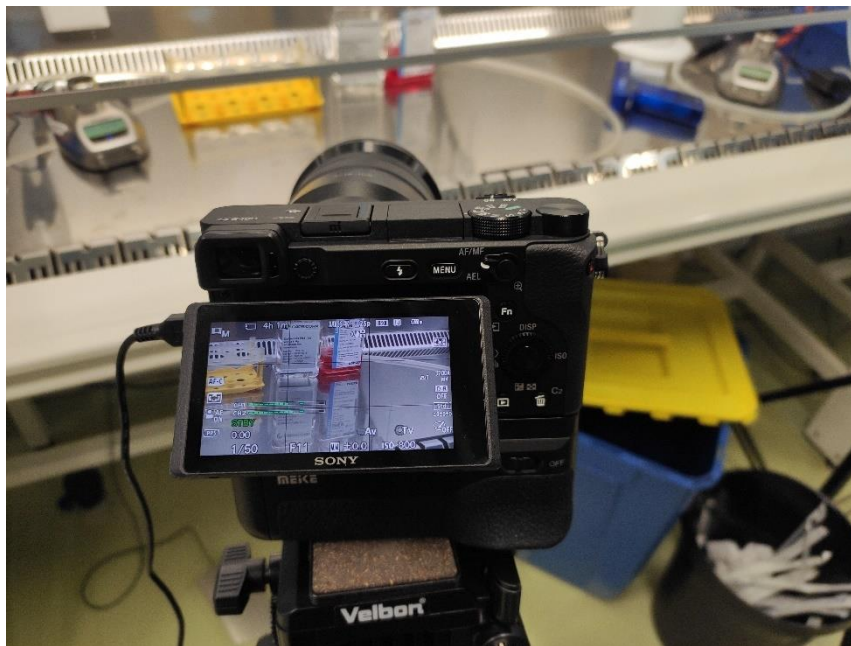


# A guide to making (interactive) videos for laboratory education

Based on SURF project OO20-02 of Leiden University – Interactive video protocols



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## Preface

This guide is designed for everyone who is eager to improve laboratory teaching at universities or universities of applied sciences. We offer you tried and tested support for using and creating interactive videos that can help your students prepare for a laboratory course. Research has shown that students' performance in the lab, knowledge retention, and motivation improves when they use pre-laboratory videos or quizzes. We combined the two and created videos with branching storylines and pop-up questions to improve laboratory preparation at our faculty – labprep interactive videos.

Chapter 1 of this guide explains why interactive videos can be beneficial for your laboratory course and helps you gain insight into the resources that are needed to create them. Chapters 2 through 6 can be used to create your own videos.

All of the videos we have created are available without charge via [www.labprep.video](http://www.labprep.video). Throughout the development, broad user-friendliness was always key – logos, detailed information about protocols or personal characteristics of actors are barely visible. Our videos are suitable for universities and universities of applied sciences, and applicable to all educational levels within them. Use of the videos is free, except for commercial parties. This includes all corresponding materials, such as protocols, scripts, voice-over text and questions.

Did you create (interactive) videos for laboratory education yourself? You can easily share them with the community via [www.labprep.video](http://www.labprep.video)! Contact us via [info@labprep.video](mailto:info@labprep.video) for more information.

*Have fun using interactive videos in your laboratory course!*

## About us

This guide and the corresponding website [www.labprep.video](http://www.labprep.video) is an initiative of enthusiastic lab experts with a shared passion

*Stimulate students to prepare for their lab experience with an engaging digital learning environment*

In 2021, a team of experts set out to develop a series of interactive videos for laboratory education in which conducting experiments is the main focus. The resulting project was sponsored by SURF (OO21-02) and lead by senior teaching fellow Marjo de Graauw.

A team of lecturers and practical coordinators from Leiden University wrote the scripts and provided interactive elements such as pop-up questions with associated feedback; Annelien Zweemer, Linda Holtman, Maayke Ruler, Quirijn Verhoog, Ilze Bot, Tahmina Fariaby, Majlen Dilweg, Daan van der Es, Charlie Clark, and Ischa Bremer. Experienced video-specialist Amber Gerritsen coached and guided them throughout the process.



Amber was also responsible for the multi-camera recordings and the entire post-production. Together with the lecturers and a team of MSc students Bio-Pharmaceutical Sciences\*, she shot more than a hundred experimental actions! The odd humorous break-down of actors or equipment proved a welcome distraction during these long days in the lab.

Ethan Warren and Emily Foster lend their voice to the narration and audio specialist Quirijn Verhoog ([precursor music](#)) edited the voice-over. Quirijn also composed the background music that underscores all videos.

The website [www.labprep.video](http://www.labprep.video) was designed by Koos van der Kolk (Founder of LabBuddy) and Tineke Bijl (Head E-learning at LabBuddy). [LabBuddy](#) provides an e-learning solution for blended laboratory education that is being used by many institutions, including Leiden University. The development team worked closely with LabBuddy and created import files to ensure easy access for other users. These offer a quick-start when designing similar LabBuddy modules.

\* MSc Bio-Pharmaceutical Sciences students Jeremy Broekhuis, Kim Elbertse, Kim Kroese, Rick Kusters, Lara van Meurs, Joep Snoeck, Nienke Vreman.

## Table of Contents

Preface .....	1
About us .....	2
1. Orientation.....	4
1.1 Why use video in laboratory education? .....	4
1.2 What is an interactive video? .....	5
1.3 Which interactive videos are suitable for laboratory education? .....	5
1.4 Which types of video can be applied for laboratory education?.....	7
1.5 Which databases contain videos for laboratory education? .....	8
1.6 Which resources are needed to create your own (interactive) videos?.....	9
2. Preparation .....	11
2.1 Review your laboratory course .....	11
2.2 Define (pre-liminary) learning objectives per video .....	11
2.3 Brainstorm about scenes, questions and scenarios.....	11
2.4 Decide how your video can be reused.....	12
3. Writing a video script.....	13
3.1 General information.....	13
3.2 Linear script information .....	14
3.3 Non-linear script information .....	15
4. Filming.....	17
4.1 Prepare for filming .....	17
4.2 Set-up film location.....	18
4.2 Filming the experiment.....	19
4.3 After filming .....	23
5. Voice-over .....	24
6. Editing .....	26
6.1 Software.....	26
6.2 Our workflow .....	27
6.3 Using text in your video .....	28
6.4 Rendering your video.....	28
6.5 Making your video interactive with H5P.....	30

## 1. Orientation

The first step in implementing (interactive) videos in your laboratory course and/or making these videos yourself is deciding

- 1) whether (interactive) videos would actually solve your current educational need,
- 2) whether you can find (interactive) videos that are suitable for your course, and
- 3) whether you have the right resources to make (interactive) videos yourself.

The information below will help you in your orientation process and enables you to decide whether (interactive) video would be beneficial for your laboratory education and where you can find suitable videos. If you decide to make your own (interactive) videos, you can use the chapters 2 – 4 to prepare, script, film, edit the videos you would like to make.

### 1.1 Why use video in laboratory education?

Different studies have shown that pre-laboratory videos help students prepare more effectively <sup>a.o.1-4</sup>. The use of such videos has a positive impact on student performance, preparation, and experience in the laboratory. Video makes it possible to visualize experimental procedures and techniques, which students would usually only experience through live demonstration on the laboratory day itself. However, live demonstration often takes a lot of time and students tend to forget details.

Many experimental techniques performed in the lab are very suitable to demonstrate via video. Watching a video before entering the lab **prepares students better** for what is to come and **video allows self-pacing**. Students can watch the material at their own pace in their own time. Students can control the playback speed, watch when it's convenient for them and rewatch when certain parts are unclear.

