READY SET ROBOT

METHODOLOGICAL FRAMEWORK

ERASMUS PLUS PROJECT NR 2018-1-EE01-KA201-047128
IO5

Ready Set Robot (agreement number: 2018-1-EE01-KA201-047128) has been funded with support from the European Commission. This document reflects the views only of the author and the Commission cannot be held responsible for any use which might be made of the information contained herein.

This methodological framework handbook is developed to boost the skills and key competences of teachers and other adults wishing to engage in Robotics. This cross-cultural framework includes the following contents:

1. Educational essays/case studies and examples of innovative methodologies for developing eLearning videos for observing and documenting robotics in schools.
2. Pan-European good practices (What works? Why it works? How it works?) on eLearning and instructional videos.
3. Didactic notes on how this methodological framework can be used by teachers but also by other professionals to boost the uptake of robotics.
4. Key terms of references to ensure common ground and understanding.

This Framework is aimed at supporting teachers, pedagogical staff, managers, trainers, decision makers and stakeholders, in the implementation of the material created in the Ready Set Robot project. This output consolidates the projects outcomes, into a methodological description and practical ideas of implementing the material in training at various levels: national, regional and local. The document also includes a curriculum based upon the resources developed in the project. It is implemented in a formal accredited training course for STEM professionals and teachers. The training course plan will describe timing, topics, contents and tools to be used.

Drafted by: ELDERBERRY AB

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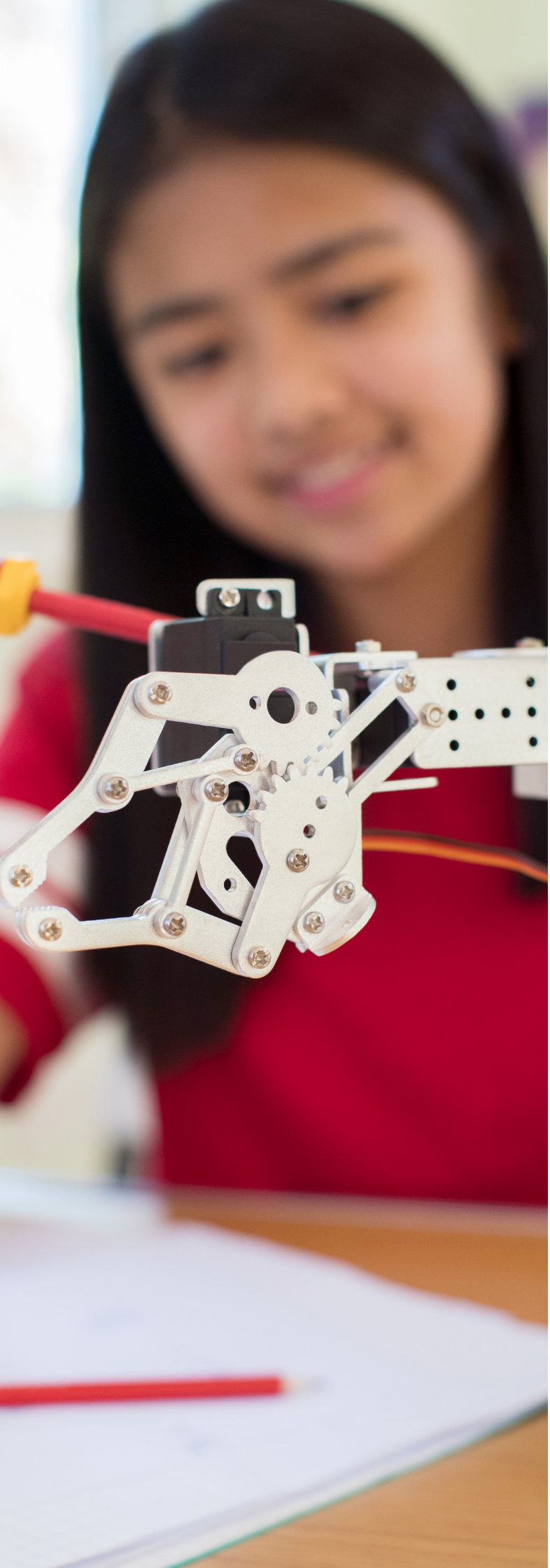
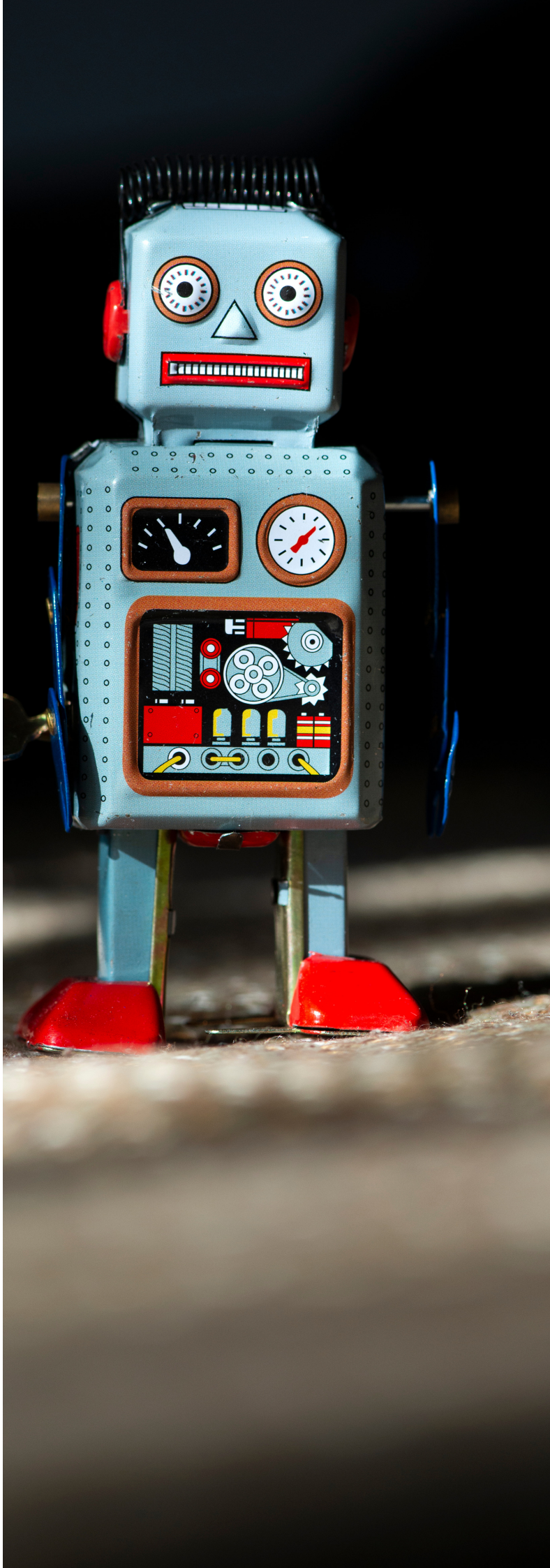




INTRODUCTION

Research carried out in the Ready Set Robot project has shown that the provision of initial and continuous training for STEM professionals and teachers and support structures for institutions in this area is at a minimum in partner countries and throughout Europe. Ready Set Robot aims to "train the educators" in the initial induction skills, knowledge and competences needed to engage in discussion about documentation of robotics in schools and training.
To this end a training course for STEM professionals and teachers on how to work with documenting and videoing robotics in STEM education has been developed. A training EU Europass accreditation will be sought for the course and the training will be created by referring to a series of learning outcomes and credit allocations that will allow future integration with European accreditation systems. A support network will be set up centering on the Ready Set Robot training material created in order to best use the visual learning methods this medium offers.

The training will build upon the programs for educators run by Elderberry in several EU Countries which are run through the Erasmus+ KA1 program www.eucourses.eu

The project will expand upon the Swedish training method developed by Elderberry AB which has proven successful in training educators in such areas.

This curriculum is integral to the Ready Set Robot project and is part of a toolkit for STEM professionals, artists and trainers.

The Educators Toolkit provided in Ready Set Robot include:

a. Video 1. Using smart phones and tablets for documentation videos
b. Video 2. How to conduct interviews using a smart phone or tablet
c. Video 3. How to document robots using smart phones and tablets
d. Examples of good practice videos from partners
e. Examples from first Lego league

1.0 THE IMPORTANCE OF VIDEO DOCUMENTATION

When expected to provide evidence that pupils are meeting learning standards, video documentation is a natural way to make learning visible. Collaboration also helps build a classroom community, which is important because it engages teachers, parents, and pupils in thinking about the process of learning. Successful video documentation formats reflect the intended audience and purposes. In addition, the format selected will depend on the individual preparing the video documentation and how the pupils are involved in the experience. For example, if one teacher wants to highlight for families and administrators how the class is meeting a particular maths or science standard, she would use examples of videos of pupils participating in science or maths experiences that align with the standard. As evidence, she might include videos of pupils using a robot kit, which includes pupil's comments about the task in hand, background information about what the pupil learned. An explanation about where the learning began and where it is intended to go will help any audience better understand the video documentation. In both cases, the quality of the end product will depend on the teacher's understanding of children, the curriculum, and the standards, along with his or her effective use of video technology for observation and documentation. Choosing a focus, the teacher might choose to video document only part of the pupil's study, and could start by providing a learning spark, such as a as scenario -based task. The video would illustrate the pupil's knowledge and understanding more thoroughly than a written, or photographic documentation. Offering specific examples of how pupil came to their understandings about just one aspect of a lesson or all the task.

One important and common topic for video documentation is individual pupil growth and development. As previous examples have shown, the documenter is a researcher first, collecting as much information as possible to paint a picture of progress and outcomes.

Documenting individual growth requires a great deal of research, as the teacher must observe each child in a variety of areas of development (such as social-emotional, cognitive, language, and motor) over a substantial length of time. Only then can the teacher create a video documentation piece that tells an accurate story about each child. A teacher should be careful to avoid displaying private or confidential video information in public forums such as social media or other places on the internet. There are times when video documentation may be more appropriately shared in other, more private venues, such as a portfolio. Portfolios used for individual assessment of pupils make a particularly good format for documenting developmental progress. Even though the portfolio focuses on a child's abilities, teachers may want to consider sharing the video documentation/portfolio in a private setting, such as a parent/child/teacher conference, so that parents do not feel compelled to compare their child to others in the class.

1.1 WHY SHOULD WE DOCUMENT?

There are several important reasons for using video documentation in classrooms. Showing accountability is one reason for video documentation. Teachers are accountable to administrators, families, community members, and others, and video documentation helps to provide evidence of pupil's learning. In addition, video documentation can improve relationships, teaching, and learning. Use of this tool helps educators get to know and understand children, and it allows them to reflect on the effectiveness of their teaching practices (Kroeger & Cardy 2006). A back-and-forth examination of the video documentation helps the teacher and pupil negotiate a curriculum that is based on the pupil's interests (Seitz 2006).

When it is expected to provide evidence that pupils are meeting learning standards, video documentation is a natural way to make learning visible. Helm, Beneke, and Steinheimer (1998) call this idea "windows on learning," meaning that documenting offers an insight into pupil's development and learning. Moreover, they observe, "When teachers document pupil's learning in a variety of ways, they can be more confident about the value of their teaching" (1998, 24).

HOW SHOULD WE DOCUMENT?

The video documentation process is best carried out in collaboration with other teachers, parents, and pupils during or soon after the learning experience.

The information and product become richer when two or more teachers, pupils, and parents work together to understand an event. Collaboration also helps build a classroom community, which is important because it engages teachers, parents, and pupils in thinking about the process of learning. When two or more people discuss an event, each brings a different perspective and a new level of depth.

1.2 STAGES OF THE DOCUMENTATION

Video documentation is a process that is learned, facilitated, and created in stages. Many educators already document pupil's development and learning in many ways; written notes, photographs etc. There are several stages to move through both individually and collaboratively. Educators who collaborate to learn more about video documentation tend to have more positive experiences than those who work on their own. The video documentation process is best done in collaboration with other teachers, parents and pupil during or soon after the learning experience. Video documentation can be a rewarding process when educators understand the value associated with collecting evidence and producing an edited video.

To become a documenter, one must first understand what to observe and what to do with the information collected. It takes time and practice to learn which experiences support effective video documentation and how to collect artefacts and evidence.

