HNUE JOURNAL OF SCIENCE DOI: 10.18173/2354-1075.2023-0096
Educational Sciences 2023, Volume 68, Issue 4, pp. 220-230
This paper is available online at http://stdb.hnue.edu.vn

DESIGNING AND USING THE VIDEO OF TEACHING PRACTICE LESSONS ON THE TOPIC OF "CELL BIOLOGY" IN BIOLOGY GRADE 10

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Abstract. Using video in teaching makes an important contribution to the development of key qualities and common competencies for students such as self-study competency, communication-cooperation competency, problem-solving, and creativity competency. In particular, using videos on practical teaching in Biology has contributed to teaching new lessons, reviewing and consolidating knowledge, and developing experimental competency for students. However, the construction of videos on practical teaching in Biology is still very limited. Therefore, in this article, we have determined the process of building videos to teach practical lessons and applied the process to build 12 videos on the topic of "Cell Biology" (Biology grade 10) and proposed 2 processes of using videos to teach new lessons and contribute to developing experimental competency for students.

***Keywords*:** video, teaching video, practical lesson, Cell Biology.

1. Introduction

Decision No. 749/QD-TTg, dated June 3, 2020, of the Prime Minister has specified Education is one of the priorities for digital transformation: "*Developing a platform to support distance teaching and learning, thoroughly apply digital technology in management, teaching and learning..."*. To meet that requirement, more and more research on applying science and technology to teaching has been conducted, especially on building and using videos in teaching. There have been many studies on the construction and use of videos in teaching at high schools such as: "*Building interactive videos to support personalized teaching of oxidation-reduction reactions, Chemistry grade 10* " (Nguyen Tung Lam, 2022) [1], *Building and using the video system to support History teaching at high schools* (Hoang Chung Hieu, Nguyen Phuong Nam, 2020) [2]. In these studies, the authors develop processes and focus on creating videos to support teaching theoretical lessons in the classroom. Some other authors research, build, or edit videos and suggest the process of using videos or digital learning materials, including videos, in teaching some content in Natural Science or Biology such as: "*Improving the effectiveness of using video channels in teaching Biology*" (Man Thi Ha, 2016) [3], "*Building and using electronic learning materials in teaching the topic of Metabolism in Organisms - Natural Science grade 7"* (Dinh Tien Viet, 2022) [4], "*Collect, design and use teaching materials in teaching Biology grade 8 to develop self-study competency for students*" (Tran Thi Ngan, 2019) [5], etc.

However, the number of videos developed in subjects in general and in Biology in school is still very limited, especially videos of teaching practical lessons in Biology are still very scarce.

Received July 23, 2023. Revised September 21, 2023. Accepted September 28, 2023.
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There are a few videos that have been filmed by teachers when teaching but have not adjusted the steps. It is extremely important and necessary to develop a set of videos teaching practical lessons in Biology, contributing to improving the effectiveness of subject teaching. Therefore, we conducted a study on the topic of "*Designing and using a set of videos to teach practical lessons in the topic of "Cell Biology" - Biology grade 10* " to make practical biology lessons easier for all students, increase interest in learning Biology, and at the same time contribute to the development of students' experimental competency.

2. Content

2.1. Videos and using videos in teaching

According to Cambridge and Oxford dictionaries, the noun "video" is understood as a digital recording of moving images and sound or videotape. Video is a program, movie, or other visual media product featuring moving images, with or without audio, that is recorded and saved digitally or on a video cassette (https://www.dictionary.com/browse/video).

Teaching video is a type of video that is designed and pedagogically processed in accordance with the content and teaching purposes to bring about effective visualization in the teaching process, creating excitement and active learning for students. Video-based learning is a long-standing learning method to enhance the effectiveness of education (Yousef, Chatti, & Schroeder, 2014) [6]. Zhang et al. (2006) [7] stated that videos are a powerful source of e-learning. Videos, in particular, can shift the acquisition of new skills into constructivist learning (Carmichael, Reid, & Karpicke, 2018) [8].

2.2. Videos to teach practice lessons

Teaching video for practical lessons is a video in which the entire practice process is recorded by the teacher or students, starting from the introduction of the objectives, the items to be prepared, the steps to take, the results, and explanations.