**In our project**, BSc-2 Bio-Pharmaceutical Sciences students confirmed that they find watching videos to prepare for lab experiments very pleasant. The videos greatly enhanced their basic knowledge of the essential steps in an experiment and the students were able to perform the planned experiments more independently and motivated. An increased number of students was able to troubleshoot without continuously asking questions to the supervisors. Questions asked were much more elaborate than in previous years. Overall, the time spend in the laboratory is much more efficient. The time we used to spend on demonstrating a technique and answering low-level practical questions like 'where can I find....' is now used for team discussions about research theory and the interpretation of results. Moreover, students more often obtain results they could actually report about, allowing them to train their writing skills with more motivation.

1. Cook MP. Visual representations in science education: the influence of prior knowledge and cognitive load theory on instructional design principles. *Sci Educ.* 2006;90(6):1073–91.
2. Lhuisset, L., Margnes, E. The influence of live- vs. videomodel presentation on the early acquisition of a new complex coordination. *Phys Educ Sport Pedagog.* 2015; 20, 490–502.
3. Jolley DF, Wilson SR, Kelso C, O'Brien G, Mason CE. Analytical thinking, analytical action: using Prelab video demonstrations and e-quizzes to improve undergraduate preparedness for analytical chemistry practical classes. *J Chem Educ.* 2016;93 (11):1855–62.
4. Stieff M, Werner SM, Fink B, Meador D. Online prelaboratory videos improve student performance in the general chemistry laboratory. *J Chem Educ.* 2018;95(8):1260–6.

## 1.2 What is an interactive video?

An interactive video is a type of video that allows the user to more actively engage with the content they see. Such videos contain clickable elements that, for example, prompt the viewer to think about the content or even take the viewer to another part in the video, so called branching storylines. Studies in which laboratory instructors have utilized a combination of pre-laboratory videos and online quizzes show that this method is more effective for preparing students for the laboratory<sup>5-6</sup>. Thus far, interactive videos, in which quizzes and other elements are embedded in a video, have hardly been used in laboratory education. Only few studies show that interactive videos helped to **increase student confidence in the laboratory, decrease student anxiety and increase preparedness**<sup>7-8</sup>.

**In our project**, we evaluated the perception of students on the use of interactive video to prepare for laboratory education. In three BSc-2 laboratory courses > **85% of the students** indicated that they **preferred interactive video** over non-interactive video. Students indicated;

- The interaction helped us to check whether we mastered the material and the protocol.
- The choices and questions triggered us to watch the videos more attentively, and thereby automatically also to better understand the content of the video.
- The branching storylines (see below) allowed us to see how an experiment could go wrong, which helped us during the lab-day.

Students that preferred non-interactive video indicated that they experienced technical failure too often and some indicated that they became confused by videos offering different scenarios.

Technical failures were overcome in follow-up courses, but any digital form of education will depend on good quality techniques and/or Wi-Fi. In the design of our videos we now always show the right way of performing an experiment, also after having discussed or show the wrong way of performing an experiment. This reduced the level of confusion amongst some students.

5. Wong A, Leahy W, Marcus N, Sweller J. Cognitive load theory, the transient information effect and e-learning. *Learn Instr.* 2012;22(6):449–57.
6. Seery MK, O'Connor C. E-learning and blended learning in chemistry education. *Chemistry education*. Hoboken, NJ: John Wiley & Sons, Ltd; 2015. p. 651–70.
7. Clemons TD, Fouché L, Rummey C, Lopez RE, Spagnoli D. Introducing the first year laboratory to undergraduate chemistry students with an interactive 360\_ experience. *J. Chem. Educ.* 2019, 96, 7, 1491–1496
8. Shelby SJ, Fralish ZD. Using Edpuzzle to improve student experience and performance in the biochemistry laboratory. *Biochem Mol Biol Educ.* 2021;49:529–534

## 1.3 Which interactive videos are suitable for laboratory education?

In general, there are many ways to make a video interactive. **In our project**, we chose to use **pop-up questions with feedback** and/or **branching storylines**. The pop-up questions allowed us to prompt students to think about the different steps an experimental technique/workflow consists of. The branching storylines were used to let students think about the different scenarios that can take place while conducting an experiment. A key element to making videos even more engaging is **humor**. Humor is especially of added value when combined with branching storylines where students can see good or bad experimental outcomes.

### *Pop-up questions with feedback*

By adding a pop-up question to your video, you stop the viewer to let them think about the content of the video. The student answers the question, and then continues watching the video. Adding such pop-up question to a video is a very powerful way to engage students and help them stay focused on the content of the video. Haagsman *et. al.*<sup>9</sup> showed that adding pop-up questions to laboratory videos significantly improved retention and engagement. Noticeably the content of the question didn't prove relevant to what the students remembered. Just the act of adding questions seemed to boost the focus and engagement of the students and the amount of information they retained.

Pop-up questions can either be designed as **pre-questions** that preview upcoming video content or as **post-questions** that review previous video content. Haagsman *et. al.*<sup>9</sup> showed that both types of pop-up questions have similar effects on student learning, engagement and retention. Yet, asking a question prior to providing the information (a pre-question) caused a certain level of anxiety in students, since they didn't have the required information beforehand.

**In our project, we mainly included post-questions** in our interactive videos to prevent an increase in anxiety. All our questions were framed as multiple choices and allowed students to gain **immediate feedback**. The questions were based on experiences of previous years.

9. Haagsman. Trends in Biology Higher Education - A journey from interactive videos to pre-labs to rubrics. Proefschrift. ISBN: 978-94-6416-708-5.

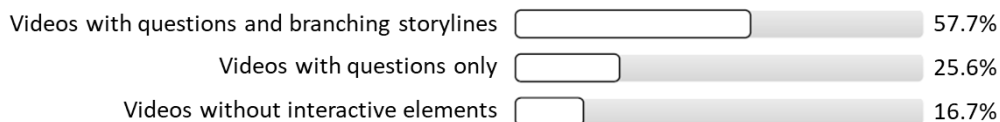
### *Branching storylines to practice experiments*

A video with branching storylines is a type of interactive video where the **viewer is able to create their own storyline**. The viewer can choose between different actions and after choosing, the video proceeds with a corresponding storyline (a certain scenario). Such interactive video is ideal for practicing experimental procedures/techniques. You can simulate a real-life lab experience, where students can experience how their selected action effects the outcome of an experiment. The level of engagement is high when using branching storylines. **Prior to entering the laboratory students can practice their experiment** (if need multiple times), make mistakes, and retry the experiment to obtain the best results without consequences for the actual, often expensive, materials and equipment. Aside from triggering the analysis skills of your students, this format can also be a lot of fun to engage with, since it creates a feeling of agency and gamification. By **including humor** in the different experimental scenarios students seem **to memorize an experimental workflow better**.

Creating such videos is, however, complex and takes quite a lot of time, since you have to think about and film different scenarios with different experimental outcomes. Yet, if executed correctly, you can use the video for many years and prepare your students very well. The interactive moments provide your students the opportunity to assess the situation of an experiment and evaluate the effect of their choices. This is something that is often not possible within the laboratory due to limitations in time, materials and equipment.

**In our project**, most of our BSc-2 Bio-Pharmaceutical Sciences students valued interactive videos with pop-up questions and branching storylines (57.7%) more than videos which contained only pop-up questions (25.6%). Only 16.7% valued videos without any interaction.

**Which video did you prefer most to prepare yourself for the laboratory (n=215)**



### *Outside-video questions*

Instead of adding questions to the video itself, questions could be addressed after having watched the video. This is a suitable option in case you do not have the software / time to create in-video pop-up questions. Such questions could be added in the learning management system (LMS) you're using for your course.

## 1.4 Which types of video can be applied for laboratory education?

There are different types of video that can be used for laboratory education; introduction, instruction, practice. Which one you choose depends on a number of things, like the set-up of your laboratory course, your needs for improvement, the learning objectives you defined, and your target audience (the level of difficulty needed). **In our project**, introduction is often combined with instruction.