STAGE:

1 Deciding what to document "What should I document?"

As documenters we learn why the information is important and begin to understand the value of video documentation for different audiences. It is important not to try to document every part of the process and the editing task afterwards in unrealistic with too much information and video footage to work through. Be selective. Recognize why certain aspects of pupil development are important to assess. In addition, documenters learn that administrators and parents value this information, yet it also has value to the pupil and the teacher. Often the video documentation provides insights into pupil's thinking and helps drive the future curriculum.

2 Exploring technology use

Documenters must explore how to use equipment and smart phones (see training videos 1,2,3) from various events and experiences.

3 Focusing on pupil's engagement

Documenters learn to video specific things and events with the intent of capturing a piece of the story of pupils engaged in learning.

4 Gathering information

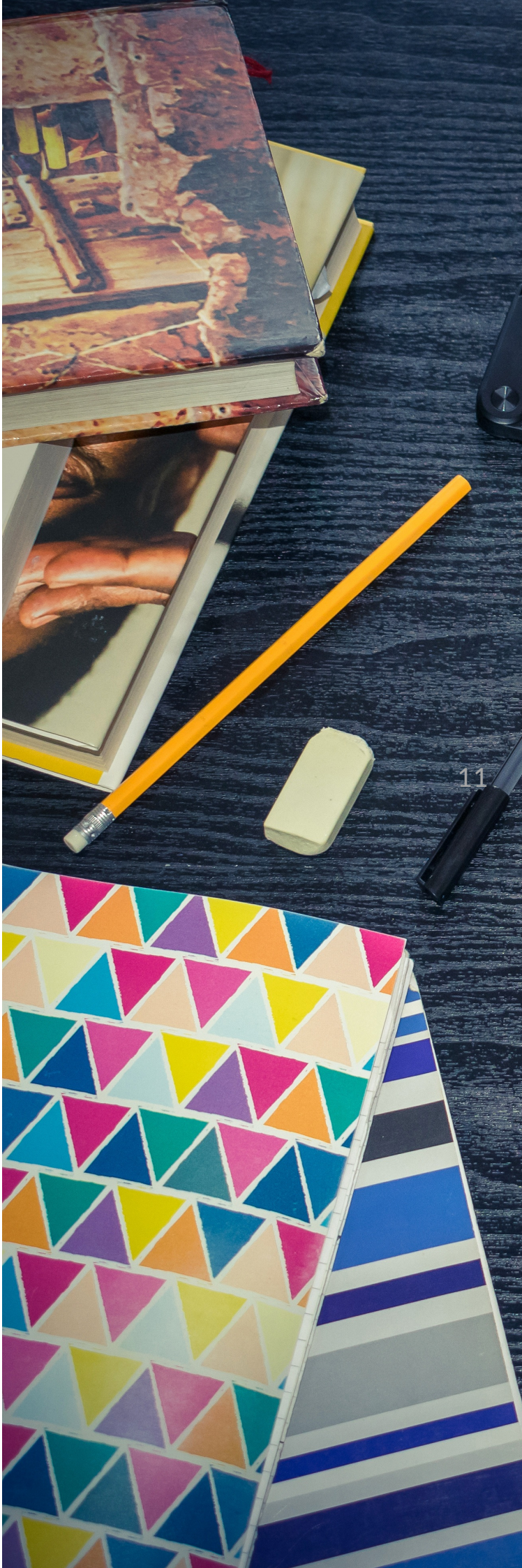
Documenters combine work samples, photographs, descriptions, and miscellaneous information in support of the entire learning event. Documenters frame questions, reflect, assess, build theories, and meet learning standards, all with the support of video documentation.

5 Connecting and telling stories

Documenters begin to edit the videos and to write descriptions that tell the story of pupil's learning. The video clips are placed in slideshows or movies and shown to pupils and parents. They tell the whole story with a beginning, middle, and an end, using supporting artefacts

6 Documenting decision making

They show pride in the pupil's actions by displaying photos and video clips. Documenters become technologically competent and able to focus on important learning events and experiences. Documenters begin to connect pupil's actions and experiences. Documenters continue to use video documentation artefacts to connect pupil's actions and experiences to curriculum and learning standards. Documenters become reflective practitioners who document meaningful actions/events, explain why they are important, and push themselves and others to continue thinking about these experiences. Finally, the documenter learns how best to interpret and display the information gathered. Often the video documentation provides insights into pupil's thinking and helps drive the future curriculum. Deepening pupil's learning is the ultimate reward of video documentation.



1.3 LEARNING IS ENHANCED

- Pupils become even more curious, interested, and confident when they think about the meaning of what they have done.
- The processes of preparing and displaying examples of the pupil's experience and effort provides a kind of debriefing or revisiting where new understandings can be clarified, deepened, and strengthened.
- Pupil also learn from and are stimulated by each other's work in ways made visible through the documents displayed.
- A display documenting the work of one child or of a group often encourages other pupil to become involved in a new topic and to adopt a new method of doing something.

PUPIL'S IDEAS AND WORK ARE TAKEN SERIOUSLY

- Careful and attractive videos can convey to pupil that their efforts, intentions, and ideas are taken seriously.
- These videos are not intended primarily to serve decorative or show-off purposes.
- An important element in the project approach is the preparation of documents for display by which one group of pupils can let others in the class working on other parts of the topic learn of their experience and findings.
- Video documentation encourages pupil to approach their work responsibly, with energy and commitment, showing both delight and satisfaction in the processes and the results.

PUPIL'S LEARNING MADE VISIBLE

- Video documentation provides information about pupil's learning and progress. The focus is on how pupil making meaning, of how they come to understand.
- While teachers often gain important information and insight from their own first-hand observations of children, video documentation of the pupil's work in a wide variety of media provides compelling public evidence of the intellectual capability and competence of young children.
- Video documentation uncovers the learning process as it highlights pupil's theories, interests and relationships.
- Conversation or dialogue is used to present pupil's words as serious attempts to understand concepts and ideas.

TEACHERS CAN PLAN AND EVALUATE WITH PUPIL

- Continuous planning is based on the evaluation of work as it progresses.
- As the pupil undertake complex individual or small group collaborative tasks over a period of several days or weeks, the teachers examine the work each day and discuss with the pupils their ideas and the possibilities of new options for the following days.
- Planning decisions can be made based on what individual or groups of pupils have found interesting, stimulating, puzzling, or challenging.
- Experiences and activities are not planned too far in advance, so that new aspects of work can emerge based on pupil's interests and be documented.
- Teachers reflect on the work in progress and the discussion that surrounded it, and consider possible new directions the work might take
- When teachers and pupil plan together with openness to each other's ideas, the activity is likely to be undertaken with greater interest than if the child had planned alone, or the teacher had been unaware of the challenge facing the child.
- The video documentation provides a kind of ongoing planning and evaluation that can be done by the team of adults who work with the children.

1.4 TEACHER RESEARCH AND PROCESS

- As teachers examine the pupil's work and prepare the video documentation of it, their own understanding of pupil's development and insight into their learning is deepened.
- Video documentation provides a basis for tweaking teaching strategies, and a source of ideas for new strategies, while deepening teachers' awareness of each child's progress.
- Using information gained through video documentation, teachers can make informed decisions about appropriate ways to support each child's development and learning.
- Video documentation explains how one activity was pivotal in understanding an issue, connecting to previous learning, or provoking a new inquiry.
- Video documentation helps teachers promote a positive exchange of ideas.
- Video documentation highlights the issues or problems that emerge during a study or activity. Parents appreciate and participate
- Video documentation makes it possible for parents to become more aware of their pupil's experience in the school.

- Parents' comments on pupil's work can also contribute to the value of video documentation.
- Through learning about the work in which their pupils are engaged, parents maybe able to contribute ideas the teachers may not have thought of.
- The opportunity to examine the video documentation of a project in progress can also help parents to think of ways they might contribute their time and energy in their child's classroom.
- There are many ways parents can be involved in video documentation within the classroom: listening to pupil's intentions, helping them find the materials they need, making suggestions, helping pupils write their ideas, finding and reading books.

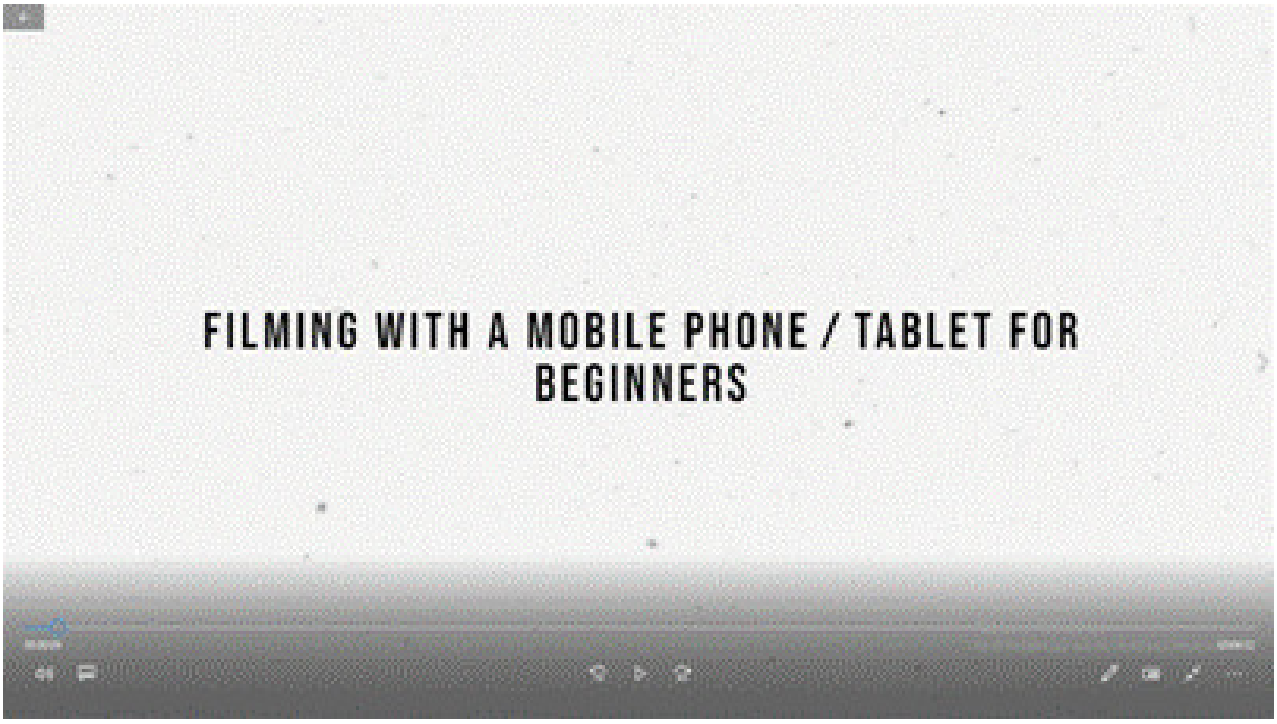
1.5 VIDEO DOCUMENTATION OF ROBOTICS AS EVIDENCE

- Teacher's description and overview of an event/ experience/skill development, such as photographs, videos and descriptions of an experiment with robots.
- Photographs of pupil at work—for example, building a robot.
- Samples of pupil's work, for example construction of robot kit to solve a certain problem.
- Pupil's comments of their experiments.
- Teacher or parent comments about a classroom event—for instance, "It was really fun helping the pupils solve that robot task".
- Teacher transcriptions of conversations during small group time when pupils are exploring a new topic.
- Important items or observations relating to an event/ experience/development.

2.0 EXAMPLE VIDEOS

2.1 EXAMPLE 1 VIDEO DOCUMENTATION USING SMART PHONES

This tutorial is aimed to support beginners with developing their filming skills on a mobile device and will provide you with some top tips to consider when creating a high-quality production. *



Prepare to film by checking your equipment list and environment – do you have:

- Phone or tablet to film with.
- A tripod.
- A flat, stable surface.
- Make sure you have an idea of what object you wish to film and how you want it positioned before filming as this can make post-production a lot more efficient.
- Place your device into the tripod.