Practical teaching videos can be used in teaching new lessons, reviewing and reinforcing students' knowledge, or testing and evaluating. Using video in teaching contributes to the development of students' competencies such as self-study competency, cooperative competency, and problem-solving competency, especially using practical teaching videos in Biology contributes to developing experimental competence for students.

2.3. Experimental competency

According to Truong Xuan Canh (2015) [9] "A learner's experimental competency is the mastery of systems of knowledge, skills, and attitudes and rationally operating them to successfully perform experimental tasks in the learning process in high school".

Thus, experimental competency is the ability of learners to detect problems, formulate experimental hypotheses, design experimental plans, conduct experiments and collect results, analyze data, and draw conclusions about experiments.

2.4. Designing videos to teach practical lessons on the topic of "Cell Biology" in Biology grade 10

2.4.1. Principles of video construction

To build a video that meets the teaching requirements, the following principles should be met:

- Ensure the goal of creating a video is clear, showing the teacher's pedagogical intentions,

and meeting the educational goals in the General Education Program (2018).

- Ensure video content is accurate, scientific, and systematically arranged, and the video layout is tight and suitable for learners. Teachers must refer to verified and reputable sources, such as practical teaching content in current textbooks.

- Make sure the image in the video is clear, easy to observe, consistent with the content, and ensures aesthetics. Bad, blurry images will make it difficult for viewers, especially for students, and also affect the quality of content transmission.

- Make sure the audio in the video is clear, easy to hear, and suitable for the video content. Sound plays an important role, as good sound will attract video viewers, and better convey content.

- Ensure the size and time of the video is suitable for the lesson and the teaching organization form. Controlling and ensuring the time in teaching lessons is very important, so it is necessary to balance the design and use of videos in a sufficient amount of time and combine them with other teaching activities in the lesson plan.

2.4.2. The process of creating videos to teach practice lesson

Based on the video creation process of the previous researchers, in this study, the process of building a video teaching practical lessons includes 5 steps, as follows:

Step 1: Analyze the goal of practical lessons, and determine the contents to build the video

From the requirements to be achieved in the topic of "Cell Biology" - Biology grade 10 according to the General Education Program 2018, identify practical lessons. In each lesson, it is necessary to define the objectives of the lessons. From the objectives, determine the video content. Each video includes the following contents: Practical objectives; Practice preparation; Steps to practice; Experimental results; and explanation.

Step 2: Build the video script

❖ *Define video layout*

The practical teaching video has a layout of 6 contents. Each content is described in detail (refer to reputable documents and apply local practical situations).

- Experiment name: The name shows the general content of the experiment.

- Objective: Based on requirements to be achieved in the General Education Program of Biology.

- Preparation: List in detail the name, number of tools, and chemicals needed for a group in the experimental steps.

- Steps to conduct: Describe in detail the steps to experiment, ensure the scientific basis, and achieve the experimental objectives.

- Results: Describe experimental results based on previous research.

- Explain. Explain experiments based on a clear scientific basis, suitable for students

❖ *Make a video script*

After defining the video layout, proceed to build the script. The script helps to identify the images and sounds that appear, based on which to easily record and edit videos.

It can create a script based on Table 1.

Table 1. Video script

Scenes	Scenario duration	Image	Sound	
			Narration	Soundtrack

Each part of the layout is a scene, and there will be corresponding images, text (subtitles), and sound (narration and soundtrack).

Step 3: Record

Determine the recording location based on the requirements and detailed content of the script.

Using technical equipment (camera, camcorder, phone) to record images in each scene. Most video recorders today can record video at 480p or higher. Use a device with a resolution of 720p or higher so that the recorded video can be viewed clearly on the computer screen.

Step 4: Technically process video with computer software

Currently, many software and applications on both computers and phones can help easily create and edit images and audio in videos. To meet the requirements of low cost, easy to install, easy to use, having many features, and fast video import and export, in this study, we recommend using the CapCut video editing application on the phone.

CapCut is a widely popular video editing software today, CapCut on Android can be quickly downloaded and installed to your phone, requires a minimum of 88 MB of free memory, and runs on the operating system from Android 5.0 and up. Users open the Google Play store, enter the keyword "CapCut" in the search bar, and download the installation application to the device. To download and install the CapCut application for iPhone a device must run on iOS 9.0 or higher operating system and have at least 132 MB of free memory space. Users only need to access the App Store and enter the keyword to find the "CapCut" application, then choose to download and install it to their phone for free [Viettel Store].

