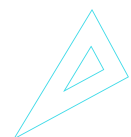
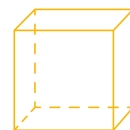
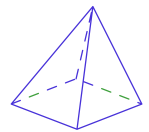


Integrating  
digital tools in  
your science &  
math pedagogical  
practices

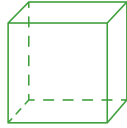


# Good practice toolkit



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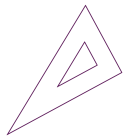


“ [...] we must avoid two temptations: idealising these technologies and demonizing them. Waiting for miracles on screens would indeed be just as useless as trying to avoid them. They are only tools. Let's not ask them for more than they can give, but let's learn to ask them for everything they can offer us! Well, to start with, let's introduce them in the right place at the right time. “

Serge Tisseron

## FOREWORD

In 2022, four workshops brought together, both in Belgium and Bulgaria, dozens of mathematics and science teachers to discuss the integration of digital tools in education. All of them had varying levels of use of digital technologies in classes, and different subjects were discussed. Hereinafter are summarised the ideas that those teachers developed together and the lessons learned.



This best practices guide aims to help you navigate the wide range of possibilities offered by digital tools in the school environment today. There will be no question of being exhaustive, as there are so many variations, but rather we wanted to give you some very concrete examples to allow you to get started quickly and independently in your courses.


Participants were aware that integrating digital content is not an innate ability and that everyone's experience is different. But one thing is certain, teaching practices can be enriched thanks to technologies. This is not about replacing the teacher, but about giving them the tools to promote and support learning through new approaches. Indeed, digital skills are more necessary today than ever before to be a critical, active and responsible citizen.

We hope that the results of our exchanges will reassure you, will encourage you to make use of new digital tools in your practice and you will want to lend assistance to your colleagues who would also like to get involved. Our approach is aimed at all teachers, regardless of their teaching habits, to help them overcome any possible fears and to demystify everything directly or indirectly related to technologies and digital tools.



In the opening part, the integration of digital tools into education will first be examined from a theoretical perspective. Then, we will propose six activities that you can take up and apply in class as you wish. Finally, as this tool is intended to evolve and be enriched thanks to a network of digital ambassadors, the third part will be dedicated to this dissemination mission. What makes a good ambassador? How can an ambassador help his colleagues? We will try to give you the necessary keys so that you can manage to act as a digital helper or referent assistant.

# Integration of digital tools in education



Computer equipment in school infrastructures does not always keep pace with modern times, despite the digital overexposure – there are still schools that do not have access to Wi-Fi, hardware, software or support for the deployment of digital tools. Very often, the teaching staff takes the initiative to remedy these shortcomings in order to set up motivating and meaningful activities in class.

During the workshops organised under this project, the groups identified certain positive and negative aspects, which then served as a starting point for the reflections in this guide. Among the advantages are the following:



*Observation and understanding of concepts that are sometimes abstract. For example, in science, digital tools make it possible to observe and carry out simulations that would otherwise be impossible to reproduce in the classroom;*

*Creation of individualised and more inclusive courses thanks to certain programmable or automated tools;*

*Personalisation of content and methods, even of pedagogical tasks;*

*Gamification of activities, with immediate feedback; possibility to reappropriate a notion or to simply present it in a different way;*

*Ensuring that students are protagonists in the use of digital technologies, and not just consumers;*

*Differentiation, exchanges and collaboration.*



*How to prevent students from getting bored and maintain motivation with these new tools?*

*How not to “get lost” in this digital ocean? How to carefully choose the tools to use?*

*When to integrate these new tools?*

*Not relying on the idea that students know how to use digital technologies because it is „their generation“.*

To improve their pedagogical practices, teachers must be equipped with the skills they need to take full advantage of the potential offered by digital technologies. This will also enable them to prepare the students for the digital society they have ahead of them. The TALIS Survey (Teaching and Learning International Survey) conducted by the OECD in 2018 points out that the use of information and communication technologies (ICT) in school setting is rarely included in the training and education of lower secondary teachers in EU countries. On average, across Member States, slightly less than half (49.1 %) indicate that ICT have been part of their training courses<sup>1</sup>.