STAGE 1. PREPARING TO FILM:

Check the following in order to ensure the filming process is as smooth as possible:

- Unlock your mobile device and check your mobile device is fully charged.
- Go into settings on the device and select airplane mode, this will prevent any disruption during filming.
- Next, scroll down to the camera settings – here you can include the option to apply a grid to support the framing of your film.
- Press “record video” option, this will open the quality of what you are filming – you have the option of 4K videos on most modern mobile phones.
  - Remember, Filming in 4K 30 frames per second will take approx. 5-7 mbps of video storage.
- Check that your device is stable – and select the camera icon
- Next, select the video mode and press record to test the quality of filming.
- You can zoom in on the screen to ensure the object being filmed is in focus.
- Press the red button again to Stop recording.

STAGE 2. SETTING UP

Adjusting exposure and lighting:

- Consider the amount of light that it is on the object, too much light entering the lens can affect your exposure on the mobile device and therefore the quality of footage you are creating.

- Correct it by scrolling down the screen to make it darker, bring back a fuller exposure by scrolling up to the lightest point on the screen to let more light in through the lens.

Adjusting Focus: You can lock down the focus and exposure on your device in order to ensure the object / or yourself is in focus – this is a manual setting instead of auto, this will remain for the entire footage.

- for auto focus on your device, press record and check that the object is fully in focus and not blurred.
- To correct the focus, press on the screen where the object is displayed.

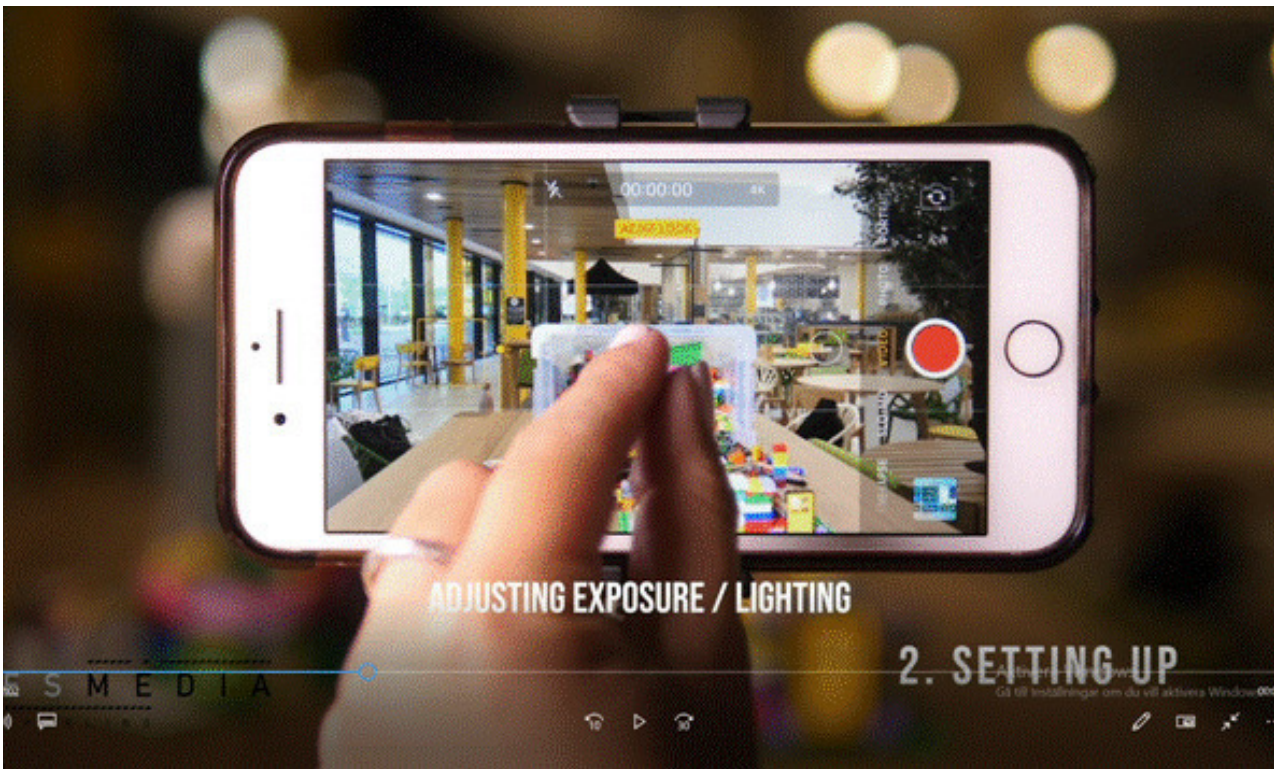
Adjusting height / rotation : Consider the height of your mobile device – ensure that it is not too high or too low on the subject you are filming, as you want to make sure it is as clear as possible for your audience to watch.

a. Filming Landscape tends to be most preferable, as you can see the full content on the screen.

b. Adjust the device and ensure the object is in the centre of the screen.

STAGE 3. PRESSING REC:

- After preparing to film, clean the rear and front camera lens with a dry cloth
- Switching from main camera to secondary: If you are filming a talking to camera piece (front facing) you want to ensure your mobile device is just below your eye level.

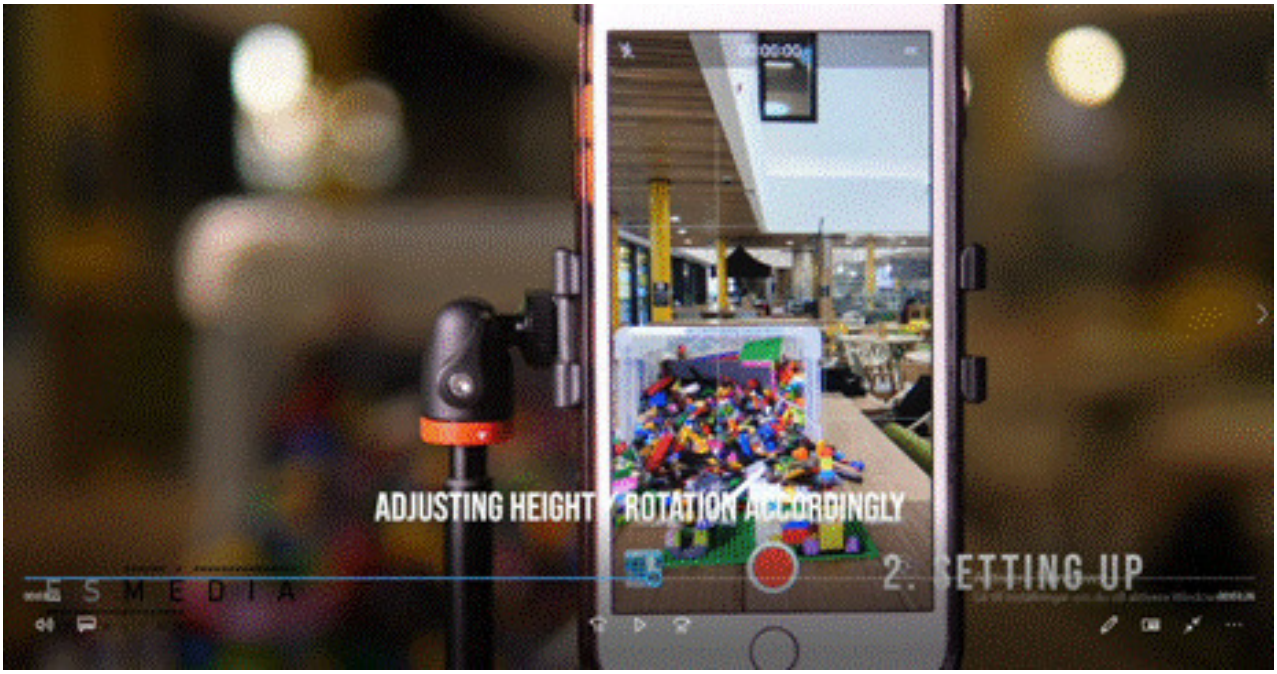


- Check the light is correct and ensure the camera is stable and handsfree when filming when using the front facing lens.

STAGE 4. ADDING MOVEMENT: UTILISE THE USE OF FOCUS AND LIGHTING

Creating movement to your footage can become more engaging for your audience to watch as it will give them a greater understanding of what you are trying to show them and will continue to keep their attention.

- **Be aware of changes whilst filming**: press pause or stop and resume play to control any uncontrollable distractions.
- **Make use of different angles and shot types:** Consider the different types of shots you can take – close up, wide angle, side. In order to show multiple details of the object or environment you are filming.
- **Using the tripod to pan or tilt:** The tripod can be used to control the movement of the camera



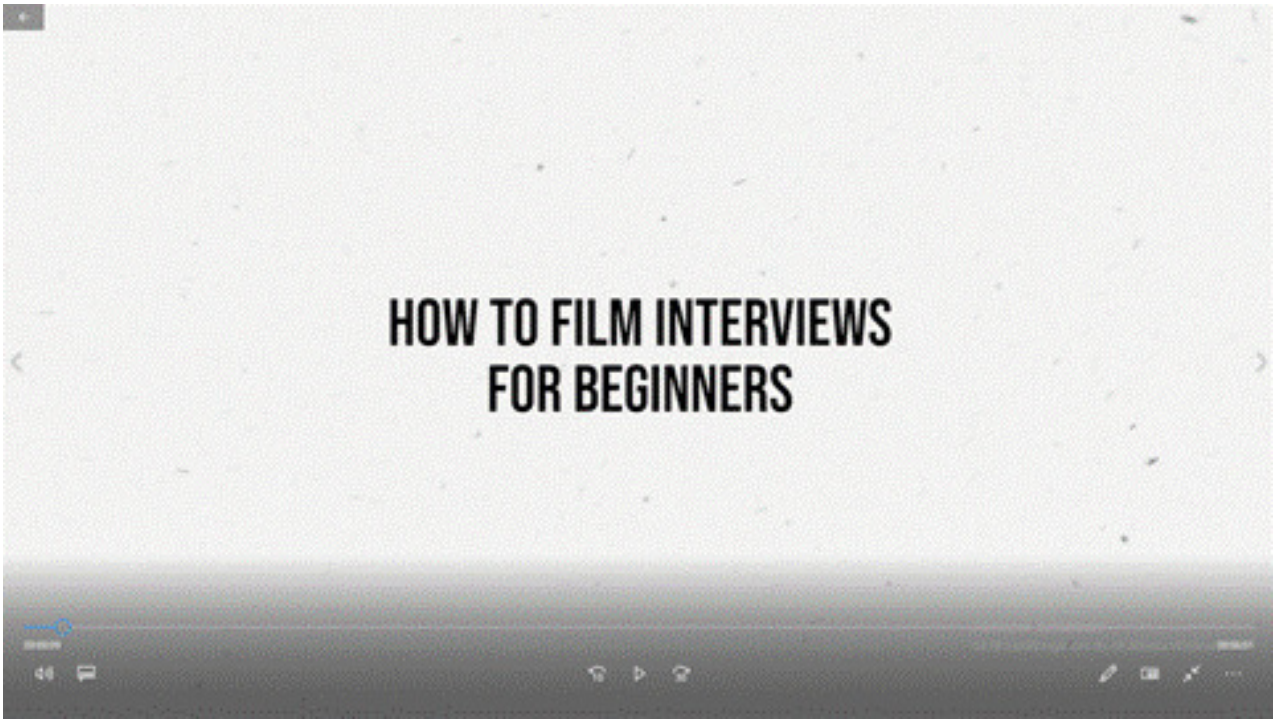
STAGE 5. REVIEW YOUR FOOTAGE: TO END RECORDING PRESS THE RECORD BUTTON.

- When you are ready to finish recording, press the red record button again to stop.
- The footage you have filmed will automatically save to your media gallery on the device.
- Watch the footage back before leaving, simply to ensure the visual recording is to the standard you require.
- Listen to the recording with headphones to check the audio is clear enough for your audience.

2.2 EXAMPLE 1 VIDEO DOCUMENTATION USING SMART PHONES

INTRODUCTION

This video will support filming an interview on a mobile phone or tablet, including how to edit the footage directly from the mobile device.