Below the three video types we applied in our project are listed. You can select the ones that would apply to your course and educational needs.

### *Introduction video*

Introduction videos are used to introduce the materials and techniques that the students will be using in the laboratory. They allow students to **recognize** techniques and methods faster to gain e.g. a better overview of an experimental workflow. The video explains a method or technique very general. This video type is usually fairly short, does not show all the actions in detail and does not explain all the underlying theories. Often an introduction video **does not need interactive elements** since students don't need to understand, but only recognize and remember (**Blooms Taxonomy level 1**). We often used **animations** to visualize processes that cannot easily be recorded. See 'animated video'.

### *Instruction video*

Instruction videos are tutorial videos, demonstrating specifics of a method, technique or experimental workflow, in order for students to apply them more efficiently. They allow students to understand how certain steps work and are put into practice. Instruction videos could for example be visualisations of a laboratory protocol in which you highlight all the steps involved and all the materials needed to perform a specific experiment. To better **understand** the content and be able to **apply** the information (**Bloom's Taxonomy level 2-3**), you can **use pop-up questions**. In addition you can add bookmarks so students can easily rewatch specific parts, while perform an experiment.



### *Practice video*

Practice videos are videos which students can use to practice certain parts of an experimental workflow before entering the laboratory. Typically in these videos the analytical capabilities of the students are triggered. Practice videos are **always interactive videos with branching storylines and reflective pop-up questions**. They contain different scenarios for both good and bad ways of performing an experiment, which students can choose from. This way students can get a feeling for performing an experiment, without actually performing it yet. They can safely see what consequences a certain action has on the experiment and learn from their mistakes, which should prepare them to better **analyze, interpret** and **evaluate** their decisions in the laboratory (**Bloom's Taxonomy level 3-5**).

### *Animated video*

Animations are very suitable for introduction videos or a brief introduction as starting point in an instruction or practice video. This way you can use animation to explain the theory behind an experiment, which is often difficult to show using a live view. In addition, animation can be a very nice way to **show specific procedures in an experimental workflow**, for example when you want to show the inner workings of a machine, which cannot be seen by the naked eye.

Animation is not the easiest format to work with. If you would like to include it in your videos, see if there's anyone with experience in your own video department or if there are any tools available to make this process easier. You can always use PowerPoint to make a simple animation if there are no official tools available at your institution. Click [here](#) if you want to watch a pretty in depth PowerPoint animation tutorial. Animating can take quite some time, keep this in mind when you want to use it in your video. You can also consider looking if an animation of sorts already exists and embed it as a separate video in your course or using it in the video with credits if it falls under creative commons. **In our project**, we used BioRender (<https://biorender.com/>) to create animations.

## 1.5 Which databases contain videos for laboratory education?

Today, there are many different resources for video. Before delving into the video making process, we recommend you to review the sources mentioned below. Searching for existing material can also help getting an idea of what type of videos you like and don't like and what you would like to do differently if you would have the right resources to generate your own videos.

### *JoVe Scientific video journal*

The Journal of Visualized Experiments, JoVE (<https://www.jove.com/>), publishes peer-reviewed scientific video protocols to accelerate biological, medical, chemical and physical research. The journal currently has different sections: Biology, Developmental Biology, Neuroscience, Immunology and Infection, Medicine, Bioengineering, Engineering, Chemistry, Behavior, Environment, Biochemistry, Cancer Research, and Genetics. A subscription is needed. You can check with the librarians in your institute whether such subscription is available.

### *Edusources*

Edusources (<https://edusources.nl/>) offers a varied range of learning materials all in one place. It is offered by SURF, the collaborative organisation for ICT in Dutch education and research that also sponsored our project and labprep.video website.

### *Labprep.video*

In our project, we developed a website in which we share the (interactive) videos that we developed. All videos and corresponding script files, protocols, and questions are freely available via <https://www.labprep.video/>

### *YouTube*

On YouTube (<https://www.youtube.com/>) you can search for videos that would be applicable for your course. You can share videos with your students by embedding links in your course, or download and use creative commons videos, which you can find by using the filter functionality 'Creative Commons'.

## 1.6 Which resources are needed to create your own (interactive) videos?

You can't create your own video without the right resources. What you need, depends on the type and amount of videos you would like to make. We have collected some pointers to take into account before deciding on making your own videos;

### *Manpower*

In principle, everyone can make a video! Yet, not everyone is able to create a professional, multi-camera video with pop-up questions and branching storylines, like we did in our SURF project. Before you decide to create your own (interactive) videos, it is important to consider what level of expertise is needed and who is already available at your institute/faculty. For each video we created, we used a team of 1 video-specialist (for recording and coaching), 2 student-assistants (for student perspective during scripting, performing experiments during filming and keeping track of voice-over and film shots on the day of filming), 1 technician (for expert insight during scripting and preparation of the film-set) and 1 laboratory teacher (for expert insight during scripting).

### *Equipment*

When filming you are going to need equipment to film with. Consider what you already have at your disposal and whether there are possibilities to invest in equipment (buy or hire). If you have a fixed list of materials, it is important to keep in mind what the possibilities are with the cameras and/or tripods before your start writing the script(s) for your video(s). [This overview](#) shows the equipment we used.

### *Video tools and platforms*

There's no use in creating a video if you can't share it with your audience. Therefore it is important to find out how you can share your video(s) and embed them into your course learning environment. Both will influence how you should record your videos and what options for student engagement you can choose from. [This overview](#) shows the most important questions to consider. If you are not sure about the answers, we advise you to contact your local ICT or other relevant department to find out what options you have.

### *Budget*

If you do not have an internal team and the right resources available to create videos for your laboratory course you need an external budget. Based on the resource descriptions above, you will hopefully have a good insight into the manpower, equipment, video tools you would need for your project. To help you in defining a budget for your project we created [this budget overview](#), which you can use to calculate how much you would need for a certain amount of videos. Keep in mind, if you prepare well, you can use the videos, licence free, for many years to come and many courses, and internship settings within your own study program and that of others. How much time would you save in explaining a technique / method over and over again? And how much budget would you save in this way? Probably enough to finance your video making project!

## 2. Preparation

When you decide to create your own (interactive) videos, you first need to prepare the production of your videos. The steps below are meant to help you create a video suitable for your course content and educational needs. The steps will prevent you from ending up with an unscripted video that doesn't support your students.

### 2.1 Review your laboratory course

Review your laboratory course to think about the improvements you would want to see by using (interactive) videos. The questions below might help you.

- What questions do you / your student-assistants get every year from the students when they work in the lab? Would a video prevent students from asking these questions?
- What experimental actions should your students go through beforehand to better understand the techniques / experimental workflow they will be using in the laboratory? Would they need an animated introduction video, an interactive instruction video with pop-up questions, or a practice video with different scenarios?
- Are there methods that students cannot see well (e.g. inside a device) that are important to understand?
- Are there experimental actions that you / your student-assistants execute e.g. due to time or budget constraints? Would it help your students to see these actions?
- At what moment in your course would a video of added value?
- Are there any other improvements you would like to make, for which (interactive) video is of added value.

### 2.2 Define (pre-liminary) learning objectives per video

Before working out the details of the content of your (interactive) videos and scripting your video it is important to design a set of learning objectives. What is the purpose of the video and should be the learning outcome for your students after having watched the video? Depending on your learning objective(s) you can choose a video type (see 1.3), and determine which element for interaction you would like to use (see 1.2).

### 2.3 Brainstorm about scenes, questions and scenarios

Before writing the storyline (script) for your video (chapter 3), it helps when you brainstorm about the different topics and scenes that should be included in the video. The basis for this brainstorm are the answers you gave to the questions in 2.1 and the video type and level of interaction you selected.