So what steps could be taken to improve the use of digital tools in a useful way? **How can we encourage the use of technologies? How could digital tools be used without being an end in themselves, but becoming a real support for students and teachers?** Hereinafter, we will try to help you get around them as best as possible, and give you the best ways to get started. The proposed theoretical approaches will allow you in a second step to better understand the detailed activities, but will also give you the opportunity to check your knowledge and measure your expectations.

<sup>1</sup><https://op.europa.eu/webpub/eac/education-and-training-monitor-2020/en/chapters/chapter1.html>

# THEORETICAL MODELS



It seems essential that people responsible for educating today's "connected" learners are aware of the potential of digital technologies and the opportunities they offer in terms of access to expanded and enriched content.

As mentioned in the introduction to this guide, technologies must be used as learning tools that complement traditional practices and their integration into teaching practices should be reasoned, structured and adapted to the needs and objectives. If there is a digital tool, it must be included from the beginning of the learning sequence designing, and not just used to overlap an existing course.

Here we are going to discuss two theoretical models that will allow you to understand the integration of digital technologies, whatever way you choose to introduce them. These models will be very useful for you to get prepared: they contextualise the activities presented in the second part and help you to ask and answer questions about the contribution of digital tools to your pedagogical approach.

## ▶ TPACK

The TPACK Model, or Technological Pedagogical And Content Knowledge, is a reference framework that combines three aspects, each of them representing the different forms of knowledge that the teacher needs to possess. It is based on the idea that they are complementary and overlapping in the process of developing a pedagogical sequence integrating digital technologies. These three types of knowledge are as follows:

### Technological Knowledge (TK)

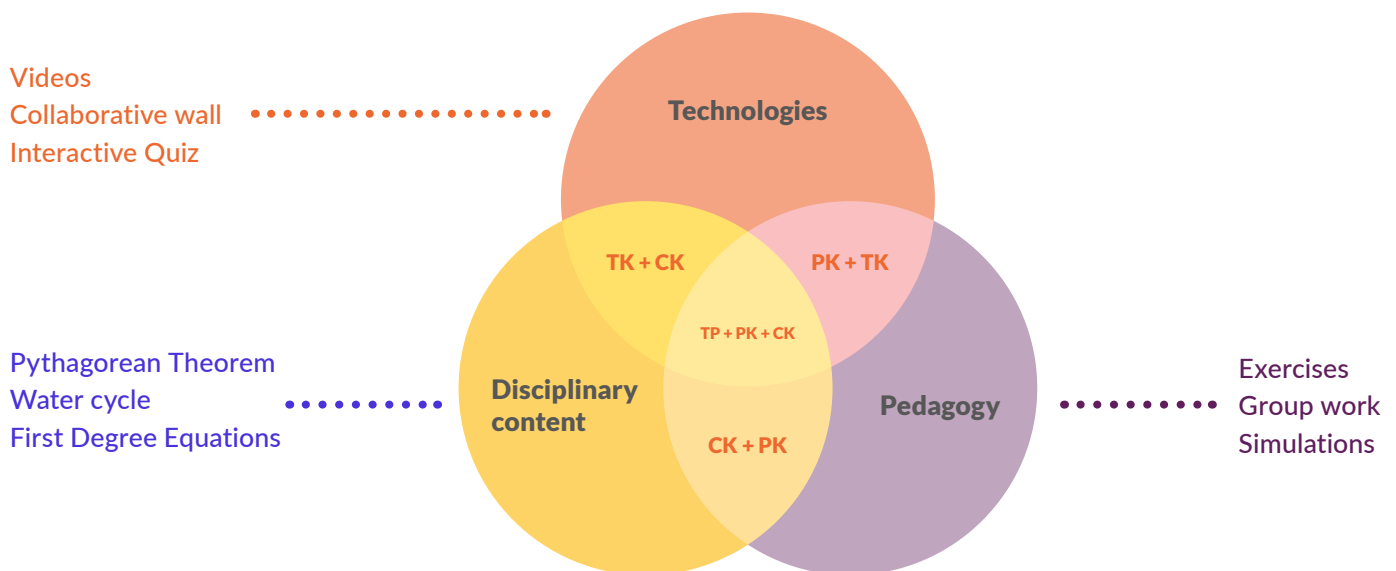
 *What is the most suitable technology to achieve the chosen objective?*