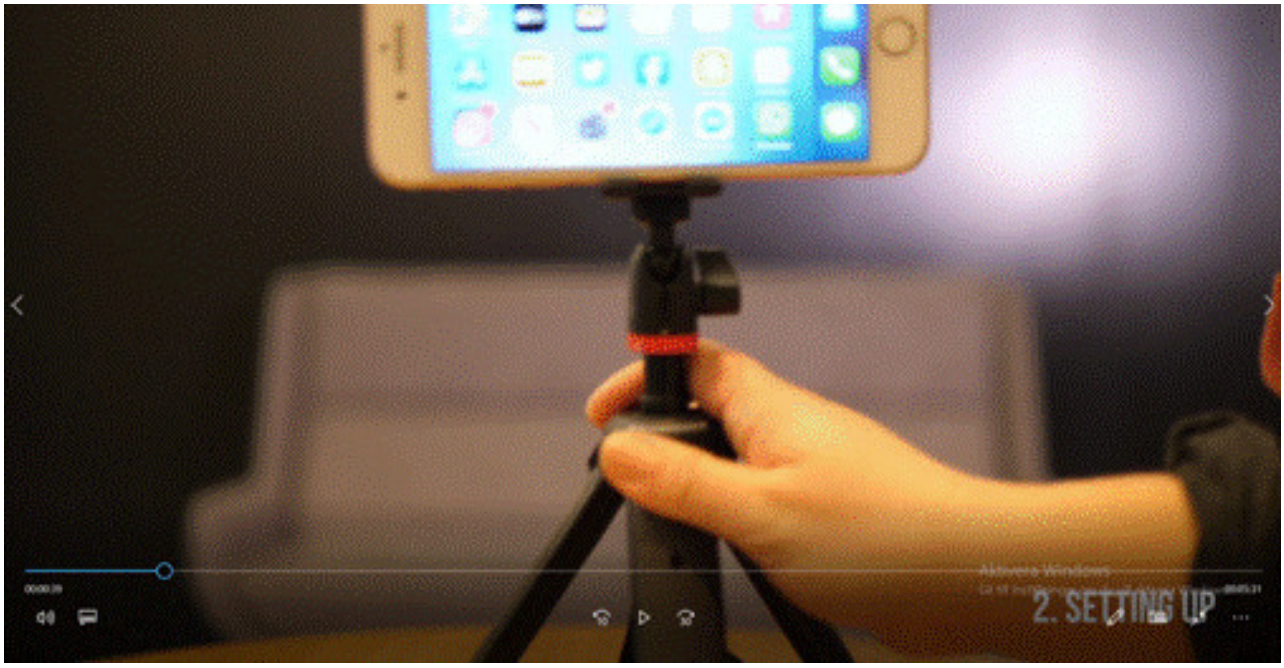
STAGE 1. PREPARING TO FILM:

Where do you start with a good interview? Firstly, you need to ensure that you have the consent of the subject prior to asking any questions. You will require the consent of a parent or guardian if you are interviewing anyone under the age of 18.
Preparing a script or questions ahead of the interview ensures that it will run smoothly.

STAGE 2. SETTING UP:

Next, ensure that your tablet or mobile device is on a tripod so that the camera is stable and in focus. Check that the space where your interview is taking place is in frame. At this point, consider if there are any distractions in the background or surrounding area, as this could take the attention away from your subject.

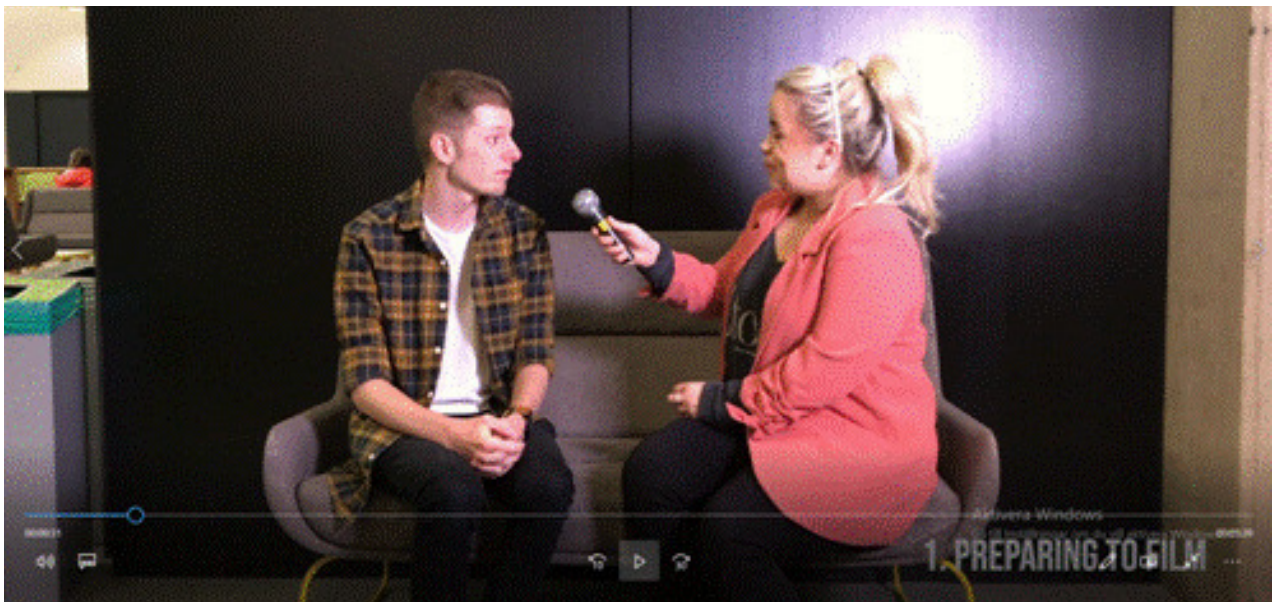
Light is important to consider, is it too bright or too dark? Are there any reflections the distract the audience? Use natural lighting where possible. Adjust the light to desired level.



STAGE 3. PRESSING REC:

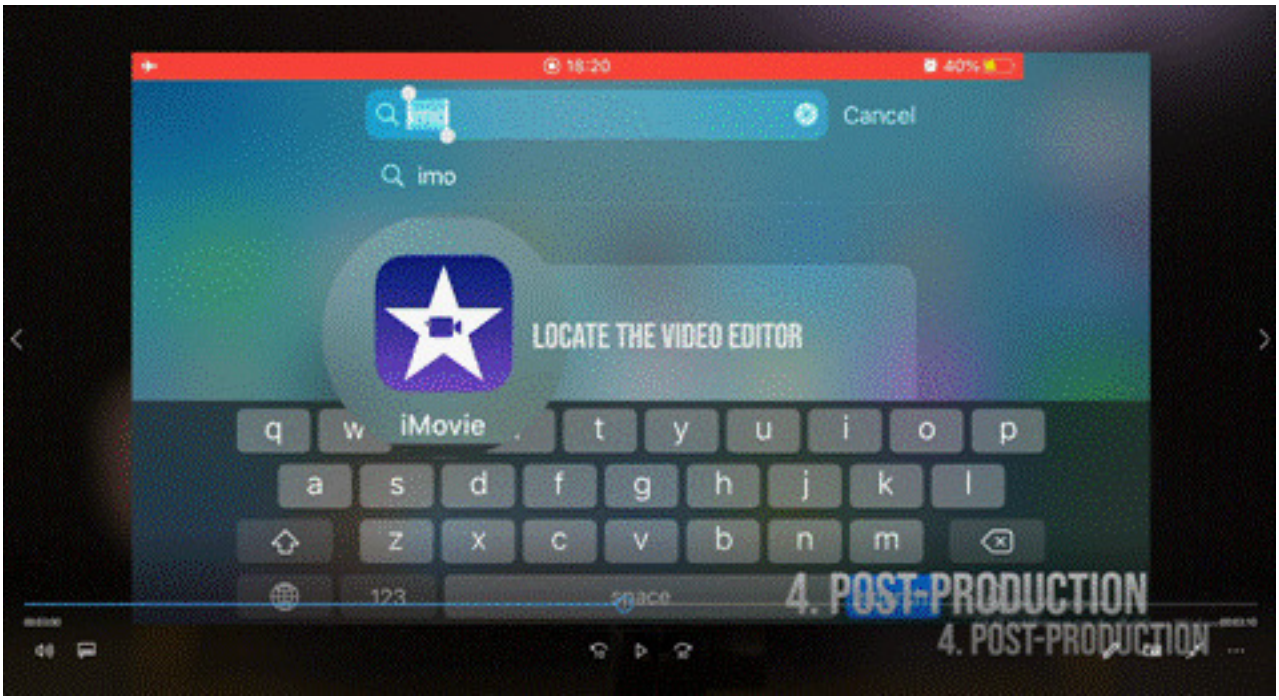
Consider where your interviewee will be placed to be interviewed. Are they standing or sitting comfortably to avoid looking awkward or fidgeting on camera?
We will be interviewing our subject on a sofa but ensure they are sitting in the right position – in the middle if the interviewer is out of shot.
If you have the interviewer in frame, ensure that both interviewee and interviewer are at the same level as this will create a more natural dialogue between the two.

Just before pressing record, if you are using an external microphone, ensure that this is neither too close nor too far away from your interviewee. This might mean that the interviewer needs to physically move closer or further away from the subject.
Now you're ready to press record and start the interview!



STAGE 4. POST-PRODUCTION:

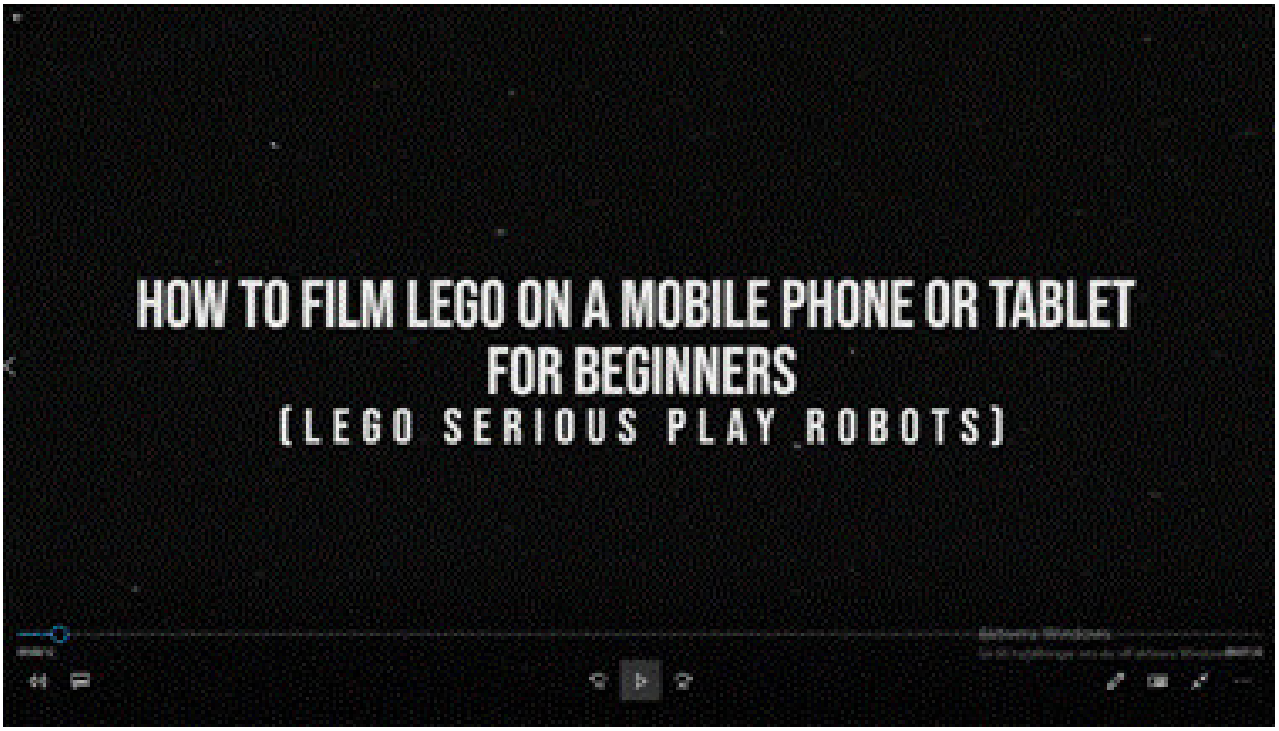
Begin the editing process by searching for iMovie (or similar video editing app)
Tap on the icon and open the application.
In iMovie, tap the create a new project icon, if you have already started to edit a video you can resume editing in the folder next to it.
Press create new project icon – and select your video to create the new movie on your phone.
Locate the footage you wish to use from the folders on your mobile device. You can select multiple media files at once which will be confirmed by the tick icon.
Tap on the thumbnail image to preview the media files. Tap again to pause play.
With your selection highlighted, tap to create a project from these selected clips, press “create movie”.
You can press “split” on the file to include additional footage to be placed and create a space for a video transition. To do this, press the icon and then select transition.



