

Step-by-Step guide

It takes six steps to conduct a [vidumath](#) project in your classroom: Preparation, introduction, planning, filming, post-production and reflection. Here is an overview and on the pages after a more detailed description of the steps.

<p><i>Step 1:</i></p> <p>Preparation by the teacher</p> <p>T</p>	<p><i>Understand the project: read guides, watch videos</i></p> <p><i>Decide on mathematics topic</i></p> <p><i>Decide which video technique to use</i></p> <p><i>Regard class dynamics when deciding on groups</i></p> <p><i>Set project timetable</i></p>
<p><i>Step 2:</i></p> <p>Introduction to the students</p> <p>T ▶ S</p>	<p><i>Introduce the project</i></p> <p><i>Show some existing videos</i></p> <p><i>Introduce the mathematical topic, task or problem</i></p> <p><i>Explain the video technique to be used</i></p> <p><i>Explain a storyboard, show examples</i></p> <p><i>Arrange groups</i></p>
<p><i>Step 3:</i></p> <p>Planning by the students</p> <p>S ▶ T</p>	<p><i>Students prepare a mathematics example, work on task or solve problem</i></p> <p><i>Students create a Storyboard, teacher acknowledges</i></p> <p><i>Students set up and rehearse the video scene (lighting, camera, framing)</i></p>
<p><i>Step 4:</i></p> <p>Filming</p> <p>S ◀ T</p>	<p><i>Students take pictures, film their video</i></p> <p><i>Teacher scaffolds</i></p> <p><i>Students check video and film again, if necessary</i></p>
<p><i>Step 5:</i></p> <p>Post-production</p> <p>S</p>	<p><i>Students transfer pictures or video for editing, if necessary</i></p> <p><i>Students edit</i></p> <p><i>Students add audio</i></p> <p><i>Students check and upload video</i></p>
<p><i>Step 6:</i></p> <p>Reflection</p> <p>S ◀▶ S</p>	<p><i>Students watch the final videos in the classroom</i></p> <p><i>Students appreciate each other's videos</i></p> <p><i>Students reflect on their experiences and learning</i></p>

(T = Teacher; S = Student)

T

Understand the project: read guides, watch videos

Decide on mathematics topic

Decide which video technique to use

Regard class dynamics when deciding on groups

Set project timetable

It is advised that you read this booklet and watch some completed videos, before starting the project. In addition, your evaluation and scaffolding is an integral part of the project, although, we have experienced significant student autonomous and collaborative work in the piloting stages. We recommend a light touch!

It is also important to understand that although the mathematics in the project is pre-eminent, the motivation for the children, is making their own video. The mathematics learning happens because the students have to spend time thinking about the mathematics they want to present and viewing the mathematics from alternative perspectives to those they have in the normal classroom. Most especially, children need first to understand deeply the mathematical concepts in order to make the video correctly.

There are some points teachers should prepare before starting the project:

- ☐ *What mathematics subject do you want to reinforce in the class? There are different possibilities as to when to use video in the learning process (see page 12 and the [vidumath](#) matrix). Experience has shown that the chosen topic should be something that the students find quite difficult.*
- ☐ *Which video filming technique do you want to use? There are three different possibilities: one-shot, stop-motion or creative exploration (see the [vidumath](#) matrix, page 13). The choice should initially depend on your experience but do consider that the students are often ahead of you.*
- ☐ *How do you want to divide the participating class into groups of two to four children? Experience has shown that homogenous groups work best, i.e. students who are together in a group have the same level of mathematics competence and enthusiasm for the work.*

- ☐ *How much time do you want to use for the project? Experience has shown that planning takes about 45 minutes. More time for the planning may be needed if the students have to solve a mathematical problem. That depends on how difficult the problem is. Only a little planning is needed if the children are given a discovery task. Filming takes between 30 and 120 minutes. A one-shot video is produced very quickly; stop-motion takes more time. Time needed for creative explorations depends on how advanced it is. Post-production takes about 30 minutes. How much time is needed for reflection depends on how many videos there are and how complex the mathematics is.*
- ☐ *You have to ensure that materials are available – both normal, class project, materials and some of the following for the mathematical visualisation: coloured paper, coloured markers and pencils, paper clips, adhesives, scissors, rulers, beads, Dienes' blocks, Math Link Cubes, play dough, interlocking plastic bricks, etc. If it is permitted in your school, it is very motivating for the children to use sweets, e.g. chocolate beans, jelly beans, gummi bears. Some projects may require things from everyday life, such as plates, cups, forks, etc.*

Step 2: Introduction

<div style="font-size: 48px; font-weight: bold; margin-bottom: 10px;">T ▶ S</div> <div style="font-size: 24px; font-weight: bold;">20' – 40'</div>	<i>Introduce the project</i>
	<i>Show some existing videos</i>
	<i>Present the mathematical topic, task or problem</i>
	<i>Explain the video technique to be used</i>
	<i>Explain a storyboard, show examples</i>
	<i>Arrange groups</i>

There are some things you have to tell your students before they can start working.