### Content Knowledge (CK)

 *What is the subject taught? What are the key points and concepts covered?*

### Pedagogical Knowledge (PK)

 *How will the teacher bring and propose the content (objectives, tools, statements, etc.) ?*



**TK + CK** = Knowledge necessary for teaching disciplinary content.

**TK + PK** = Understanding of how technologies can be used in an educational context.

**CK + TK** = Representing the supported or deepened disciplinary content using technologies.

**TP + PK + CK** = Ability to develop meaningful learning experiences for students by integrating effective use of technologies<sup>2</sup>.

<sup>2</sup><http://cultivoo.fr/index.php/classe-ipad/2601-le-modele-tpack>

Combining these types of knowledge helps to promote learning, make content accessible and increase learners' motivation. In order to do that efficiently, teachers must be aware of the working context and take it into account to apply digital technologies in their teaching activities. Ideally, the pedagogical aspects, the content and the technological tools are studied simultaneously.

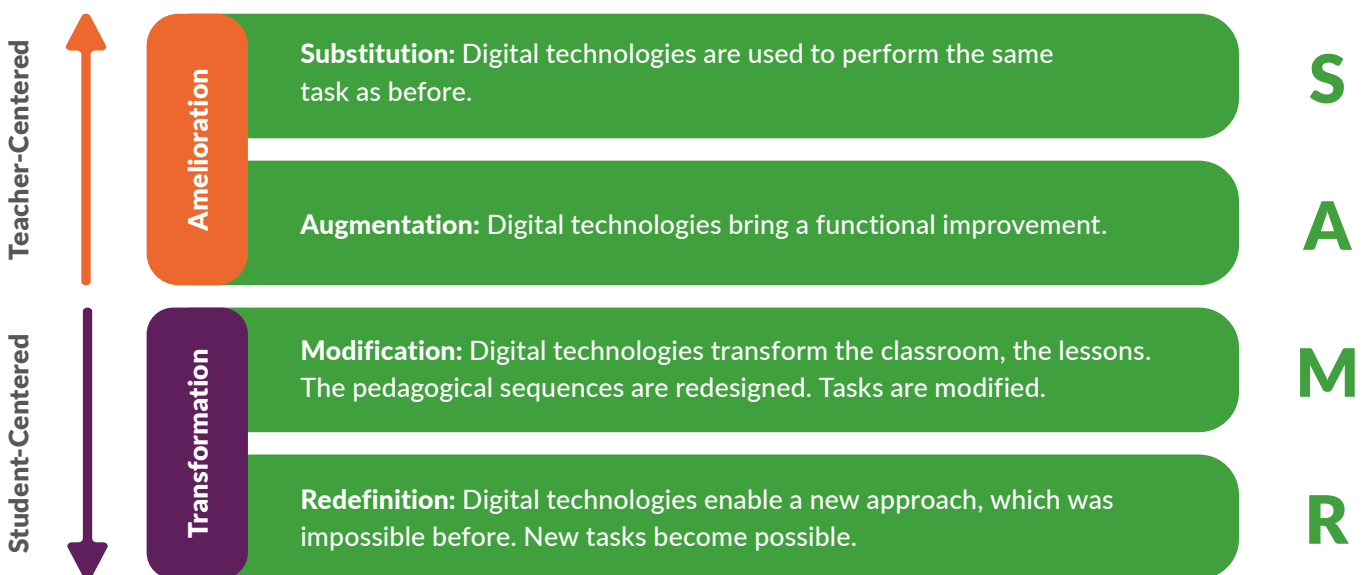
The TPACK is a tool that allows you to gain more confidence in your technological skills and it could become important to demystify the use of digital tools.