On iMovie you can change the speed of the footage by this icon.
Check the levels of sound using the volume icon.
Add text onto your movie to give your audience more information.
By using the filter icon, you can change the colour of the footage you have filmed.
Once complete, tap the “done” icon. This will give you the option to export your movie and share.
Export project and select the size HD1080p for maximum quality.
This will save your movie in your recently added media file on your mobile device. Press to play and check the movie you’ve filmed and edited directly from your mobile device.

2.3 EXAMPLE 3. HOW TO FILM LEGO ROBOT KITS A MOBILE PHONE OR TABLET FOR BEGINNERS

This video will support filming Lego Serious Play robots in movement, static and handheld on a mobile phone or tablet, including how to capture putting together a kit.



STAGE 1. PREPARING TO FILM:

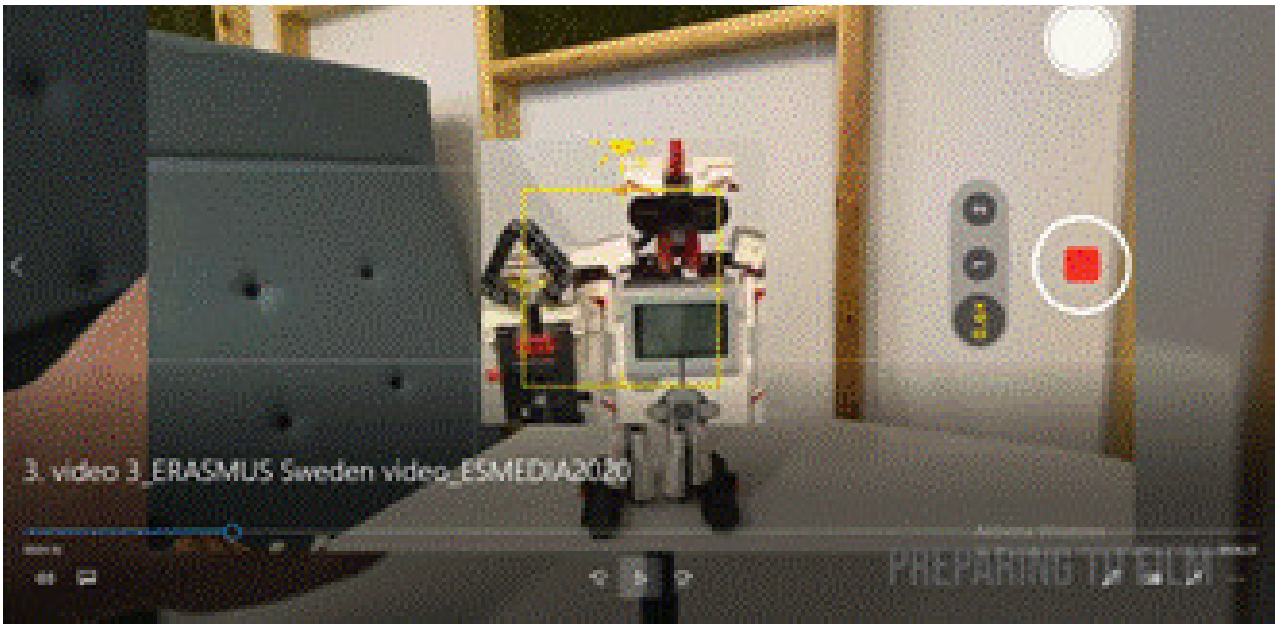
Stability - Ensure that your tablet or mobile device is on a tripod so that the camera is stable and in focus.

Light - Light is important to consider, is it too bright or too dark? Are there any reflections the distract the audience? Use natural lighting where possible.

Space - Consider where your subject will be placed to film. Is it in an environment that is suitable, as later we will be filming moving shots of the Lego robot in order to create a more dynamic shot to increase the engagement of your audience.

At this point, consider if there are any distractions in the background or surrounding area, as this could take the attention away from your subject/model.

Focus – Tap on the screen of your mobile device to trigger the auto-focus recognition. Light can also have an impact on the auto-focus of the camera, therefore adjust the light to desired level and prepare to press record



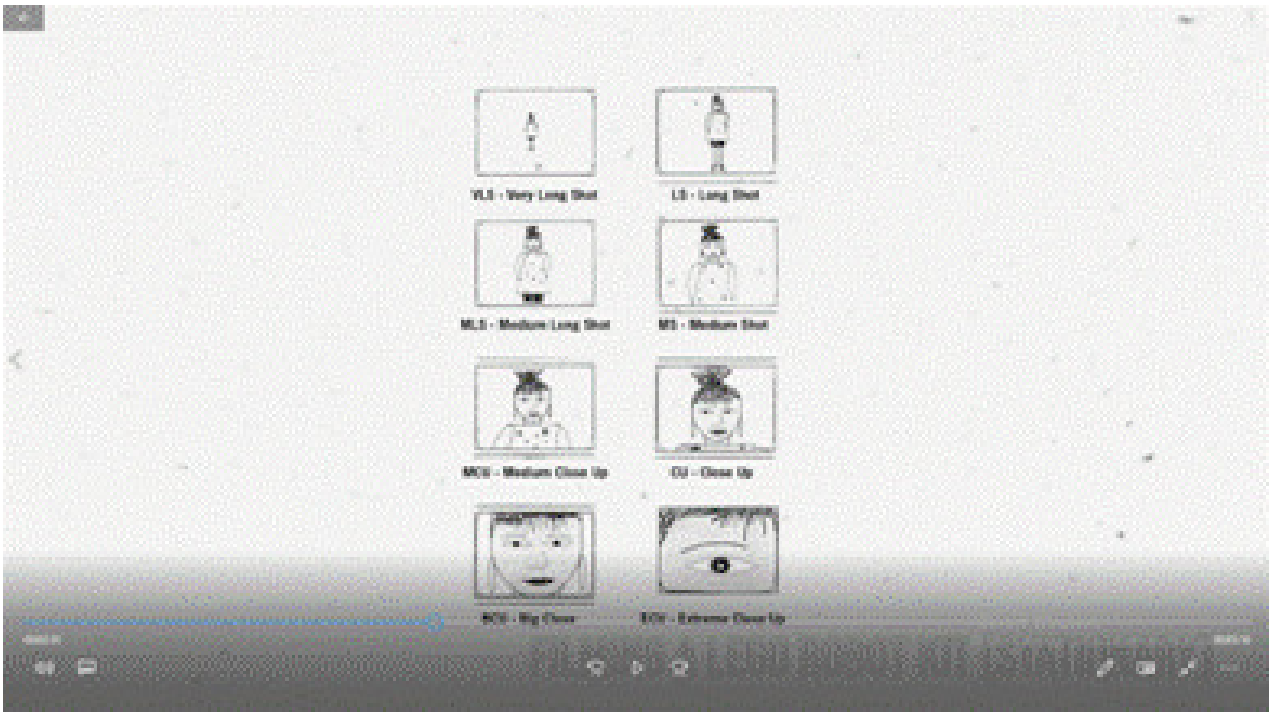
INTRODUCTION:

STAGE 2. PUTTING TOGETHER A LEGO ROBOT KIT:

(A pair of hands putting together a Lego Robot kit)

In order to create an engaging and stable video with your mobile device, it is suggested that two pairs of hands are better than one, for this video!

Whilst one person will be putting together the Lego Robot kit, the other will be operating the camera on the mobile device.



To give a clear viewpoint of the Lego pieces you are using, you will need to clip your mobile into the tripod and use an overhead shot (otherwise known as an elevated shot). This will allow the viewer to gain a better knowledge of building a kit, as it will show everything that will be in their eyeline.

EXAMPLE 3 A. FILMING A LEGO ROBOT KIT (STATIONARY)

A stationary Lego robot kit in action i.e... a mechanical arm, where we can show it moving at a distance and mechanisms moving in detail up close

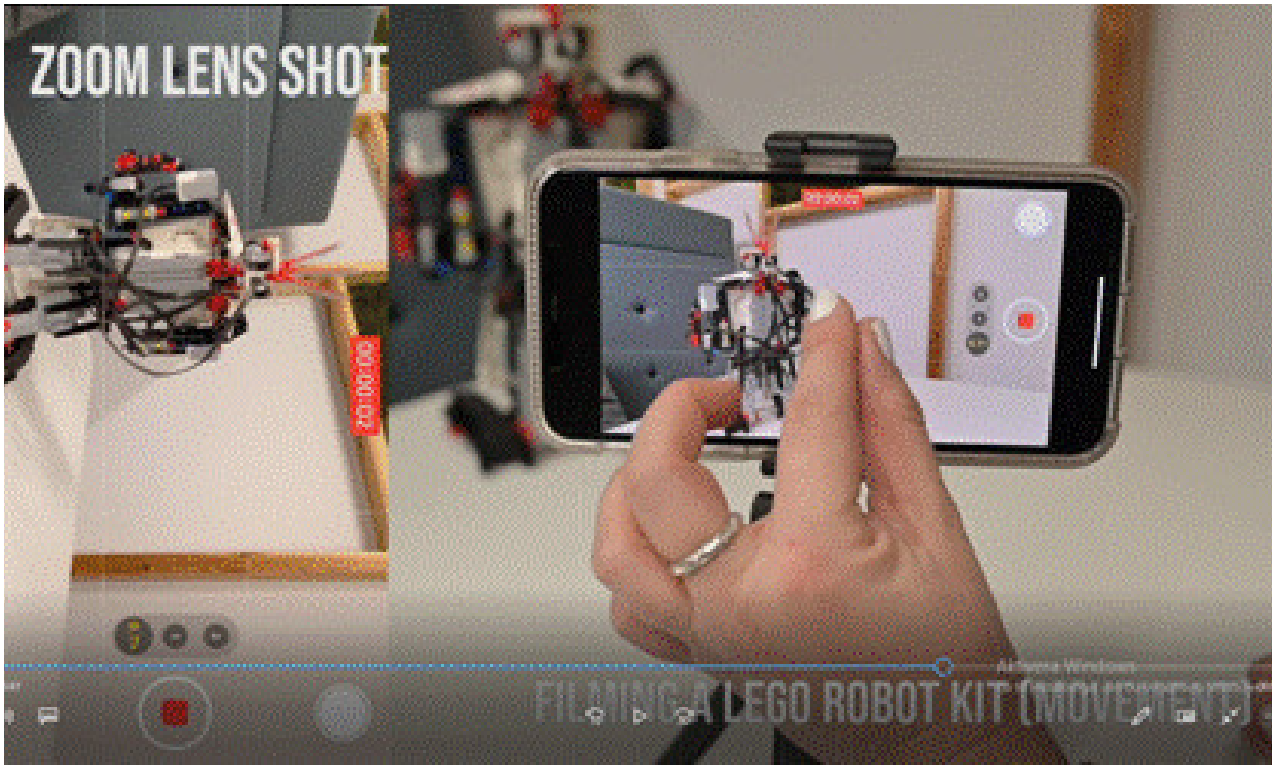
Filming a Lego robot kit that is stationary, and does not have any movement, will require the following shots, preferably in order to give better context to your viewer:

Full shot (FS): this will show the entire structure and give the audience a full framed shot of the kit so that they can understand what it is that is being used, and the size – as in the full shot there will occasionally be other objects in view, as the structure will not fill the shot entirely.

Medium shot (MS): This will show just the Lego structure and a small amount of the environment it is in, so for example some of the desk perhaps. It will be closer than a full shot and give more detail, so that the viewer can gain a clearer insight of what is being used.