1. Decide which steps of a certain technique, method or experimental workflow you want to visualize. Which actions should your students see, while watching the video? Do not yet discuss different scenarios with good / bad experimental outcomes.

2. Per action, write down / draw the different scenes you would like to film, describe the video shots and/or experimental views.
3. Mark which of these scenes could best be animated (p. 8).
4. Prioritize scenes and/or group scenes based on the video duration you want to use. In terms of student engagement the maximum duration of a video should be between **6-9 minutes** and the best time is around **3 minutes**. Often you can split one technique or experimental workflow in two or three parts to make sure your video is not too long.
5. Optional - when you want to create a practice video, you need to think about the different scenarios that could take place when using the technique or conducting an experiment. To note down these scenarios it helps to brainstorm about the things you see going wrong in the laboratory each year. Keep in mind that humor helps students to memorize (p. 7). For practice videos it is quite normal when the video exceeds the 6-9 minute, because of the branching storylines. This should not pose a problem as long as it doesn't take the students much longer than 6-9 minutes to finish the video.

After brainstorming you might realize that you should adapt your learning objective or video type. Do so before writing your script!

#### 2.4 Decide how your video can be reused.

When creating your own video it is important to think about the reusability. It would be great if not only you, but also others could make use of the material you created. The more people do this, the less you have to invest in creating your own videos. When taking reusability into account there are a couple of things to pay attention to:

- **Don't show your face in the videos.** This allows others to use the video for their course. Focus on the hands instead.
- **Prevent using logos of your institution.**
- **Caption and subtitle the videos.** This makes the videos more accessible both for non-native speakers and people with hearing disabilities. This also allows people to watch the videos without audio.
- **Don't make the videos too protocol or institution specific.** Make sure that there are no numbers mentioned that are only specific to your protocol. Refer to these parts as "as written in your protocol". If there are parts you want to include about the workings in your own institution, make sure to add this as a separate item, so it can be easily cut-off or modified by others who use your videos. It is also helpful to make a disclaimer at the beginning of the video for students to have a look at their own protocol.

### 3. Writing a video script

Now that you've prepared and thought about the most important aspects of creating a video, you can continue by writing one or more video scripts. We have created a template file, which you can use to write a script. This can also be used to create a text for voice-over (chapter 5).

[Download the template file](#) to start writing your own script! Use the additional instruction on page 14

Our script template file can be used to write a **linear script** or a **non-linear script**. In the script template file we provide two examples that can be used to write your own script. The linear script is for introduction and instruction videos that **won't include branching storylines** and non-linear script is for practice videos that **will include branching storylines**.

Before filling out the script template file you need to consider;

- 1) **Which equipment you have available.** If you have a fixed set of materials at your disposal, it is important to keep in mind what the possibilities are with the cameras and/or tripods while writing your script(s). In 1.5 you can download an overview of the equipment we used.
- 2) **Which language you will use.** It is important to write the script(s) in the same language as the video(s) you would like to make. This will save you a lot of time, since the length of the video fragments that you will use for editing will automatically correspond to the subtitles, captioning, and/or voice-over text you would (potentially) like to apply.

#### 3.1 General information

Under *general information* you can write down information that can be used by the video specialist / editor. The information can later on also be used to categorize your videos or better understand your script when sharing your script file with others. Open the script file and fill out;

- **Learning objective** - Instruction, introduction or practice
- **Audience** - First year students, second year students, third year students, master students or other
- **Content** - What do you want to show in your video.
- **Location(s)** - What locations will be used to perform the experiment? (E.g. fume hood, workbench)
- **Example videos** – Examples will help a video specialist / editor to better understand what you have in mind. Note down some example videos that will help you / your editor.
- **Activation** - How do you want to activate your students? > Pop-up questions, branching storylines or interactive images (or combination)
- **Voice-over** – Note down whether you want to use voice-over.
- **Reusability** – Note down if you want your videos to be reused by others.
- **Video duration** - Fill in out the preferred length of your video.
- **Film duration** - How much time do you expect to be filming?
- **H5P** - Does the video need to be edited in H5P?

### 3.2 Linear script information

To create an introduction or instruction video you need to write a linear script. Open the linear script tab and fill out the information below;

#### *Number of steps (video fragments)*

Note down how many steps will be included. To determine the number, you can for example divide your video content into the different steps needed to perform and experiment. Dividing a video into different fragments helps you to shoot the video more efficiently, since you can focus and, if needed, redo a single step. It also helps to edit the movie faster and reuse different fragments for different scenarios or videos.

#### *Description activity*

Describe what it is you are going to perform in per fragment. For example, pipetting a mastermix, selecting the right gloves, etc.

#### *Script and voice-over text*

Write down which information you want to share with your students, either in a textual matter, via voice-over or both. Be sure that there's no spelling mistakes if you want to use this for captions and other forms of text! **Also stay clear of using exact volumes in case you want to switch up the protocol or share your videos with others. Mention a disclaimer at the beginning of the video to follow the volumes as indicated in the protocol.**

#### *Materials necessary*

Write down all the materials you are going to need for this specific shot and make sure everything is in place before filming.

#### *Preparation activities*

Think about the samples etc. you need to prepare before the day that you will be filming. Always make sure to prepare some extra in case the shot or experiment fails the first (few) times!

#### *Preparation time*

Write down how much time it is going to take to prepare the samples and start on time if they have to stay overnight or if you want to start filming in the morning.

#### *Filming order and location*

Write down where you plan to film the different video fragments. You can then reorder your script by clicking the dropdown arrow next to the title. It will give you the option to sort A to Z to order the shots you planned on location. This can be very helpful if you have to switch between e.g. a fume hood and workbench during an experiment. If you don't film per location, but rather the order of the experiment, you risk having to set up your cameras in different positions over and over again.

#### *Type of shot*

Describe what you want to film and/or animate. It is important to keep in mind which cameras and equipment you have at your disposal. For example if you want to show what materials are to be used in the experiment, you need to be able to take an overview shot from above and will need a tripod that is high enough. If you want to visualize the content of a small tube, you need to be able to film a close-up.

If you want to film in a fume hood, you may need a GoPro camera which you can attach to the glass window. Switching camera angles during one shot (e.g. overview to close-up) makes your video more dynamic and engaging, but you need more camera's to prevent having to exchange camera stands all the time. Your description of the type of shot that is needed, will allow a fast preparation on the set and film day.

#### *Film notes during filming*

Here you write down the shot numbers during filming. This will help you or your editor to match the correct shots with the correct video fragments.

#### *Pop-up questions (optional)*

Here you can note down the pop-up question(s) you want to ask per video fragment. There doesn't have to be a question for each fragment as this could also interrupt the flow of the video. Think about what your learning objective is and which questions are best to achieve this. Remember that even if the questions aren't that 'useful' in terms of content, a pop-up question of itself is a great way to boost engagement and retention! Also take into account how long your video is and how many questions you want to add in that duration. Ten questions in a one minute video is probably too much, while one question in a 9 minute video is not probably enough.

### 3.3 Non-linear script information

The non-linear script tab is specifically designed **for those videos where you want to include branching storylines**, like a practice video. In basis you fill out the same information as you would do for a linear video. Yet in this case you will add additional steps for which you describe each scenario you would like to include in your video. To do so you need to consider how many scenarios per moment of choice there will be. When will the student be able to choose a different ending of an experimental step? How many choices (branching storylines) will the student be offered? The more moments of choice within a video, the more complicated the editing and recording of the video will become. Especially if you also have different moments of choice within each branching storyline. It could help to draw a decision tree to get an image of how many different video fragments you have to record.

In addition to the extra video fragments you will add in a non-linear script, you also need to fill out information in the 'redirect' column.

#### *Redirect*

At some point in a practice video with branching storylines you have to redirect the students. For example if the student made the wrong choice and viewed the corresponding video fragment, the student should be redirected towards the moment of choice, to be able to retry and select another scenario. Write down to which point in the video the student should be redirected.