Step 5: Export the video and store

In CapCut, output video quality depends on input video quality and user choice. CapCut allows exporting videos with a maximum quality of 4K. Depending on the purpose of use, users export videos of different qualities. The higher the quality of the video, the more time it takes, the more data it takes to output, and the more storage space it takes.

In this study, we chose to export the video in HD quality so that it can be viewed clearly when viewed on the projection screen, stored on YouTube to ensure longevity, save memory for the device, and easily share.

Finally, check the exported video file according to the criteria and requirements set out initially.

2.4.3. Example illustrating the process of creating a video in teaching the topic of "Chemical composition of cells" in Biology grade 10 according to the 2018 General Education Program

Based on the video design process outlined, we have built 12 videos of practice teaching. An example illustrated in "Experiment to determine the presence of starch in cells" is as follows:

Step 1: Analyze the lesson objectives, and determine the content to build the video

Lesson objectives: Determine the presence of starch in cells.

Content to build video: (1). Objective: Identify the presence of starch in cells; (2) Preparation: (see table 2); (3) Steps to take: (see Table 2); (4) Experiment results: The solution inside the test tube turns blue-black; (5) Interpretation of results: (see Table 2).

Step 2: Build the video script

Table 2. Video Story Scenario

Scenes	**Time**	**Images**	**Sound**	
			Narration	***Soundtrack***
Experiment name	4s	The background is a video of the prepared instruments, and the name of the experiment is red with a white border prominently.	Here is a video about "Experiment to determine the presence of starch in cells"	- Background music is in CapCut's music store. Choose cheerful music, the volume is equal to ¼ of the voiceover volume.
Objectives	4s	The background image is a video of the prepared tools. The word "Objectives" is red with a white border, and the content of the objective is black with a white border.	The objective is to "identify the presence of starch in the cell"	
Preparation	40s	Image of all prepared items in one tray. Then there are the arm segments that lift each object. Subtitle each item.	We need to prepare tools, chemicals, samples + About tools: 1 test tube, 1 dropper, 1 mortar and pestle, 1 razor + About chemicals: 1 bottle of Lugol reagent, 1 bottle of distilled water + About the specimen: 1 piece of raw potato	
Steps to conduct	1 minute 10s	Step by step Subtitles step-by-step	The steps to experiment are as follows: Step 1: Cut the potatoes into small cubes and put them in a porcelain mortar. Step 2: Add distilled water to the mortar, and pound the potatoes. Step 3: Aspirate the potato juice and put it in a test tube. Step 4: Add a few drops of Lugol reagent to the test tube and shake gently.	
Result	10s	The phenomenon occurs Result subtitles	The solution inside the test tube turns blue-black	
Explain	15s	Subtitles explaining the results	Lugol is a solution containing I_2 and KI. When a solution of iodine is mixed with starch, iodine will enter the amylose helix of starch to form a blue-black complex.	

Step 3: Record

- Recording object: The process of conducting experiments
- Recording location: In this study, the filming location is at laboratories in the Faculty of Biology, Hanoi National University of Education.
- Recording equipment: GoPro Black Hero 9 camera (with camera tripod).
- Proceed to find samples and take pictures according to the requirements of the script.

Step 4: Technically process video with computer software

Use the CapCut app on the phone.

Step 5: Export the video and store

Export HD-quality video and upload to YouTube for storage

Construction results of video of "Experiment to determine the presence of starch in cells".

Table 3. Some photos were taken from the video

Experiment name		Result	
Preparation		Explanation	
Steps to conduct			

List of videos that have been built into the topic

In this study, we have built 12 videos that cover the practical lessons of *Cell Biology* (Biology 10).

Video name	QR Code	Video name	QR Code
Determine the presence of glucose in the cell		Selective prime competency of living cell plasma membranes	
Determine the presence of starch in the cell		Testing starch hydrolysis activity of amylase	
Determine the presence of proteins in the cell		Effect of pH on amylase activity	
Observe prokaryotic cells		Effect of temperature on catalase enzyme activity	
Observe animal cells (oral mucosal cells)		Observe the root specimen of the onion root	
Observe the phenomenon of protoplasmic contraction and anti-contraction in plant cells		Observe meiosis on locust testis specimens	

2.5. Using videos of teaching practice lessons

Videos of teaching practice lessons are built to be used to teach new lessons, to teach review lessons, to consolidate knowledge and skills, and also to be used to develop and assess students' experimental competency.

