vidumath — STEP BY STEP GUIDE

It takes six steps to conduct a vidumath project in your classroom: Preparation, introduction, planning, filming, post-production and reflection. We give here an overview first and a more detailed description of the steps afterwards.

Step 1: **Preparation** by the teacher **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
Step 2: **Introduction** to the students **T → S**	Introduce the project Show some existing videos Introduce the mathematical topic, task or problem Explain video technique to be used Explain storyboard, show examples Arrange groups
Step 3: **Planning** by the students **S → T**	Students prepare mathematics example, work on task or solve problem Students create a Storyboard, teacher acknowledges Students set up and test the video scene (lighting, camera, framing)
Step 4: **Filming** **S ← T**	Students take pictures, film their video Teacher scaffolds Students check video and film again, if necessary
Step 5: **Post-production** **S**	Students transfer pictures or video for editing, if necessary Students edit Students add audio Students check and upload video
Step 6: **Reflection** **S ↔ S**	Students watch the final videos in classroom Students appreciate each other's videos Students reflect their experiences and learning

STEP 1: PREPARATION

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 correct.

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

- What mathematics subject to reinforce with the class. There are different possibilities when to use video in the learning process. Experience has shown that it should be an area that the students find quite difficult.
- Which video filming technique to use: *one shot*, *stop-motion* or *creative explorations*. The choice should initially depend on your experience but do consider that the students are often ahead of you.
- How to divide the participating class into groups of 2 to 4 children. Experience has shown that groups work best when students have the same level of mathematics competence and enthusiasm for the work.
- How much time to use for the project. Experience has shown that planning takes about 45 minutes. More time for the planning is needed if the students have to solve a mathematical problem. That depends on how difficult the problem is. Little planning is needed if the children have got a discovery task. Filming takes between 30 and 120 minutes. A one shot video is produced very quick, stop-motion and creative explorations take more time. 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.
- Ensuring materials are available – both normal class project materials and concretes for mathematical visualisation: coloured paper, coloured markers and pencils, paper clips, adhesives, scissors, rulers, beads, Dienes' blocks, Math Link Cubes, play dough

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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 require things from everyday life, such as plates, cups, forks, etc.

STEP 2: INTRODUCTION

20' – 40' **T → S**	Introduce the project Show some existing videos Present the mathematical topic, task or problem Explain video technique to be used Explain storyboard, show examples Arrange groups

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 ***vi**deo e**du**cation in **math**ematics*, 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 or online as a Flipbook https://www.flipsnack.com/AEAED958B7A/vidumath-student-guide.html.
- Show to the class some existing vidumath student videos which you find on YouTube: https://www.youtube.com/playlist?list=PLSSaIZb01gn44Tr5rUbGSVDBmREBtiI8V. The examples should show the technique you want the students to use. They shouldn't show the same mathematics topic otherwise they would 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. In so doing, children can collect some ideas in advance.
- Explain the video filming technique that the children shall use. Experience has shown that this doesn't take much time. Most children of age between 9 and 12 years have already experiences 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 2 to 4 children in the way you have decided beforehand.

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STEP 3: PLANNING

~ 45' S → T	Students prepare mathematics example, work on task or solve problem Students create a storyboard, teacher approves Students set up and test 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 discover that students get on a wrong track.

We have to distinguish three different cases:

- 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.
- If the children shall visualise a mathematical concept, idea or procedure, the group will collect ideas and very soon start working on the storyboard.
- If the children have got 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 that tour. **Only in this case, the storyboard can be skipped and the project continues with step 4.**

The group discussion is the key part of the project. Here most of the mathematics learning happens. The storyboard plays an important role in this process. It provides a powerful and new way to bring out mathematical thoughts. If you observe during the process that the students have made a mistake or got on a wrong track, give them first some time to discover it by themselves. Sometimes a little hint is enough.
Your evaluation of the storyboard is crucial. **No group gets 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 that the plans are not too ambitious. The latter can be a difficult choice as the students are usually more familiar with video work than adults.
Last part of this step is the practical preparations for filming. A steady camera is often the hardest part, were teachers 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. Usually, students have used large books standing open. Piles of books, chairs, tables and sticky tape can help as well.
The children have to setup the filming 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.
The students have to find solutions for lighting and framing, too. Trial and error works fine.

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STEP 4: FILMING

30' – 120' S ← T	Students take pictures, film their video Teacher scaffolds Students check video and film again, if necessary

This this the most enjoyable part of the project. The children work autonomously on their videos. The teacher helps if students ask for help and scaffolds if needed. 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.

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.

STEP 5: POST-PRODUCTION

~ 30' S	Students transfer pictures or video for editing, if necessary Students edit Students add audio Students check and upload video

If students use a digital camera, this step is necessary. The children have to transfer the pictures from the camera to a computer (PC or MAC). The teacher has to ensure in advance that this will work. A USB cable or a SD card reader can be used for example. On the computer the pictures will be copied into video editing software to create a video. Most children will manage this work autonomously with no or little help.

After the visual part of the core video is finished, the fun part starts. This is not a requirement but students enjoy it. They want to add a title, credits and audio, i.e. music and sound effects. Please ensure non-copyright audio is used to avoid problems. We recommend providing a limited set of audio files only. Searching the internet for suitable music takes much too long time. If the children are using a video or stop-motion app on a smartphone or tablet computer, this app can be used for post-production. Otherwise, this will be done in the video editing software on the computer.

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.

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The very last step is to share the videos with the tandem school by uploading them to the wiki, or with the world by uploading them to YouTube. This can be done after the lesson is finished.

STEP 6: REFLECTION

~ 45' S ↔ S	Students watch the final videos in classroom Students appreciate each other's videos Students reflect 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 by the class. With the first reactions to each video, no negative comments are allowed. Afterwards, suggestions for improvement can be made, but the following rule should be observed: You have to speak out 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 leads often to new insights.

"We do not learn from experience…
we learn from reflecting on experience."
— John Dewey

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