Close up (CU): This shot will provide an in-depth look at exactly what is being used and feature more areas of the Lego structure, to give a better insight on the mechanics of it. Hold the tripod to give a Set, closer look and it can also add in small amounts of movement to your shot.

Extreme close up (ECU): The close-up camera shot fills your frame with a part of your subject. Remember to pay attention to the focus of your camera at this point, touch the screen of the device to re-adjust the focal point. This shot is key to highlight important areas of a robot/ Lego structure.



EXAMPLE 3B. FILMING A LEGO ROBOT KIT (MOVEMENT)

A Lego robot kit buggy/vehicle where we can film it moving along a path a distance and up close.

Filming a Lego robot kit with movement of the camera will require the following shots, this series can be used in any order in order to create a more dynamic tutorial video:

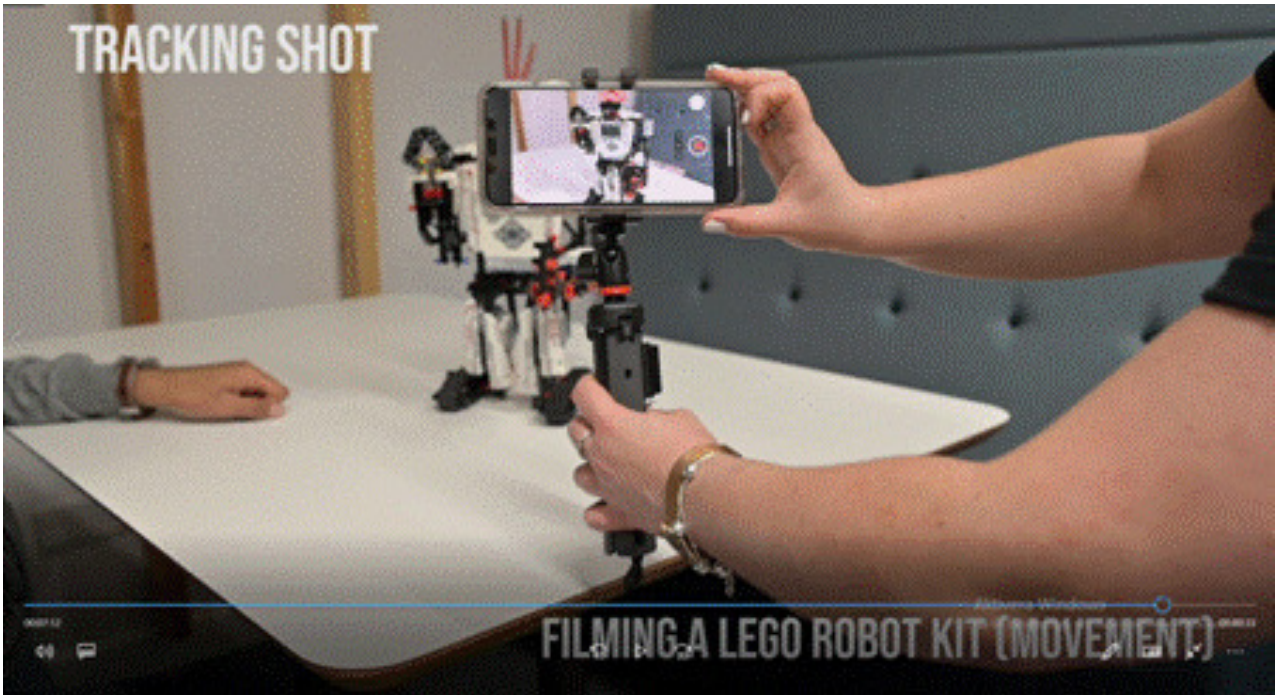
Static shot: When there is no movement of the camera itself, it is called a static shot. This will emphasise the appearance and movement of your Lego structure and how it moves on its own accord or with support. Keep your mobile device placed in the tripod and on a stable surface.

Zoom lens shot: Zoom shots are camera shots that change the focal length of the lens during filming. This action can either be zoomed in or out. Keep your mobile device in the tripod and for better stability keep it placed on a flat surface. Next, by gently touching the screen with your fingers, slowly zoom in on the subject. You will be able to slow this down in post-production.

Camera pan shot camera pans move the camera side to side on a horizontal axis. This can reveal something to your viewer or allow them to follow an action- for example, showing the movement of your Lego structure.

Camera tilt-shot: A camera tilt is when you move your camera up and down on a vertical axis, this is similar to a pan shot but only vertical.

Tracking shot: In order to give the Lego structure a dynamic and exciting shot – when it is moving you will need to hold the tripod with the device securely placed and follow beside or behind as it is moving. This can be made smoother by holding the tripod with both hands and slowly following the Lego structure. Often handheld shots are moved by a camera operator – they are not stabilised and often shaky, but this can make it feel more dynamic.



2.4 EXAMPLES OF GOOD PRACTICE VIDEOS

Why do we need good video material of robotics, FIRST LEGO League etc....?

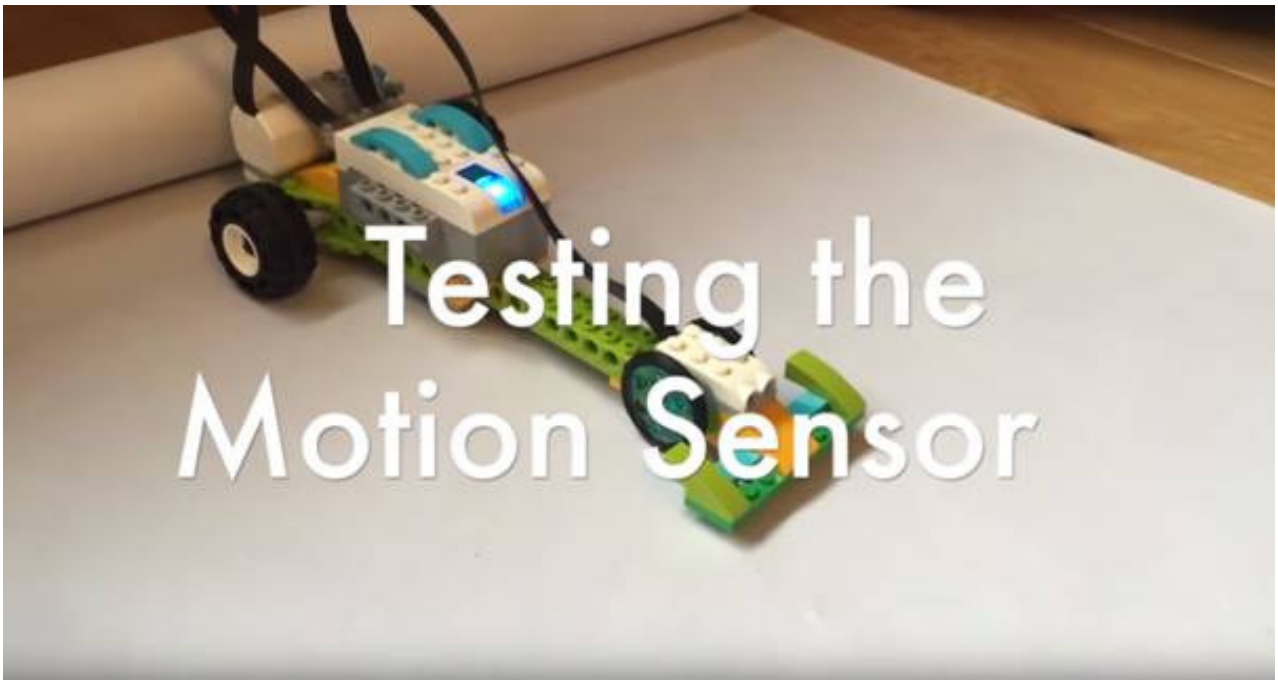
This project is called into action because we want to increase the quality and learning effect of videos produced by pupils in technical fields. FIRST LEGO League being the biggest extracurricular program in the world has made thousands of pupils to share their robots and projects online to others. Often it is seen that even if the content is worth sharing, ways of doing that do not carry the same quality with it. We want to help them to increase the knowledge about making good learning movies. More teams will benefit through better learning material and build higher level robots and make more in depth research. Ready-Set-Robot is not only helping pupils to create good material, we are uploading also ourselves a set of videos from four FIRST LEGO League events in four countries. These movies are done by professionals in special manner and will be beneficial for a lot of teams over the coming years. It does not matter that missions and theme change every year. Overall concept how to build a good FIRST LEGO League robot remains the same. Examples of previous years solutions will not give direct answers to pupil of how to solve a new mission but rather guide them towards their own innovative and original designs. Videos produced in RSR are equipped with comments from the teams and pupils that engineered robots and researched for projects. Videos from all countries – Sweden, Finland, Latvia and Estonia have English subtitles.

1 *https://www.youtube.com/watch?v=ekt2SVMU9hg*

Why this video is good example? It really gives the idea how a simplified robot works. Anybody that watches it will understand what is Matatalab, how is it programmed and what are the possibilities for continuation. Video is simple, friendly and clean.

2 *https://www.youtube.com/watch?v=pW9qNiZT6U8*

Why this video is good example? It is child friendly, simple and homemade introduction to WeDo 2.0. It involves samples from programming environment and has enough light. It is very long and includes fast forward parts of building models.

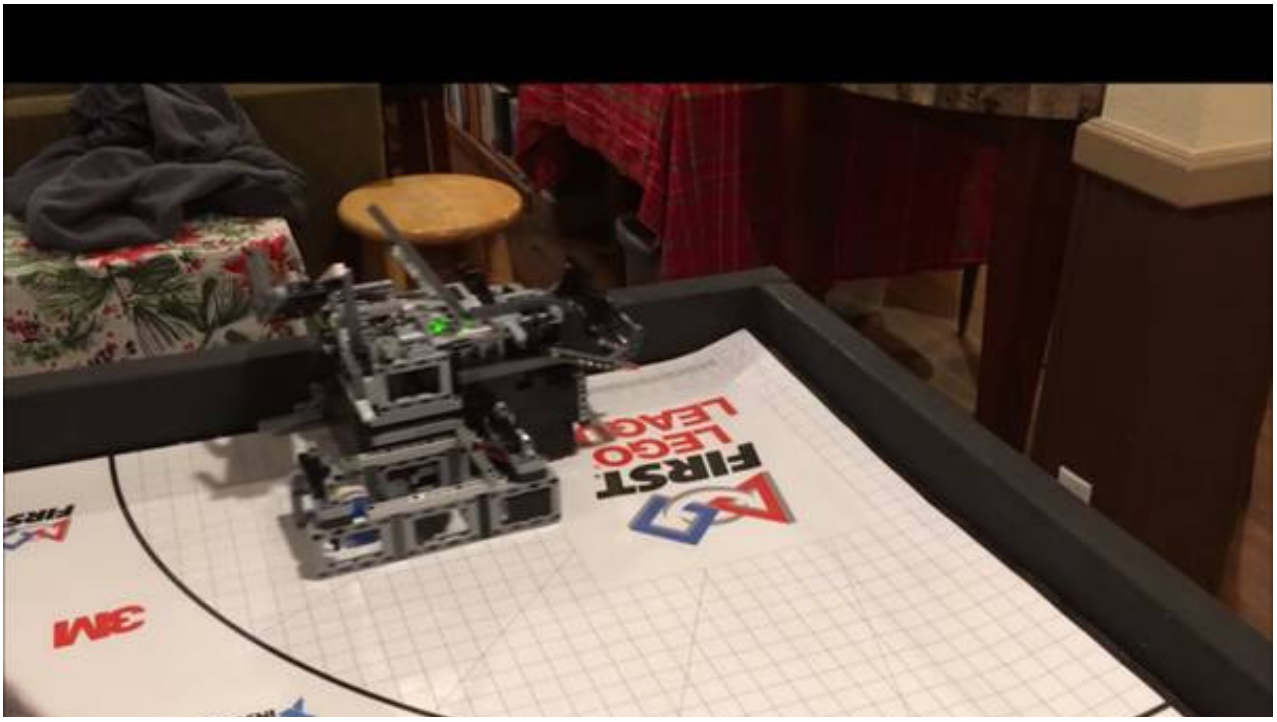


3 *https://www.youtube.com/watch?v=TTui3shLRPk*

Why this video is good example? This video is technically very well built. It also includes very funny problem – how much can LEGO propellers and motor lift weight. It is presenting numbers after each trial and constantly improving its build and design to reach more. It uses fast forward to skip slow building parts. It engages viewers by its simplicity and connection to the core problem.