## ➤ SAMR Model

The SAMR (Substitution, Augmentation, Modification, Redefinition) theoretical model describes the different levels of technology integration within a pedagogical sequence.

This method makes it possible to better understand the impact of technologies on teaching and learning. It is not about using technologies at any price, but integrating it in a reasoned way in order to boost teaching practices of teachers, training staff, educators and coaches. Technologies are put at the service of learning and is not a goal in itself. The main objective is to engage the student in learning experience so that it becomes meaningful.

The model is presented in the form of a reference grid comprising four steps:



Each step of this model must allow the teacher to ask themselves and answer questions about the expected and provided benefits. For example, if a student uses a word processing software instead of a pencil to write, we are talking about a **substitution**.

The student has acquired a new skill by changing the way of writing, but the contribution of the tool used remains limited in the broader context of his/her learning. If this same student uses a spell checker or a graph creating tool, we are talking about an **augmentation**. Indeed, here technologies bring additional functionalities.

Now, if the student is led to create a document on a sharing platform, such as Google Drive or Microsoft Teams, thus allowing her classmates to work with her on the same medium as part of a collaborative writing workshop, we are talking about a **modification**. This new step brings a new way of working and modifies both the teaching practice and the task execution process thanks to the interaction created between students, offering an approach that is impossible or difficult to implement without the use of digital technologies.

Finally, let's imagine that the student and his/her classmates enrich the text with media content, such as video or an audio clip. The finalised document can be put online and disseminated beyond the initial working group: we are talking here about a **redefinition**. For this last step of the SAMR model the technological know-how is such that digital technologies allow the performance of entirely new tasks that would be impossible to achieve otherwise. The teacher can then evaluate the practical contribution of digital tools to the course design.

# TEACHER'S POSTURE



During the various workshops, the issue of posture came up many times. The evolution of pedagogical practices and tools pushes certain actors in education *to call into question the pattern "teacher" versus "learner"*, or in other words „teacher who speaks“ and „students who listen“.

However, *it would not be a question of changing posture radically and in all situations*, but rather of adapting it depending on the public and requirements identified in pedagogical terms.

For example, some students need the teacher to maintain their position as transmitter of knowledge for certain subject areas, while others expect the teacher to position themselves as a coach or facilitator in order to give them more autonomy.

Although the hierarchy of positions should not be systematically modified, it is useful to call it into question from time to time, depending on the objectives to be achieved. The posture of the teacher and that of the students influence learning: „The teacher is led to lose part of the control over the activity and to adopt a peripheral posture which places the learners at the centre of attention.“

*How to involve digital tools in this changing of posture?* Thanks to multiple possibilities for their personalisation, they make it possible to shift roles in learning environment. A teacher could, for example, suggest that students carry out projects and let them work independently while providing them digital tools and technical support, thus positioning themselves as a supporter. Project work offers the opportunity to some of them, who feel less comfortable with usual practices, to play a different game, and to get more involved than usual. Digital tools integration in such a context also allows differentiation or personalisation of learning, leaving no one behind.

It should be noted, however, that *posture and digital tools are not dependent on each other*, but are rather complementary. In other words, you can adapt and modify your posture without involving digital tools, just as you can integrate digital technologies without necessarily having to change the posture you have already adopted.





## ➤ Changing the teacher's posture: examples

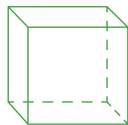
# 1



*Minh, mathematics teacher at a general secondary school in Belgium, uses Khan Academy with his students.*

Thanks to the Khan Academy platform, it is possible as a teacher to differentiate learning or even to do remediation, by assigning, for example, specific content to **each student**. The digital tool offers the possibility of monitoring while allowing everyone to work at their own pace. As a teacher, you can then go to everyone during the remediation sequence using a **supporting** or coaching posture and, thus, providing individualised support.