#### *Pop-up questions*

Here you can note down the pop-up question(s) you want to ask for the different branching storylines.



*Tips to make an effective branching storyline video*

- **Don't make your video over complicated.** You can go very deep with a decision tree, stacking mistake on mistake on mistake, leading to all kinds of different outcomes. Try to limit stacking mistakes on top of each other. When the student chooses a wrong option, immediately direct them to a visual presentation of the end result. This ensures that students see the result and hopefully understand where they went wrong, without you having to record 20 different outcomes and the student getting frustrated because they can't figure out where they went wrong.
- **Showing the wrong answer regardless of the option the student chooses.** Showing certain (common) mistakes can help students recognize and deal with the mistake in the lab. Students remember best if you show the mistake in a very overexaggerated way and ask the student if they can continue this way or not. This both adds a bit of humor to the video and ensures that the students understand that this is not the way to perform certain actions.
- **Beware of the confusion that showing wrong answers can provide.** Sometimes showing a wrong option could be very confusing to students, especially if it is an action performed in the wrong order. Make sure to properly reflect and trigger the student to always put the experiment together in the correct way before moving on to the next question. Otherwise the student might misremember the incorrect option as being correct. Always make very clear that it is a mistake. Either by really overdoing it or by triggering the students analytical abilities and have them put everything into the right order using e.g. drag and drop.

## 4. Filming

Now that you've prepared everything you can start filming. Below tips and tricks are provided. We also discuss things that we encountered during our shooting days, from camera settings until experimental set-ups.

### 4.1 Prepare for filming

#### *Time estimation*

After filling out the script you can make an indication how much shooting and editing time you are going to need to make the video. To estimate the time you are going to spend filming and editing take these things into account:

- **What kind of set-up do you have?** A multi-angle camera set-up takes more time to prepare, but might save a bit of time while shooting, because you don't need one shot to perfectly cover everything. However, in the editing department, multiple camera angles takes a lot more time to process.
- **How prone are the experimental steps to failure?** Take into account how often you think a certain step has to be shot for it to be recorded properly. Sometimes certain experimental steps can be very precise and multiple takes have to be recorded.
- **How difficult is the shot you're taking?** If there is a lot of movement involved and you are doing a close-up shot, it might take one or two extra shots or some practice time before shooting to track the movement of the person carrying out the experiment.
- **How often does the camera set-up change?** If you have to shoot from multiple angles and locations, it is going to take longer to set up the equipment accordingly. Try shooting all of the shots of one location/angle in a row, to reduce the time spend readjusting the set-up. The provided script template offers the possibility to filter your shots per location.
- **How much experience does the videographer have?** If the person behind the camera is not very experienced it might take longer for a shot to be correct than if you hire a professional. This also influences the post-production. The better the settings of the camera and the more stable the shots are, the less time the editor needs to clean up all the footage.
- **How much experience does the person carrying out the experiment have?** Someone who is inexperienced with the experiment might stumble more during the steps and requires more retakes than someone with a lot of experience in this particular experiment. Practicing the experiments before shooting could help!
- **How much experience does the editor have?** The same goes off course for the person editing the footage. It is important that they know the quickest approach in organizing and editing the material and are experienced with the software their using.
- **Set-up time.** Make sure you take enough time into account for setting up the materials. This usually took us about 1.5-2 hours, especially the first couple of shoots we did.

On average we redid the experimental steps between 2-3 times for a more difficult setting like filming the hands of a researcher performing a very subtle pipetting step. The easier set-ups like filming the workings of a machine or piece of equipment were mostly doable in 1-2 takes. As a rule of thumb, keep in mind that one minute of the final video takes about one hour to edit. Of course this depends on the experience of the editor and quality of the material.

## 4.2 Set-up film location

The setting in which you are filming is very important for the quality of your videos. When selecting a location and your film equipment, you want to keep in mind the following things:

### *Location*

- **Check if the desired location is available.** Make sure the room you want to use is physically available and block it for the filming days.
- **Cleanness.** Is the location you are using and most importantly the background of your shot clean and organized? Make sure to clean the workbenches and tidy up all unnecessary material. This material can be distracting in your video. Of course you don't have to get rid of all the apparatus in the lab, but those piles of pipet tips, cables and other small materials, have to go.
- **Make sure the apparatus you are using are empty and available.** For example, we searched a while for a stove, since the one we wanted to use wasn't empty.

### *Lighting*

- **Be careful with natural light.** Natural light can look very nice, but is also very prone to changes. If the sun gets brighter or you need to shoot a follow-up of your experiment at a later moment in the day, you have to be aware that the natural lighting changes. This can lead to over- or underexposed video shots. It's better to not make yourself too reliant on natural light sources and **use additional or only artificial light**. Unless, of course, you're shooting outside.
- **Prevent backlight.** Backlight makes it very hard to get the proper exposure in your shots. If your background is very bright, it is very hard to get the subject you want to focus on at the right level of brightness. Try avoiding shooting in front of windows or into lamps.
- **Prevent shadows.** The direction of your light source is important, since it influences the formation of shadows. If the light is directly behind the camera person, this can cause their shadow to show up on your video. A wrong direction of light can also cause shadows of the researcher's hands to show up over the tubes you want to bring into focus.
- **Prevent light reflection.** If you use lots of shiny surfaces the direction of the light can aid in making these surfaces even more shiny. Prevent using these kind of surfaces, like glass or plastic see through containers, or if they are absolutely necessary, position your camera or the light source differently to minimize the shine. You can also try to dim the glow of your light source by using soft boxes, or paper towels, but only if it is a led light that doesn't get too hot by covering it up. Also keep in mind that your own reflection can show up on reflective surfaces.

- **Choose the correct artificial light or camera filter.** With artificial light it is important to check the light source and color. Lightning tubes in fume hoods can, for example, cause your video input to flicker. Some lights are very yellowish, giving the entire video a very yellow look. This can be reduced when using the white balance of your camera (see camera settings).

### Equipment

- **Make sure you have all the experimental equipment at hand.** When the film day starts it's great to have all the solutions, tubes and machines primed and ready to go.
- **Prepare a stash of the same kind of materials like tubes and gloves.** Sometimes you have to retake a shot multiple times. You don't want to run out of material!
- **Take the right video equipment with you.** Determine where you are going to be filming and adjust your equipment accordingly. *E.g.* in a fume hood you need a Suction Cup to attach the GoPro to get a shot from above. Don't forget the necessary extension cables and chargers.
- **Charge the equipment beforehand!** You don't want to end up with empty batteries.
- **Always have two batteries available** of which at least one is charged when you start filming.
- **Invest in external chargers,** so you can charge batteries while filming. This is especially important if you use a GoPro in a fume hood, as this prevents it from being charged while filming.
- **Remember to bring a laptop** so you can take the notes directly inside the script.
- **Bring equipment to be able to check your shots.** Either bring a laptop with build-in SD-card reader, take an SD-card reader with you or keep a usb cable that can connect your camera with the laptop. Checking the first couple of shots can really help to make sure everything is in focus.

### Film crew

- In our project, we shot the videos with three to four people; one note taker & script reader, one - two people manning the cameras and one person performing the experiment.

## 4.2 Filming the experiment

### Camera settings

The easiest option is probably filming with **the automatic settings**. However, sometimes these settings won't be good enough and you'll want to switch to manual mode. These are the most important settings:

- **Video format.** If possible film in mp4 format. This format is most widely accepted across different video editing software. If you have the option you can film in 4K or 5K. This allows you to zoom in during post-production, without losing video quality. **In our project,** we used a GoPro that at least supports 5K video, so we could zoom in very far in post-production. We also used camcorders with a zoom function, which also worked really well.
- **The exposure triangle.** When trying to get the best exposure for your video you should use a so called exposure triangle. Most often the automatic settings are sufficient, only read this part if you notice

that the camera doesn't give you the right results! **Take a test shot to check this beforehand.** The three points on the exposure triangle together make or break your exposure. This triangle consists of ISO, aperture and shutter speed. In photography you have a bit more room to play around with the settings per shot, but in video you generally want to keep your settings as similar as possible especially in the shutter speed and aperture department, so most of your brightness will be determined by the ISO.