4 *https://www.youtube.com/watch?v=SKyzIxxYoMU*

Why this video is good example? This video is a good example of showing how robot solves FIRST LEGO League game table. Camera is stable and authors have made good close shots to make viewer understand how robot's different mechanical parts are working. On short side video could have a clock showing time and it is missing parts where kids are changing robot's mechanical parts.



5 *https://www.youtube.com/watch?v=wC2Yrfw9lQ0*

Why this video is good example? This video is not too long and does not explain the details, but let's viewers know generally how to build a robotic hand. It includes parts of all production, starting designing, producing, programming and testing. It is clear picture and includes computer screen of design and programming parts.

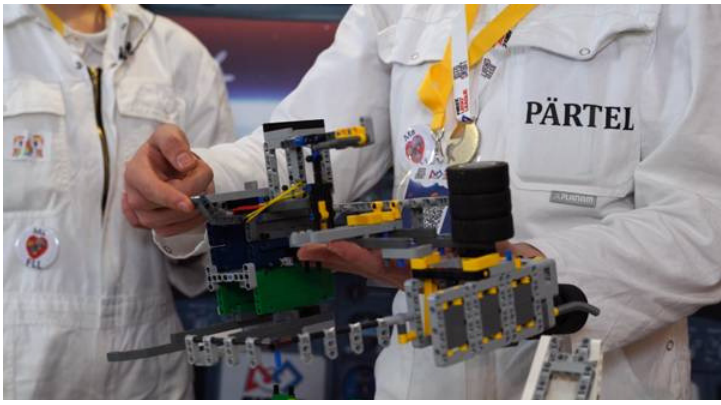
2.5 EXAMPLES OF DOCUMENTATION FROM FIRST LEGO LEAGUE

1 The problem that Marspatukat solved is about the depression of astronauts. The astronauts get rather easily depression or other mental health issues though very intensive training. The team has done a large search in reliable sources on these problems. The solution that Marspatukat found out is a clever technological but easily adapted answer to the psychological problem. The astronauts are given a virtual reality headset connected to astronaut's home and a walking mat which allows the astronaut to walk and look every direction. Marspatukat found and easy and applicable solution to a very difficult problem. All the ingredients are already available.

Marspatukat are Susanna Mikkola and Petra Kalimo

2 Here a team is describing a FIRST LEGO League robot extension. Rubber bands are pulled up before sending robot to the drive. Robot is driving against the mission model and extension level is getting touched and releases the trigger. Rubber bands are pulled up and after release cause the extension to act out its purpose with the mission model.

This is a good example because most of the robots will transfer power from the robot to extension through gears or other ways which are usually slower. This triggering method is fast but might be failing if robot hits something it should not, but even in this case more common extensions would not help. Connecting this extension to robot is easier since it does not require transfer of power.



3 Team BlackCom has come up with a shoe solution "Sandy" that allows our astronauts to walk freely on mars. They have found similar comparison to Mars in nature on Earth - Sahara Desert. As we know that camels move freely around desert, and that is why they made "Sandy" shoe design based on camel foot - just as flexible and wide and fits well together with astronaut suit.

3.0 READY SET ROBOT TRAINING COURSE

The objective of the Ready Set Robot training course is to train STEM professionals in the Ready set robot methods of documentation. A training for STEM professionals and teachers with focus on Documentation of Robotics has been outlined in the project. The course is open to educationalists and pedagogues working in STEM education wishing to learn more about the practical and theoretical aspects of Video Documentation. By exploring different practices and methodologies throughout Europe and by highlighting the pedagogical framework from the Swedish partner, Elderberry AB.
The courses will comply fully with the Erasmus+ KA1 criteria for mobility grants. We provide full modules for preparation, monitoring and validation. The course is assessed using the EQF and ECVET frameworks for definition of Learning Outcomes in terms of Knowledge, Skills and Competences for each moment. We use this framework as it is linked to each country's National Qualification framework and therefore comparable in all EU countries. The expanded and adapted "live" training course module will fit into the already existing course curriculum and is derived from the material and tools produced in the Ready Set Robot project. It will be subsequently incorporated into the regular training programs delivered by the partners. The Ready Set Robot OER platform will be used in training situations to be incorporated into the training course.

A specific focus of the training is visiting STEM professionals, artists and cultural workers who have good proven experience of working with Ready Set Robot principles and will share with the participants their ideas and knowledge based upon real-life scenarios.

The purpose of the Ready Set Robot Training Course Curriculum is to guide all users in delivering and using the educational material developed within the context of the project. In the course we introduce the aim and objectives, target groups, and the results of the needs analysis consultation conducted that supports and helps justify the needs for developing and implementing the READY SET ROBOT program.

The course presents an extended explanation about the outcomes of this project and how to use them for training purposes: the READY SET ROBOT Competences Matrix; the Methodology Handbook; and the READY SET ROBOT Implementation Strategy. The course explores the use of the READY SET ROBOT OER platform in training the action learning method. Each element introduces the aim and objectives of the educational material followed by an explanation and opportunity to use those in practical examples in training.

3.1 AIMS AND OBJECTIVES

One the basic of principles the READY SET ROBOT project draws on the lessons of previous innovative initiatives on practical and experiential projects exploring the pedagogical potential of introducing documenting and videoing robotics into STEM through the use of a training in practice and complementary materials. The READY SET ROBOT project has designed a curriculum that is able to meet these goals by enhancing a specific field of the training for STEM professionals, managers, trough incorporating the products of this project. Our aim is to raise awareness of the necessity of using the methodologies and educational materials developed in combination with the OER platform tool. The partnership developed the project based on the assumption that working on such a specific concept will help create better understanding between formal, non-formal education, and training and other forms of learning in order to encourage better collaborations. The READY SET ROBOT Competences Matrix which is available on the READY SET ROBOT platform is a working tool designed according to the European Qualifications Framework (EQF) and the National Qualifications System and Framework (NQF) and it presents how the READY SET ROBOT learning program is in context with those guideline documents. The READY SET ROBOT Competence Matrix is aimed at potential participants of a training course.

HOW TO USE IT?

The Competence Matrix works hand in hand with the Ready Set Robot training sessions teachers and trainers must learn about the specificity of the Ready Set Robot approach, which details:
The learning levels according to the defined target groups and the explanation on how these levels can be framed in the EQF levels based on learning in practice.

The structure of Ready Set Robot explaining its main elements:

3.2 TARGET GROUPS FOR TRAINING:

- Managers of STEM institutions, services and schools.
- STEM professionals (pedagogues, teachers) wishing to understand video documentation theory and practice.
- Cultural workers wishing to collaborate with STEM.

One of our most important subjects of concern is to cover the many ranges of documenting a variation of experiences, in different cultural and educational settings with a variety of target audiences related to the work carried out by the partners involved in this project. The main objective is to engage all those targets groups in active and continuous learning activities through collaboration and the action learning method. To comply with this purpose the partnership developed a set of activities to help improve the educational competence of all target groups that may use such sites for education and training, by helping them acquire new skills.

3.3 NEEDS ANALYSIS CONSULTATION ON TRAINING

The starting point for the training course curriculum development was the conduct of a short pre-application needs analysis to verify the true training needs in the specific area of STEM in relation with the identified users of the project. Most of the answers informed us about documentation of learning practices. As to the perception that professionals have on their own skills and competences in the fields of documenting and videoing robotics in STEM education and engagement. The descriptions of the needs for training and professional development in this area served as an important benchmark for the development of a competence index of areas addressed in all the educational material provided. The majority of the respondents work within the context of STEM and also provided information about the sector leaving us with more material to use in the development of the methodology.

A summary of needs analysis identified the following outcomes:

IDENTIFIED NEEDS/DIFFICULTIES

- *A need for an easy to use simple cheap methods that could help with documentation*
- *A need for training on documentation processes*
- *A need for training on observation and reflection practices*

KEY CHALLENGE/OPPORTUNITIES

- *A lack of common method*
- *A way to release staff from time consuming task*
- *Incorporating the material into existing training courses*
- *Exploiting the outcomes of Ready Set Robot*

The course developed is focused material to be found on the Ready Set Robot OER platform. A typical course to be run in Estonia, Finland, Sweden or Latvia and consists of formal lectures, workshops, study trips and time for mutual interprofessional reflection.

3.4 LEARNING OUTCOMES

- *Understanding formal national / EU framework for STEM education using a rights-based approach*
- *Rights & Responsibilities at institution level*
- *Developing a personal training framework for the Ready Set Robot Methodology*
- *Using appropriate terminology and Glossary of terms*
- *Managing your Robotics programme*
- *Understanding collaboration values between pedagogic methodology issues when working with STEM*
- *Explore the Ready Set Robot platform aids for documentation*
- *Ready Set robot conceptual models for videos*
- *Ready Set Robot Methodology for documentation*

Specific:

- *The learning environment for documenting and videoing robotics in STEM*
- *Examples of learning activities*
- *Teaching and training videos*
- *Documentation skills; practical skills, digital skills, writing narratives*
- *Observation and reflection skills*
- *Training Course Curriculum Simple and objective explanation of the documentation skills and tasks to be developed*
- *Self-confidence and feel supported/welcome*
- *Give them enough time to understand the technology*
- *Understanding own progression*
- *Active participation in the experiential learning process*
- *Understanding the process of own skills validation*
- *Recording tool to keep track of tasks completed during projects and actions*
- *Programs for teacher in STEM education need to be revised to equip teachers with the knowledge and experience necessary to observe and document learning situations*
- *To adopt innovative learning models*
- *Ensure sustainability of the program*
- *Improvement of working and communication protocols for greater adaptation to the pupil's development*
- *Promotion of team working and integration*
- *Equipping employees with new documentation-related skills*
- *Recognising and recording what skills the learner actually demonstrates*
- *A wish to contribute to society, community and the people in it*
- *Adapt to the individual being documented*

Educator's Needs:

- *Appropriate training, raising awareness what tools are available, various phones, cameras, editing apps and programs etc.*
- *Real and active involvement and motivation of the pupils engaged in documenting and videoing robotics*
- *Skills to promote the collaboration of parents*
- *Dividing the documentation into smaller parts, reducing the number of tasks to be performed, increasing the number of exercises and repetitions of the material, adjusting to each pupil and the group*
- *Constant supervision and monitoring necessary to ensure every child achieve realistic goals of development*
- *Finding time and resources to ensure consistently*
- *Knowledge how to work with documenting children with special needs individually and in groups*
- *Gathering good experience, creating new educational materials*

Educator's Competences:

- *Willingness to collaborate in documenting and videoing robotics activities with children*
- *Observation and adaptability*
- *ITC, including apps and online collaboration tools such as Ready Set Robot OER and documentation tool*
- *Educational-pedagogic*
- *Develop, adopt and/or adapt learning and training materials and practices addressing documenting and videoing robotics*

3.5 TERMS OF REFERENCE TO BE CONSIDERED WHEN DELIVERING THE MATERIAL

Learning outcomes are statements of what a learner knows, understands and is able to do on completion of a learning process. Learning outcomes are defined in terms of knowledge, skills and competences.

Knowledge means the body of facts, principles, theories and practices that is related to a field of work or study. It is described as theoretical and/or factual knowledge.

Skill means the ability to apply knowledge and use know-how to complete tasks and solve problems. They are described as cognitive (logical, intuitive and creative thinking) or practical (involving manual dexterity and the use of methods, materials, tools and instruments).

Competence means the proven ability to use knowledge, skills and personal, social and methodological abilities in work or study situations and in professional and personal development. It is described in terms of responsibility and autonomy.

Therefore, each section should not solely be a statement of facts or content but should be preceded with a verb and possibly adverb/adjective.

Examples:
Knowledge: He/she is able to…
… describe the functioning of components, assemblies and systems.
… assign the necessary documents for service and maintenance.
… differentiate between chemical substances.
Skills: He/she is able to…
… receive orders and plan own procedural steps.
… analyse data and present it as a basis for decisions.
… use information and communication technologies.
… develop a marketing plan and use marketing tools.
Competence (in the sense of taking over responsibility and autonomy): He/she is able to…
… apply problem solving strategies
… reflect upon his/her own action
…cope with and withstand strain and stressful situations in a way that is not harmful to health
…communicate with appreciation colleagues or team members; with patients, family members/reference person groups involved in the care process.