When using videos to form new knowledge, it is possible to use videos before learning new lessons. By observing, answering questions, and conducting practical activities based on videos, students can learn new knowledge.

When using videos to consolidate knowledge, after teaching a new lesson, teachers instruct students to watch the video and answer questions.

When using videos to develop or assess experimental competency, students can be asked to observe each part of the video, answer questions, and conduct experiments. Teachers evaluate students through evaluation criteria of experimental competency.

Within the scope of this research, the main purpose of the topic is to build and use videos to teach new lessons and develop experimental competency for students. Therefore, the steps of the process of using video will be designed in this direction.

2.5.1. Using videos of teaching practical lessons to guide students in performing experiments

Purpose: students can conduct experiments, compare results, answer questions, and contribute to developing experimental competency for students.

Step 1: Set the problem: The teacher poses a problematic situation related to the experiment, the problem posed must be solved through the experiment; Suggested questions can be given to help students think to raise questions about the content of experiments. Teachers need to help students come up with testable scientific hypotheses to solve problems.

Step 2: Guide students to design an experiment to test the hypothesis: The teacher assigns tasks to students/groups of students to design an experiment to test the hypothesis.

Teachers can use the *Worksheet* to collect results with the following questions: 1. What is the name and objective of the experiment? 2. What samples and chemicals should be used in the experiment? Why use them? 3. What steps does the experiment include? Explain each step. 4. Predict experimental results

Step 3: Ask students to watch the video from the beginning to the end of the experiment steps: The teacher shows the video, asks students to watch the video and note the steps, explains each step; and then asks some students to present it orally. Teachers can ask more questions to emphasize the role and techniques of each step.

Step 4: Ask students to perform experiments according to instructions: Teachers ask students to perform experiments, using tools, chemicals, and samples. Depending on specific conditions, teachers can ask students to work individually or in groups. Teachers observe and support students if necessary. Ask students to record changes during the experiment and the results of the experiment.

Step 5: Ask to report the experiment results: Students report the results and explain the results, compare the results done with the prediction of experimental results in step 2., and explain.

Step 6: Ask students to watch the video of the experiment results: The teacher shows the video of the experimental results and explains; Ask students to compare the results of their experiments, and interpret the results; draw scientific conclusions.

Step 7. Comment, evaluate, and conclude: The teacher asks students to self-assess and peer-assess the experiment's progress. The teacher assesses students' experiment progress and results.

Example 1: Using the video to teach the practical lesson "Experiment to determine the presence of starch inside cells" to guide students to experiment.

Table 4. Operational progress of teachers and students

Teacher's activities	Steps	Students' activities
- Provide suggested questions to help students think to raise questions about the content of experiments. Example: Name foods that contain starch. How can I prove that these foods contain starch? - Students may or may not anticipate needing iodine for starch testing. - Set problem: To test starch, people often use iodine. To know how to do it and the results, we learn through the following video.	*Step 1*: Set the problem	- List the foods that contain starch. - Predict how to prove foods contain starch: Do experiments using different chemicals, e.g. iodine? (hypothesis)
- Ask students to design an experiment to test the hypothesis, do the *Worksheet*	*Step 2*: Guide students to design an experiment to test the hypothesis	- Receive tasks from teachers, do the *Worksheet:* 1. What is the objective of the experiment? 2. What samples and chemicals should be used in the experiment? Why use them? 3. What steps does the experiment include? Explain each step. 4. Predict experimental results
- Show a video from the beginning to the end of the experiment steps, and ask students to watch the video and note the experiment steps, some students present it orally. - Ask some more questions to emphasize the role of important steps and techniques during implementation.	*Step 3:* Ask students to watch the video from the beginning to the end of the experiment steps	- Watch the video, take notes, and answer questions. - Present the experiment steps. Step 1: Cut the potatoes into small cubes and put them in a porcelain mortar. Step 2: Add distilled water to the mortar and pestle, and pound the potatoes. Step 3: Aspirate the potato juice and put it in a test tube. Step 4: Add a few drops of Lugol reagent to the test tube and shake gently.
- Divide students into groups of 4-6 students, and ask students to take sample trays and tools. - Ask students to work in groups to perform experiments according to instructions.	*Step 4*: Aske students to perform experiments according to instructions	- Collect tools, chemicals, and specimens in groups - Perform experiments