- **ISO.** Your ISO determines the brightness of the scene. The more ISO you use the brighter the scene will be, but also the more ISO you use the more grain you will have in your shot. Usually with proper light sources, noise won't be a problem. Try preventing over-exposure however. This means that the scene is too bright. Fixing overexposure is generally speaking much harder than fixing underexposure. Try to stay between an ISO of 400-1250, going over isn't that big of a deal unless you really have to go into the 4000-6000 ISO. Keeping your ISO on auto can usually help keeping the correct exposure in your shot. If you want to keep your ISO on manual: beware of fluctuating light sources!
- **Aperture.** Aperture determines the amount of light that enters the lens. With these kind of videos you want a very small aperture (indicated on your camera with the 'f' symbol). The wider the aperture the shallower the depth of field will become and the more of your shot will be out of focus. This is really nice for a cinematic effect and can work great for subject separation, but if you have to pan your camera around a lot it's easier to have a bigger focus area. A smaller aperture means a higher f number in your camera settings. You want as much as possible to be in focus while filming, so try keeping your aperture above 4f. We found f6 to be a nice number to shoot on, but this also depends on your lighting conditions, since a higher f number means less light is entering the lens. Therefore making your scene darker. Most zoom lenses don't go lower than f3.5, unless you bought one specifically for it's low aperture.
- **Shutter speed.** As a rule of thumb you want your shutter speed 2x the speed of your frames per seconds. This causes a natural looking motion blur. Usually this would result in a shutter speed of between 50-60 per seconds, depending on your cameras frames per seconds, which is usually listed behind your file format (e.g. MP4 25p would be MP4 format with 25 frames per second) 25 frames per second is the most common format.
- **White balance.** The white balance determines what color is seen as 'white' in your shot. Changing the balance to match a natural look while filming really helps with color correction in post-production. Try to match your white balance across your cameras, so you won't need to match the color of the shots in post-production.
- **Refresh rate.** Some cameras, like GoPros, have anti-flicker options with different refresh rates. If you happen to see flickering of the light in your camera, this might very well be caused by a wrong refresh rate. Try changing the rate from e.g. 50 to 60 hertz or the other way around.
- **Focus.** While filming you generally want to be using autofocus. Using manual focus can be useful if your camera has trouble staying focused on a specific point that should be in focus at all times, but as soon as you start moving around and want to focus on different focal planes (meaning that you want to focus on objects closer and further away from you that don't stay in the same location depth wise) autofocus can really help you out. Set your camera to continuous autofocus with a wide area for the

best results. In some cameras it's possible to enable a touch functionality, where you can tick on the touchscreen to influence what your camera is focusing on. This can be a big help, when the camera has difficulty identifying the subject to focus on.

- **Possible wireless usages.** For the GoPro it was possible to turn it off and on using a dedicated app on your mobile phone. This was very useful while filming in the fume hood, because we couldn't reach the record button in there. Check how to install the necessary software and if it works on your device.

### *Taking notes*

When shooting your video it is very important to note down for yourself or your editor which shot matches which step in the script. To remember/find the shots during editing calling out the shot number at the beginning of the shot is a great help. If you use a multi-angle camera set-up, clap at the beginning of the shot, so you can easily match your shots using the audio in post-production.

Aside from shot notes, it is also very helpful to note down things you noticed during filming, which might be relevant again while editing. Especially if you work with an external editor, who doesn't know the experiment giving relevant info such as which parts of a shot were useful, which shot they should use for a certain step or which part of a shot are most important, can really help out in the editing process.

### *The practitioner*

As the person carrying out the experiment there are a couple of things to take into account:

- **Do a dry-run of the experiments**, so the practitioner knows what to expect and so does the person behind the camera.
- **Be aware that everything the practitioner does has to be visible**, so also holding tubes should be done in such a way that the camera can see the inside. Sometimes the person performing the experiment has to get their hands or bodies into weird angles to accommodate the camera.
- **Keep your hands in the same position as much as possible.** This makes it a lot easier for the camera person to follow your movements. If you suddenly move up the tube to a higher position, this might lead to jarring camera movements.
- **Make sure that the person carrying out the experiment doesn't get their head in the view.** This might cause some movements to be a bit unnatural.

### *Camera angles*

- **Start the videos with an overview of the required materials**, so students can immediately see what they are going to need at the beginning of the experiment. Even if you prepare the materials yourself and not the students, it can still be useful to show them all they are going to need when the time comes that they are going to have to do it themselves. Make sure to include the overview shot in your script and mention **all** the materials you are going to use. These were the shots we had to redo most often, because something always appeared to be missing when we started editing.

- **Make sure that the film crew is not in view of the secondary or even primary camera!** Especially when you do not have the opportunity to crop the videos afterwards, it is very important to not see any random feet in the shots, since this looks unprofessional and can be distracting.
- **Determine which camera angle you are going to take:**
  - Check what the dominant hand is of the person carrying out the experiment and adjust your angle appropriately.
  - Check if you want additional text to appear next to the person carrying out the experiment in the editing process and leave some room if this is the case.
  - When using multiple cameras: make sure they're both filming the same parts of the workbench/flow cabinet.
  - You can paste some painters tape to mark the location of the tripod and location the practitioner can use on the workbench, so they won't go outside of the overview shot.
  - In our experience an over the shoulder shot positioned a bit from the side was usually the best shot to show the experiment.

#### *Camera handling*

- **Always keep enough distance to your subject.** It's better to zoom in during editing than to have your shot start too close to the subject.
- **Freeze a shot for text written on tubes** to make it **readable** to the viewers. Also if you have specific parts of a substance you want the viewers to see, make sure to **hold it still** for a while in front of the camera. Off course you can always freeze while editing and/or add the text to the video during editing.
- **Don't zoom in and out all the time.** Choose a distance and try to deviate from this distance as little as possible. Zooming in and out can get distracting really easily and often messes with the autofocus of your camera. If you do want to zoom in and out, always have one static shot (like an overview GoPro) you can switch to.
- **Move the camera slowly once your realize that certain things are not visible in your shot.** Ask the practitioner to slow down so you can reset your shot. You can always speed-up the shot while editing.
- **If your camera can't seem to focus on an object while zoomed in, you might be standing too close.** Lenses have a minimum focus distance which should be kept in mind while getting close to an object.
- **Check your focus.** Keep a close eye on whether the camera focuses on the right objects.
- **Check the first couple of shots you take from all cameras,** to determine if they aren't overexposed, in focus, if it's the right angle etc.

#### *During filming*

- **Clap your hands at the beginning of a shot** and shout out the step + shot number so you can easily find and match shots from different camera's while editing.
- **Clean up droplets** of the workbench, if something spilled, to prevent unnecessary reflections.
- **When redoing shots** e.g. when shooting an interactive video or when the shot just didn't work out the first time, **make sure to reset the set.** Meaning that the waste bins should be emptied and the shot should start just the way you shot it the first time. With the interactive videos you sometimes

have to replicate a certain set-up if you film the interactive moments on another day. Always make a screenshot of the set-up so you can rebuild it. Taking a picture of the camera location etc. can also help for future filming days.

- **When on a break don't leave the cameras alone** in the lab to prevent theft.
- **For screen captures use software like OBS.** Always check beforehand if your computer supports this kind of software. Recording the screen often looks really bad on camera.