3.6 READING THE READY SET ROBOT COMPETENCES MATRIX AND TERMS OF REFERENCE

A competences matrix according to the EQF as a set of learning outcomes – in terms of knowledge, skills and competences/attitudes – that the trainees are expected to achieve by going through the READY SET ROBOT training. In order to implement the EU framework for the READY SET ROBOT Curriculum and associated competences matrix, partners will need to compare their NQF and the EQF. As most EU countries has synchronised their national framework with EU directives, this should be standard.

The EQF each of the 8 levels is defined by a set of descriptors indicating the learning outcomes relevant to qualifications at that level in any system of qualifications, in terms of Knowledge, Skills and Competences.

Level 1 *General basic knowledge General basic skills for accomplish a simple task Work/study under direct supervision in a structured context.*

Level 2 *Basic factual knowledge in a working/study area; Basic cognitive and practical skills needed for the application of the adequate information to the accomplishment of tasks and current problem solving through simple rules and instruments; Work/study under direct supervision with some autonomy.*

Level 3 *Knowledge of facts, principles, processes and general concepts in a study/work area; Range of cognitive and practical skills necessary for the task accomplishment and problem solving through selection and application of instruments, materials and basic information; Taking responsibility for executing tasks in a study/work area; Adapt the behavior to circumstances in order to solve problems.*

Level 4 *Factual and theoretical knowledge in broad contexts within a field of study/work; Range of cognitive and practical skills necessary for the conceiving for specific problem solving in a study/work area; Manage own work within the guidelines established in the context of study/work, usually predictable but liable to change; Supervise the routine work of third parts and taking responsibilities in terms of evaluation and activity improvements in study/work contexts.*

Level 5 *Comprehensive, expertise, factual and theoretical knowledge in a study/work area and awareness of the knowledge limits; Large range of cognitive and practical skills for conceiving creative solutions for abstract problems; Manage and supervise in study/work contexts subject to unpredictable changes. Revise and develop the thirds development.*

Level 6 *Deep knowledges for a specific study/work area which demands an critical comprehension of theories and principles; Advanced skills which show mastery and innovation for complex and unpredictable problem solving in a study/work specialized area; Management complex technical or professional activities or projects, taking the responsibility for decision making in unpredictable study/work contexts; Taking responsibilities in management for individual, professional and collective development.*

Level 7 *Highly specialized knowledge, some of them are in the forefront of some study/work knowledge, that underpin the capacity for original thinking; Specialized skills for problem solving in terms of investigation and innovation, to develop new knowledges and procedures in order to integrate them in different areas; Manage and transform study/work complex and unpredictable contexts which demand new strategies; Taking responsibilities in order to contribute to new knowledges and professional practices and/or review the strategic team performances*

Level 8 *Cutting-edge knowledge at the forefront in a study/work area and in the interconnection of areas; The most advanced and specialise techniques, including synthesis and evaluation skills, necessary to solve critical problems in the investigation and innovation areas, for the enlargement and redefinition of the existing professional practices; Demonstrate a considerable level of authority, innovation, autonomy, scientific and professional integrity and assume a sustained commitment regarding the development of new ideas or processes in the forefront of study/work contexts, including the investigation field.*

3.7 READY SET ROBOT EXAMPLE COURSE CURRICULUM AND COMPTENCE FRAMEWORK

Below is a curriculum example within a framework of EQF. The document is designed to both display the curriculum framework and to act as a means of monitoring participants and their development throughout the training week. Ready Set Robot example Training Curriculum consists of 56 hours training. The training includes lectures, workshops, individual and group projects and study trips.

Activity/Unit	*Learning Objectives*
Pre-course Preparation	*To research training and access to documenting and videoing robotics in STEM in the setting of the participants own country*
Course Introductions objectives and Group tasks	*To understand the general setting, content of the Ready Set Robot course and its individual and group tasks*
How schools work with documentation	*Looking at examples of good practice*
Rights & Responsibilities at institution level	*To understand the rights and responsibilities when using video documentation. Copyright, videoing children, responsibilities to the parents and school authorities, using social media.*
Developing a personal training framework for learning observation and documentation skills	*To understand the importance of developing an individual training program and how to implement it*
Using appropriate terminology and Glossary of terms	*To understand the terminology of training in a contemporary setting*

READY SET ROBOT OER platform	*To be able to use the training material on the RSR platform*
Practical Skills 1	*Video Documentation using Smartphones*
Practical Skills 2	*How to Film Interviews For beginners*
Practical Skills 3	*How to Film Lego on a mobile phone or tablet for beginners*
Examples of Good documentation videos documenting learning activities	*To be able to compare several different videos documenting learning activities and choose where and how to implement them*
Observation and reflection skills	*To develop better skills in observing children from specific learning perspectives*
Documentation skills; practical skills, digital skills, writing narratives	*To be able to document children's activities and work using several tools, e.g:* • *Collecting narratives,* • *Using video creatively,* • *Using tablets,* • *Using smart phones.*
The learning environment	*To understand and show how document diverse learning environments, inside and outside the classroom*
Course round up, monitoring, validation and Europass	*Validation and assessment*

4.0 A FINAL WORD FROM THE PARTNERS

NPO Robootika www.robootika.ee is the roof organisation in Estonia for Educational robotics. Our main goal is to attract schools to take part in robotics activities and to use robots in their curriculum and in extracurricular activities.

Educational robotics in Estonia started in 2008 when first robots went to the schools and teachers were first trained by NPO Robootika. Since then there is a growing need for digital learning materials. Estonia adapted step by step different robotics activities into curricular and extra-curricular activities. One of the biggest success has been FIRST LEGO League that is an interdisciplinary program including robotics, science, teamwork and other life skills. The Methodological framework handbook will help teachers and students to better organize their work and gives a new perspective to the activities. Thanks to the handbook the popularization of robotics will grow in social media and in other web platforms.

ROBOTIIKKA- JA TIEDEKASVATUS RY

Robotiikka- ja tiedekasvastus ry www.fllsuomi.org is a non-profit organization to improve the interested in robotics and science. The audience are the pupils and teachers at schools, but the also the parents and others. We organize ompetitions, camps and educational activities around the Finland.

Educational robotics is rising Finland. We have multiple robotics disciplines, mainly using FIRST LEGO League, sumo and robotics dance. However, the Finnish robotics scene using social media to document is quite new. For this reason, the Methodology Framework will have a positive effect. The ideas presented here are easily adapted to teachers, pupils, and parents in Finland. Within a few years, we expect the Finnish robotics scene to explode on social media.

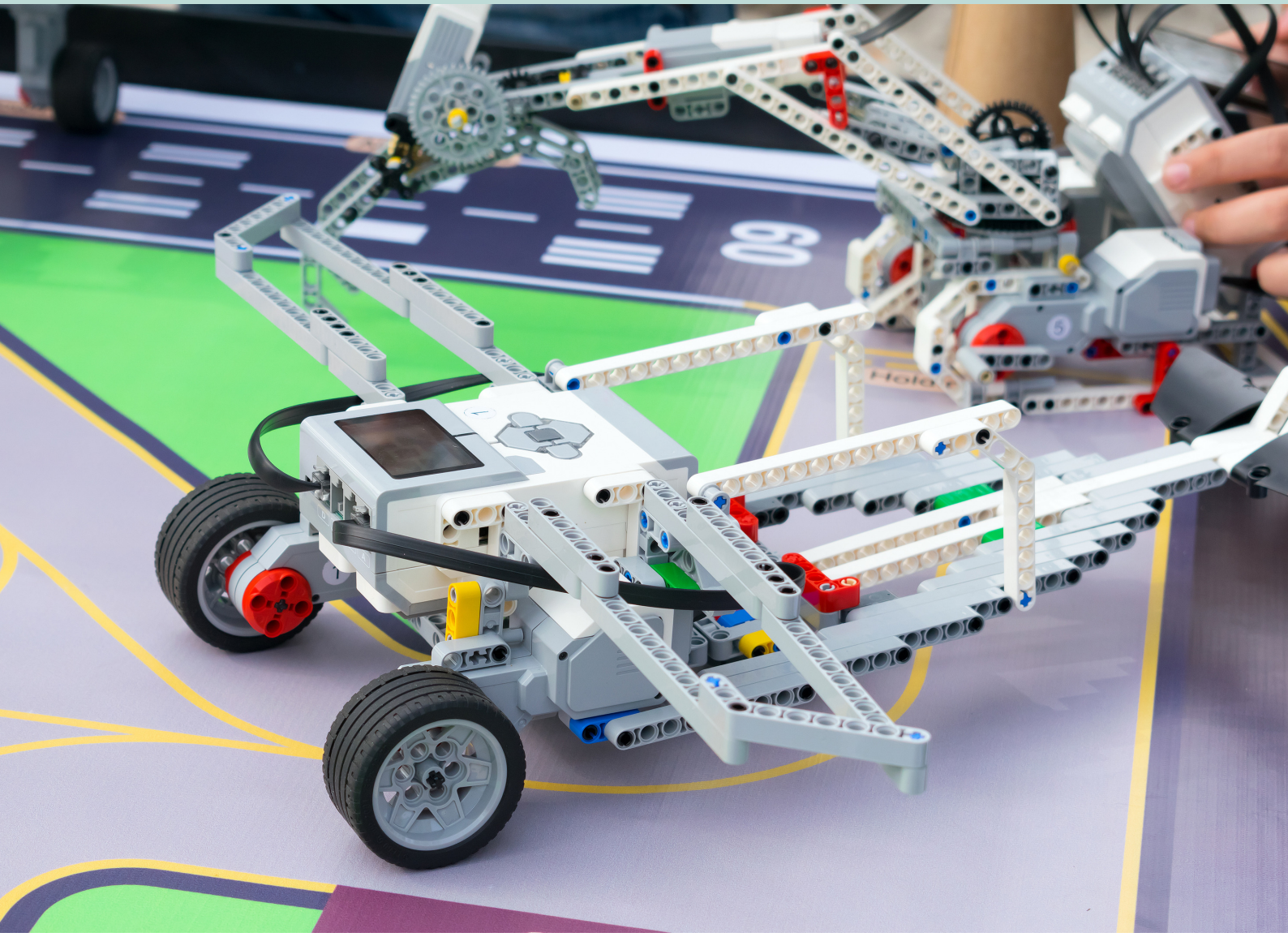
Elderberry AB www.elderberry.nu undertake teacher training and curriculum development, authoring, testing, editing and publishing within the following sectors; school, adult, VET, youth, culture and heritage and special needs, often with socio-cultural and urban implications. Members of staff are published (best-selling) educational authors. Elderberry AB has experience in developing teaching material for schools and colleges, special needs, heritage and culture, environmental, migrants and refugees and advanced IT skills/coding and robotics. The company is experienced with traditional methods (ISBN) for educational material and training as with eLearning and mobile learning.

Robotics through such actions as FIRST LEGO League is a growing phenomenon in Sweden. The Ready Set Robot Methodology Framework allows others to share in the events and for young people to share their results to inspire others. The methodology also gives teachers the skills to observe and document such programs and a clear pedagogical framework for their use.

Robotiem's www.robotiem.lv main activities each year is the FIRST LEGO League program, it includes:

- *School teacher trainings (more than 100 teachers this year)*
- *Robot workshops in schools for kids*
- *Competitions (more than 300 participants in 1 competition)*
- *Summer camps for kids*
-

Robotiem is supported by companies, local governments and other institutions. Schools and other educational institutions in Latvia are in growing need of digital learning materials, this is why this methodology will be included not only in teacher training workshops (like for FIRST LEGO League program and other), but will also be distributed in webinars and other online channels, such as social media and web page (RSR and partners). We believe that this methodology would be very helpful especially in the current pandemic situation.



Ready Set Robot (agreement number: 2018-1-EE01-KA201-047128) has been funded with support from the European Commission. This document reflects the views only of the author and the Commission cannot be held responsible for any use which might be made of the information contained herein.