely interrelated. Each of them is affected by a technical factor (fig. 1). For example, tremor and image blur contributes to cognitive overload.



**Fig. 1.** The relationship between important aspects of educational video development

To create an educational video, you need to make next steps:

- Designate a learning goal and objectives. Answer the questions: Who needs it? Why and what is it for? What is the idea inherently? What result should be at the end?
- Select the educational video type (based on the proposed classification)
- Develop a concept and the initial scenario based on methodical guidelines (methodological, psychological, didactic, ergonomic, technical aspects)
- Prepare for video recording (event logistics, location, necessary equipment, decorations, tools, etc.)
- Choose the software (video editing, design, animation, etc.) and educational video distribution channels
- Maintain feedback

Studying the ideas, principles, approaches and techniques of educational video content developing, we tried to summarize the experience belonging to completely different areas of knowledge (computer science, pedagogy, psychology). As a result, methodological guidelines were formulated. They will be useful to practicing teachers in educational videos developing.

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