### 4.3 After filming

After filming you can pack up your materials and start editing, however before you do so it might be nice to take the following things into account:

- **Back-up your notes.** You really do not want to lose your editing notes! It's quite the puzzle to match all the shots in the right order if you do not have your notes.
- **Empty the SD cards immediately after filming and put all the materials in a clear folder structure.** Always back up the material in two locations! So make sure to use an external hard drive and your laptop or two external hard drives. Choose an SSD drive for extra processing power if necessary. This can help speeding up the editing process. For most projects 1-2 TB is more than enough.
- **Recharge your batteries for a next shoot.**



## 5. Voice-over

When making a video we recommend to record the voice-over separately. If you record while filming, you would need a really good microphone, the voice-lines should be well pronounced and when you stumble over a line during filming you have to redo the shot.

You can record a separate voice-over using your script file. There are multiple things to consider when recording a separate voice-over.

### *Preparation*

Write out the voice-over lines in the script and while recording in the lab, read these parts out loud. This helps to determine if the voice-over matches the duration of the shots. By reading it out loud you might discover that you forgot to include certain steps that you are performing or maybe added a little bit too much information.

### *Can I do the voice-over myself?*

You might be wondering if recording the voice-over is something you can do yourself. Take these things in consideration if you don't want to hire someone to read the voice-lines:

- *Can I read well from a script?* You don't want to spend hours cutting out ehms or redo every shot because you keep stumbling over the text. Really ask yourself if you are comfortable and can sound natural whilst reading out loud.
- *Do I have an accent that could be distracting?* If you have a heavy accent both in your native or non-native language it might be a good idea to ask someone who has no accent or a more subtle accent to read the voice-lines.
- *Record yourself.* Are you not sure if your voice is suitable for a voice-over? Write a mini script and record yourself while reading it. Listen back to it or have someone else listen to it, to determine if your voice is suited for voice-over.

### *Audio quality*

Audio quality is very, very important. Listening to bad audio can gravely influence your focus on the video material. When recording a voice-over without professional help make sure:

- *To have good equipment.* Quality is very important, so have a good microphone with build-in noise-reduction is very nice to have. We used the [Renkforce CU-4 USB studio microphone](#) with a simple [microphone stand](#).
- *To be in a quiet environment,* preferably with a low ceiling and carpet, since this reduces echo.
- *To have enough knowledge of the recording software* or have someone help you out. Good free software is [Audacity](#).
- *To keep the right distance to the microphone.* Too close means audio distortion and peaking, causing the audio to be unusable and too far away produces a very hollow sound and can cause background noise to be picked up sooner. Experiment a bit with the setting to find the distance you like and try to keep it constant throughout the recording to prevent differences in volume. Use something like a ruler to keep this as consistent as possible. Also make sure to keep the same volume throughout the takes to prevent them from sounding different.

- *To pay attention to things that could produce background noise*, like ventilation, but also reading your script from paper. The noise paper makes when holding it or flipping pages can be very prominent in a recording.
- *To make a test recording* to test all of the points mentioned above.

#### *Subtitles and in-video text*

An alternative to a voice-over is adding text in post-editing to explain the steps to the students. Text can be a very nice alternative for a voice-over, but should be added with care as to not distract the students from the actions you are showing in the experiment. More about adding text you can find under the 'editing' tab. You can of course also choose for a combination, in which the text highlights the most important aspects that are mentioned in the voice-over. Especially with calculations that can be hard to visualize when only orally communicated.

## 6. Editing

Editing the video may sound very overwhelming when you start out with no previous knowledge of the software or editing in general. Fear not: we have got you covered!

How difficult the editing process is going to be also depends on your set-up. Multiple cameras is a bit harder to edit than just the one.

### 6.1 Software

We used Adobe Premiere Pro 2022 and Davinci Resolve, but there are easier programs out there that can get the job done. There are three options listed below for you to check out.

#### *Basic open source editors*

If you need to use an open source editor [OpenShot](#) and [Shotcut](#) are both great options. There are plenty of tutorials available for both programs, but the University of Leiden already made a basic tutorial on Shotcut: [https://video.leidenuniv.nl/media/t/1\\_ffgwgeki/42960862](https://video.leidenuniv.nl/media/t/1_ffgwgeki/42960862). Beware that it is in Dutch.

#### *Basic paid editor*

[Adobe Premiere Rush](#) is a nice example of a simpler editor that can be used instead of Premiere Pro. If you have a SURFSpot agreement with your institutions, chances are you can get it for very cheap.

#### *Paid advanced editor*

Here we would definitely recommend [Adobe Premiere Pro](#). It also has a really neat feature build in for using multiple camera angles. Even though it is way more advanced than the other software, it is easier than you might expect! We made a tutorial for the workflow we used for editing multi-camera footage. If your institution has a SURFSpot agreement you can get this software cheaper.

Some universities also use **Camtasia**. We didn't use this program, but there are lots of tutorials online and it has some pretty good reviews.

#### *Free advanced editor*

[Davinci Resolve](#) software has a free version that allows you to do almost everything you can do in Premiere Pro as well. Beware that if you are using a GoPro with 5k footage, you need to buy an extra extension to be able to edit it in Davinci on Windows. This extension can be found in the Windows store for 1 euro. It's called "Uitbreidingen voor HEVC video".

Here are some tutorials for each of the above mentioned software. These tutorials also include the basic shortcuts etc. to start editing:

- [Shotcut NL](#), [Shotcut English](#)
- [OpenShot](#)
- [Adobe Premiere Rush](#)
- [Adobe Premiere Pro](#)
- [Camtasia](#)
- [Davinci Resolve](#)

## 6.2 Our workflow

Once you have selected your editor you can start importing your videos into the software and adjusting your workflow.

We adjusted our editing workflow a lot during this project. The flow that we found worked best for our intents and purposes is listed below. This workflow is compatible with Adobe Premiere Pro and to some extent Davinci Resolve.

### *Before importing your files*

Be sure to organize your files. We started by having one big project for all the videos combined, but found that it was much more manageable to separate each video into a different project. Before importing the files into the project, we would rename all the files in a way that corresponded with the steps they were supposed to be used in. E.g. Step 1 – shot 2 – SRB – Zoomlens. This made it much easier to order the files once imported into the project.

### *Folders*

Within this project we would organize all the materials in different bins (folders). One for the GoPro, one for the Zoomlens, one for the biorender files etc. This way it's easy to navigate to the correct file if you need to.

### *Sequence*

Next we would make a sequence with the dimensions of an HD video (1920x1080) and with frames per second that matched with the lowest frames per second that we recorded with. Usually this would be 25 frames per second. If you shot in HD you won't need to change anything about the material. If you shot in 4k or higher, it is advised to right click the footage and select the "fit to frame" option (not to be confused with "scale to frame"). This way all the material will match the frame size of your sequence and you can zoom in, without losing any quality till 100. This is only required in Premiere Pro, since Davinci does this automatically.

### *Building up the video in the timeline*

Every video we made starts with a disclaimer, so students will know not to overlook their own protocol in regard to the video we made. We noticed that this was something that happened often during our first test-runs with the videos. Then we would introduce the title of the video with either an animated picture of the experiment or a particular frame chosen from the video, which matched best with the featured experimental procedure. Next would be a short explanation of what this video would be about and which materials you were going to need for the experiment. This would be displayed via an overview shots in which the materials would light up individually.

Lighting the materials up cost quite some time, but if you're interested:

- First duplicate the track that you want to light up, so make sure there's two tracks above each other of the same video/photo.
- Apply a dark colour grade on the bottom clip (e.g. by lowering the exposure)
- Cut up the top clip in sections that match a possible voice-over calling out the materials
- [Mask out](#) the materials mentioned, in each specific clip on the top track. Tip: if you are using a picture and are used to photoshop or similar tools, it is easier to mask out the items in photoshop

and import them as transparent .png files into your project. These tools are better suited for masking photos.