- ☐ *First, you should introduce the project in general: **vidumath** means **video education in mathematics**, i.e. the students are going to produce videos that are related to mathematics. It is a European project that means children from different countries work on the same project. You will show videos that were made by children in other countries and your students' videos will be shown in other countries. If your school already has a tandem partner school, you can introduce this school. You can also use the Student guide available as a PowerPoint presentation or online as a Flipbook <https://www.flipsnack.com/AEAE958B7A/vidumath-student-guide.html>*

- ❏ Show some existing [vidumath](#) student videos to the class. The examples should show the technique you want the students to use. They shouldn't show the same mathematics topic otherwise they can stifle children's creativity.
- ❏ Present the mathematical topic, task or problem. If you use [vidumath](#) to introduce a new topic, it is useful to present the topic one or more days before the work on the videos actually starts. Then children can collect some ideas in advance.
- ❏ Explain the video filming technique that the children will use. Experience has shown that this doesn't take much time. Most children of age between 9 and 12 years have already had experience with video filming, some even with stop-motion.
- ❏ It is very important that you explain what a storyboard is. You can find a lot of examples and templates on the internet.
- ❏ Divide the class into groups of two to four children as you have decided beforehand.

Step 3: Planning



*Students prepare a mathematics example,
work on task or solve problem*

Students create a storyboard, teacher approves

*Students set up and rehearse the video scene
(lighting, camera, framing)*

This step is primarily student work. Let the students work autonomously, offer help only if asked and scaffold only if you see that students are on a wrong track.

We have to distinguish three different cases (see the [vidumath](#) matrix, page 13):

- ❏ **Introduction:** *If the children have been assigned a discovery task, such as finding numbers in the neighbourhood, there will not be a long planning phase in the classroom. They have to go on an expedition. The group discussion will happen on the expedition. **Only in this case, the storyboard can be skipped and the project continues with step 4.***

- **Problem solving:** *If the children have to solve a mathematical problem, the group will do this first. Working on a storyboard can help to solve the problem, but normally, students will discuss how to visualise the solution, after they have solved the problem.*
- **Consolidation:** *If the children visualise a mathematical concept, idea or procedure, the group will collect ideas and very quickly start working on their storyboard.*

The group discussion between the students is the key part of the project. This is when most of the mathematics learning occurs. The storyboard plays an important role in this process. It provides a powerful and new way to bring out mathematical thought. If you observe during the process that the students have made a mistake or are on a wrong track, first give them some moments to find it themselves. Sometimes a little hint is enough. Mistakes are an important part of the learning process.

Mistakes are opportunities for learning, as students consider the mistakes and correct them. But they are more than that. Recent neurological research found that when you make a mistake your brain is activated two times. The first time is an increased electrical activity when your brain experiences a conflict between a correct response and a mistake. This brain activity occurs even if you don't know that your response was wrong. The second activity happens when you notice that you made a mistake and think about it.

□ *The brain sparks and grows
when we make a mistake,
even if we are not aware of it,
because it is a time of struggle;
the brain is challenged
and the challenge results in growth.*

— Jo Boaler

In order to free students to contribute ideas without the fear of being wrong, it is important that you create a mistake friendly environment. That means that you value mistakes, value all of the students' thinking and help them to know that mistakes improve their brains. However, in order to prevent later frustration during filming and reflection, students should discover mistakes while planning the video, not later. Therefore the teachers' evaluation of the storyboard is crucial. ***No group should receive permission to start filming before a teacher has approved the storyboard!*** You have to ensure that the solutions

and concepts are mathematically correct and complete, and the plans are not too ambitious. To judge how ambitious the plans are can be difficult as the students are usually more familiar with video work than adults.

The last part of this step is the practical preparations for filming. A steady camera is often the hardest part, were teachers in the piloting have had to help physically. If camera tripods are not available, you may have to suggest building a platform to hold the camera steady in the same position. In previous piloting, students have used large open books or piles of books, chairs, and tables. Sticky tape can help as well. A steady camera is particular important if you want to film a stop-motion video.