- Ask the groups to report their experiment results, comparing them with the predictions made in Step 2 and explaining the results.	*Step 5*: Ask students to report the results of the experiment	- Report the results of the group's experiment, compare the results with the original prediction, and explain the results obtained.
- Show the video of the experiment results and explanation; ask students to watch the video and answer the questions: Compare students' experiment results with the results in the video. Explain and conclude the experiment.	*Step 6*: Ask students to watch the video of the experiment results	- Watch the video, compare the results with the results in the video, and explain. - Conclude experiment.
- Ask students to self-assess and peer-assess about the experimental progress. - Evaluate the process and results of students	*Step 7*: Comment, evaluate and conclude	- Self-assess and peer-assess about experimental progress.

2.5.2. Use videos of practical lessons as a visual teaching media

Purpose: students can observe and answer questions, which contributes to developing experimental competency for students.

In some schools, it is difficult for students to do experiments in the laboratory, teachers can use videos to teach practical lessons as a means of teaching to develop practical competence for students. However, only using video as a visual medium will not train students' skills to perform experiments.

The process of using video includes the following steps:

Step 1: Set the problem (See Step 1 in Process 2.4.1).

Step 2: Guide students to design an experiment to test the hypothesis (See Step 2 in Process 2.4.1).

Step 3: *Ask students to watch the video from the beginning to the end of the experiment steps (See Step 3 in Process 2.4.1).*

Step 4: Ask students to predict the results of the experiment and explain: Ask groups/individuals to predict the result of the experiment and explain why, then share the results prediction of the experiment and explain.

Step 5: Ask students to watch the video about the experiment results: Show a video about the experiment results and explanations, and Ask students to discuss and compare the predictions about the experiment results with the results in the video. Ask students to conclude the experiment.

Step 6: Comment, evaluate, and conclude: The teacher asks students to self-assess and peer-assess about the experiment's progress. The teacher assesses the student's experiment progress and results.

Example 2: *Using video as a visual teaching tool for the lesson "Experiment to determine the presence of starch inside cells".*

Table 5. Operational progress of teachers and students

GVC's activities	Step	HS's activities
- See step 1 in Example 1.	*Step 1:* Set the problem	- Answer the question.
- See step 2 in Example 1.	*Step 2:* Guide students to design an experiment to test the hypothesis	- Receive tasks from teachers.
- See step 3 in Example 1.	*Step 3:* Ask students to watch the video from the beginning to the end of the experiment steps	- Observe, take notes, answer questions in the study sheet, and discuss with friends to agree on the results.
- Divide students into groups of 4-6 students, ask students to predict the results of the experiment, and explain why. - Share the prediction of the results of the experiment and explain.	*Step 4*: Ask students to predict the results of the experiment and explain	- Predict the results of the experiment and explain why. - Share the prediction of the results of the experiment and explain.
- Show the video about the experiment results and explain. - Ask students to discuss and compare the predictions about the experiment results with the results in the video. - Conclude the experiment	*Step 5:* Ask students to watch the video about the results of the experiment	- Watch the video, discuss, compare, and explain - Conclude the experiment: Lugol is a solution containing I_2 and KI. When a solution of iodine is mixed with starch, iodine will enter the amylose helix of starch to form a blue-black complex.
- Ask students to self-assess and peer-assess the experimental progress. - Evaluate the process and results of students	*Step 7*: Comment, evaluate and conclude	- Self-assess and peer-assess experimental progress.

3. Conclusions

Building a video system in teaching in general and teaching practical lessons, in particular, is very necessary for schools. Using practical teaching videos helps teachers guide students to perform experiments easily and also contributes to the development of experimental competency for students. However, the video development needs to be performed following a certain process, especially the teachers need to understand the steps of the experiment as well as to be proficient in experimenting. This study proposed the process of creating a video, building 12 videos of practical teaching on the topic of "Biological cell" (Biology grade 10), and developed 2 processes of using video in teaching. These results contribute to developing students' experimental competency and improve the teaching quality of biological practices.

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