After the overview shot, the experiment would begin. Align the shots in the correct order on the timeline and match them with your voice-over duration. If some steps take too long, don't be afraid to speed the clips up to 200-300%. Things that are redundant to show can just be left out of the video, like taking of caps of bottles etc.

If you want to add background music, make sure that the music is not too loud, especially when you are using a voice-over. You can use the [“auto ducking”](#) feature in Premiere to automatically lower the volume of your music, while someone is speaking.

The last thing we would do was applying colour grading. This is quite the tricky process, but there are many tutorials online out there that can help you out. The most difficult thing we found was matching the colours of the GoPro footage, with that of our Sony cameras.

### 6.3 Using text in your video

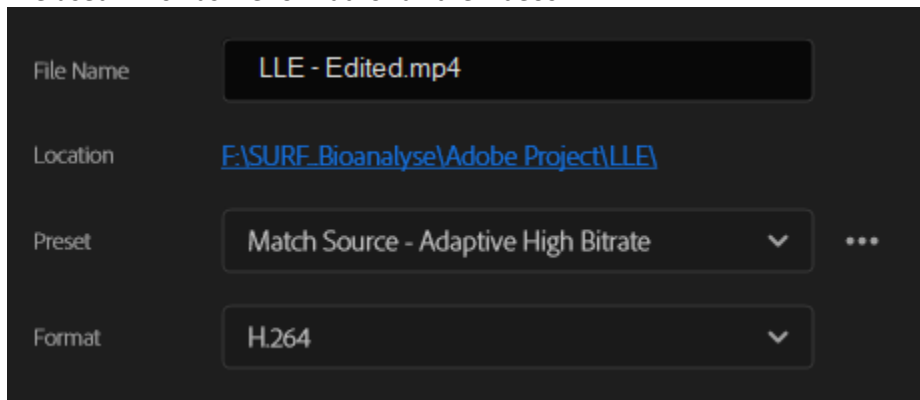
When using text as a means of communication, be sure it isn't distracting the viewer from the actions performed during the experiment. This can be achieved by adding text to repetitive moments in your video that don't add much value by themselves or by freezing the frame when stating instructions about the experiment. Always make sure you don't overlap your text with important movements/actions that take place in the video. Try leaving some space on the side whilst filming and only add very short sentences meant for clarification. If you want to give actual instructions, freezing the frame is the best way to go about it.

Subtitles and captioning are always a nice addition to your videos. Both for people who are hearing impaired or have a hard time understanding a certain language. In YouTube it is fairly easy to add automatic captions and/or subtitles to your videos. Most platforms nowadays have an option for generating subtitles and captioning though, so have a look at what's available at your institution. We would not recommend using subtitles as only means of communication, since this can be distracting from the message of the video.

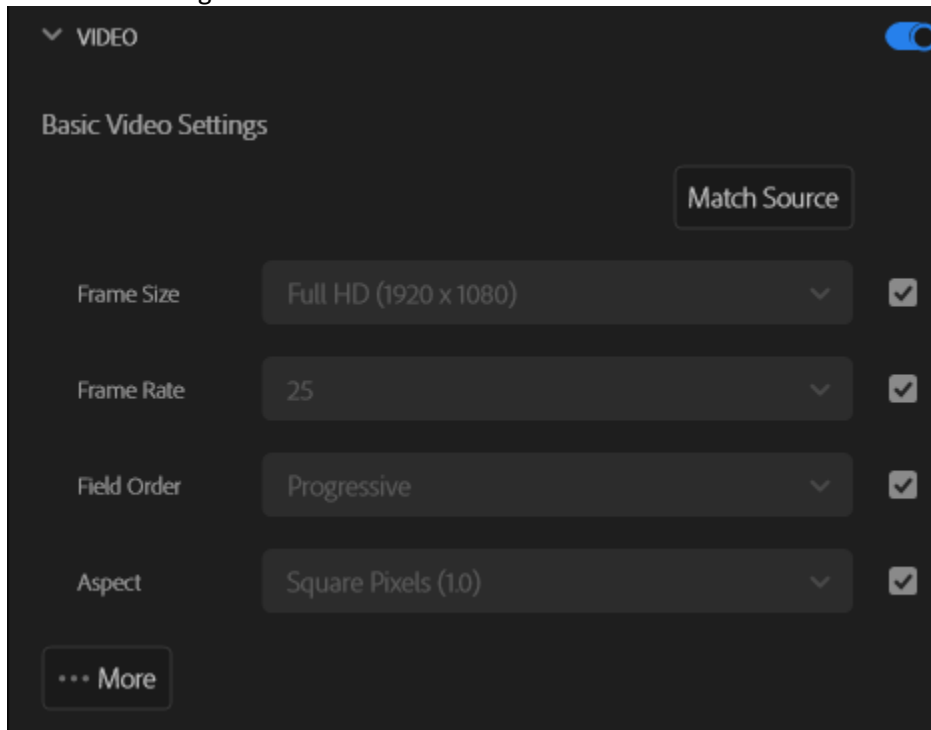
### 6.4 Rendering your video

These were the settings we used to render our videos in Premiere Pro:

We used H.264 as file format for all the videos.

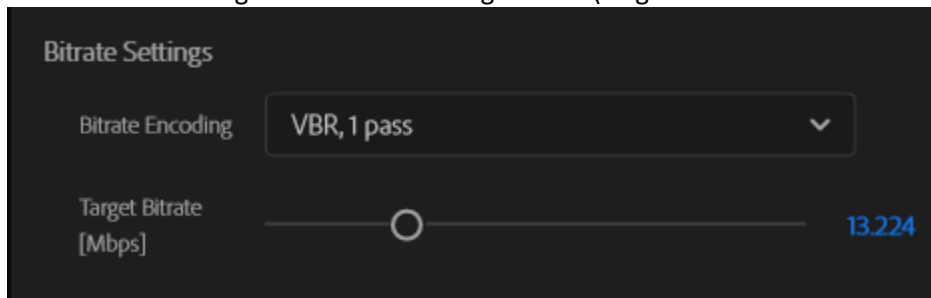


The video settings were as follows:

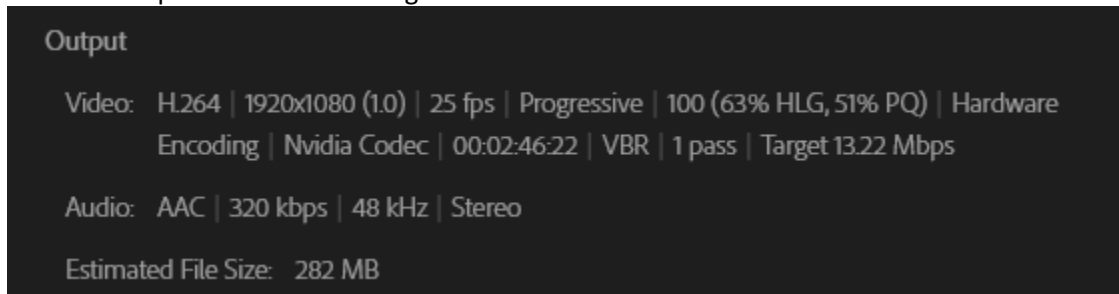


Click on "...More"

Go to bitrate settings and use the settings below (target bitrate can be tween 12-14):



The final output looked something like this:



## 6.5 Making your video interactive with H5P

H5P offers all kind of interactions which you can add to your videos. Options include navigation hotspots, single, multiple choice, true/false and statement questions, fill in the blanks, drag and drop, mark the words, drag words and crossroads. Almost all interactions give options to seek (skip) to a certain moment in the video corresponding with the answer a student gives. Sometimes a multiple or single choice question can be enough for your purpose, but when you want to go deeper, you can set-up entire branching storylines in one video.

[Check out our guide about how to add interactions in H5P.](#)