The children have to setup a film set and prepare props. It could be as simple as a coloured piece of paper acting as a backdrop. Sometimes, students want to build a whole set. You will need to provide limited oversight to ensure that their creative ideas can be completed and built within the time limitations.

One-shot videos often show how students manipulate objects to solve the mathematical problem or visualise the mathematical concept. If privacy is an issue, you have to ensure that the set is arranged in a way that the video will not show children's faces. Showing hands is fine, everywhere.

The students have to find solutions for lighting and framing, too. Too little light is sometimes a problem. Trial and error is the best way to arrive at a good result.



S ◀ T

30' - 120'

*Students take pictures, film their video**Teacher scaffolds**Students check video**and film again, if necessary*

This is the most enjoyable part of the project. The children work autonomously on their videos. The teacher can scaffold if asked by students for help. Experience has shown that unexpected obstacles may occur. Not all students will precisely follow their storyboard, and some good looking storyboards turn out to be difficult to implement.

The purpose of this step isn't only to enhance students' motivation and enjoyment. Students have to transfer their mathematical ideas and concepts from the storyboard to reality. That deepens their understanding of the mathematical relationships. Especially when obstacles occur, the cognitive conflict will lead to deeper insight.

You will find more information about how to make videos in the technical support section (see page 33).

Step 5: Post-production

S

30'

*Students transfer pictures or video for editing, if necessary**Students edit**Students add audio**Students check and upload video*

Post-production is different for one-shot videos, stop-motion and creative explorations (see the [vidumath](#) matrix, page 13):

- ☐ A **one-shot video** needs no post-production at all. Even if not needed, it is possible to make some editing for fun, if the students want, are able and you have enough time (see below)

☐ A **stop-motion video** needs to be edited to become a video.

o If the children are using a stop-motion app on a smartphone or tablet computer, this app can be used for post-production. The app's user guide will tell you how to do it.

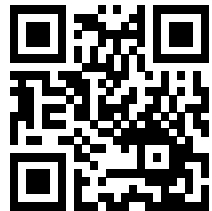
o If students use a digital camera, the post-production will be done in the video editing software on the computer. First, the children have to transfer the pictures from the camera to a computer. The teacher has to ensure in advance that this will work. On the computer the pictures will be copied into the video editing software. You will find more detailed information in the technical support section (see page 33). Most children will manage this work autonomously with little or no help.

☐ When doing **creative explorations**, everything is possible. The only limit for post-production is set by the students' video editing skills and the given timeframe.

After the visual part of the core video is finished, the fun part starts. This is not a requirement but students enjoy it. If there is not enough time for this during the mathematics lessons, this could be part of arts or music lessons or done at home. Usually the students want to add an opening title, end credits and audio to the video. By audio we mean music and sound effects. Please ensure that only audio with an open license is used to avoid problems. We recommend providing a limited set of audio files. Searching the internet for suitable music takes much too long.

When the final video is finished, it has to be saved as a video file! We recommend mp4 format. Finally, all video files have to be transferred to the device that is used to show videos in the classroom.

The very last step is to share the videos with the tandem school (if applicable) or with the world by uploading them to the internet, e.g. YouTube. The videos, and something about your class and school, should be uploaded on to the project wiki, <http://vidumath.wikispaces.com/>. If you haven't done yet, you will need to register and let the project know the name of your school so we can add your own page, for you. This can be done after the lesson is finished.






45'

*Students watch the final videos in the classroom
 Students appreciate each other's videos
 Students reflect on their experiences and learning*

It is a very important stage for the students to have their videos shown to the class. This can be taken further by sending the links of the uploaded videos to the parents, or adding them to the school website. This strengthens the students' self-esteem and contributes to the sustainability and effectiveness of the project.

Each group presents their video. The students act as teachers for the rest of the class. Please ensure that every video will be appreciated and complimented on by the class. The first time a video is shown no negative comments should be allowed. Afterwards, suggestions for improvement can be made, but the following rule should be observed: You have to say at least two positive comments before you can express one criticism.

It is a beneficial part of the mathematics learning process to reflect on the videos. How do my classmates understand the video? Was that what I had intended? Why do they interpret things differently? Reflecting on different perspectives, different visualisations, different ways of solving a problem and different solutions to one and the same problem deepens the understanding and often leads to new insights.

 *We do not learn from experience
 [...] we learn from reflecting on experience.*

— John Dewey