In order to complement the work via the platform, you can also propose different activities in class. The teacher is then not obliged to use a traditional structure of the type „explain the lesson to the students while the latter listen to“. He will be able to offer students the opportunity to **address challenges on the platform, in groups or individually**, or to produce summary reviews on subjects studied that the students can see or review through the content available on the platform. The teacher adopts the posture of facilitator by relying on the Khan Academy tool as a resource point.



# 2

✓ formula

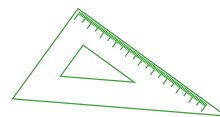
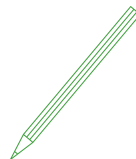
*Anne, a mathematics teacher (Belgium), did robotics in a technical and vocational school where she was able to develop a series of Lego activities with her students.*

Initially, the project was intended to work on STEAM lessons using robotic tools. However, as robots are extremely costly an alternative has been put forward. The senior training team put in place content that the teachers could quickly reappropriate: therefore the activities were realised using robotics and Legos. We were able to integrate a variety of tools thereto to achieve the final objective set with the students.

**This project has enabled students, sometimes having problems with learning, to distinguish themselves and develop their creativity**, whereas when faced with a more traditional maths lesson they feel like they can't do it. Setting up an activity using new tools encourages us to remain open to the possibilities and willingness of each and everyone while managing to bring the contribution of each student to the pure pedagogical needs. **Thanks to the robot, they did mathematics and mobilised several skills**, both disciplinary and transversal. The different stages of the project were reported in a PadLet, and even if it was complicated for some participants at the beginning, all could overcome their fears and actively participate.

From the teacher's point of view, there was a question here to **make the link between transversal skills and subject-specific competencies**, and the 21st century list of competencies .

This type of project can be a challenge for the teachers themselves. Anne's advice: the first thing to do is to get your hands dirty. Learn to do yourself what you are going to ask the students to do afterwards.



<sup>3</sup> <https://ojs.uclouvain.be/index.php/NEXUS/article/download/54193/55863/>

<sup>4</sup> <https://oce.uqam.ca/les-competences-qui-font-consensus/>

# PEDAGOGY THROUGH THE PRISM OF DIGITAL TECHNOLOGIES

Before proceeding further with the application, here are some practical elements to start an activity involving digital tools.

## ► *The steps to design your sequences and sessions*

- 1 Define the public and its specificities (age, situation in the process, digital knowledge, etc.);
- 2 Define subject(s) covered, sequences and number of sessions;
- 3 Define the general objectives, then the pedagogical and operational objectives;
- 4 Write a storyboard & link the sequences;
- 5 Define the types and conditions of learning (creation of the scenario in different stages);
- 6 Define the activities to implement per session (from introduction to closure);
- 7 Define the digital tool(s) that are useful to achieve the activity objective;
- 8 Choose the tool(s) that meet the needs of each sequence, for each of them.

## ► *Self-assessment tool: what, when, how?*

Non-exhaustive list of practical questions to ask yourself before integrating digital tools into a lesson:

### A. Necessary and available material

What kind of material do I have available? Material available for me? Material available for students? In what amounts?

- Is the internet connection stable?
- How is the classroom space organised?
- Can I display elements on a screen?

### B. Preliminary Questions

Is your objective defined in relation to a specific subject?

Do you already have a sequence?

- If yes, are there any digital tools already integrated in it? Do you have the technical means to set it up? At what point(s) could they be integrated?
- If not, could digital tools help you achieving your objectives?

### C. Contributions that digital tools can make

Expected results: Do digital technologies make it possible to achieve the objective? What is the added value that the digital tool provides to learning?

Sequences of tasks or actions: how to switch from one digital tool to another? How do digital and non-digital tools fit together?

What are the selected digital tools used for? What are you doing with? What are the students doing with?

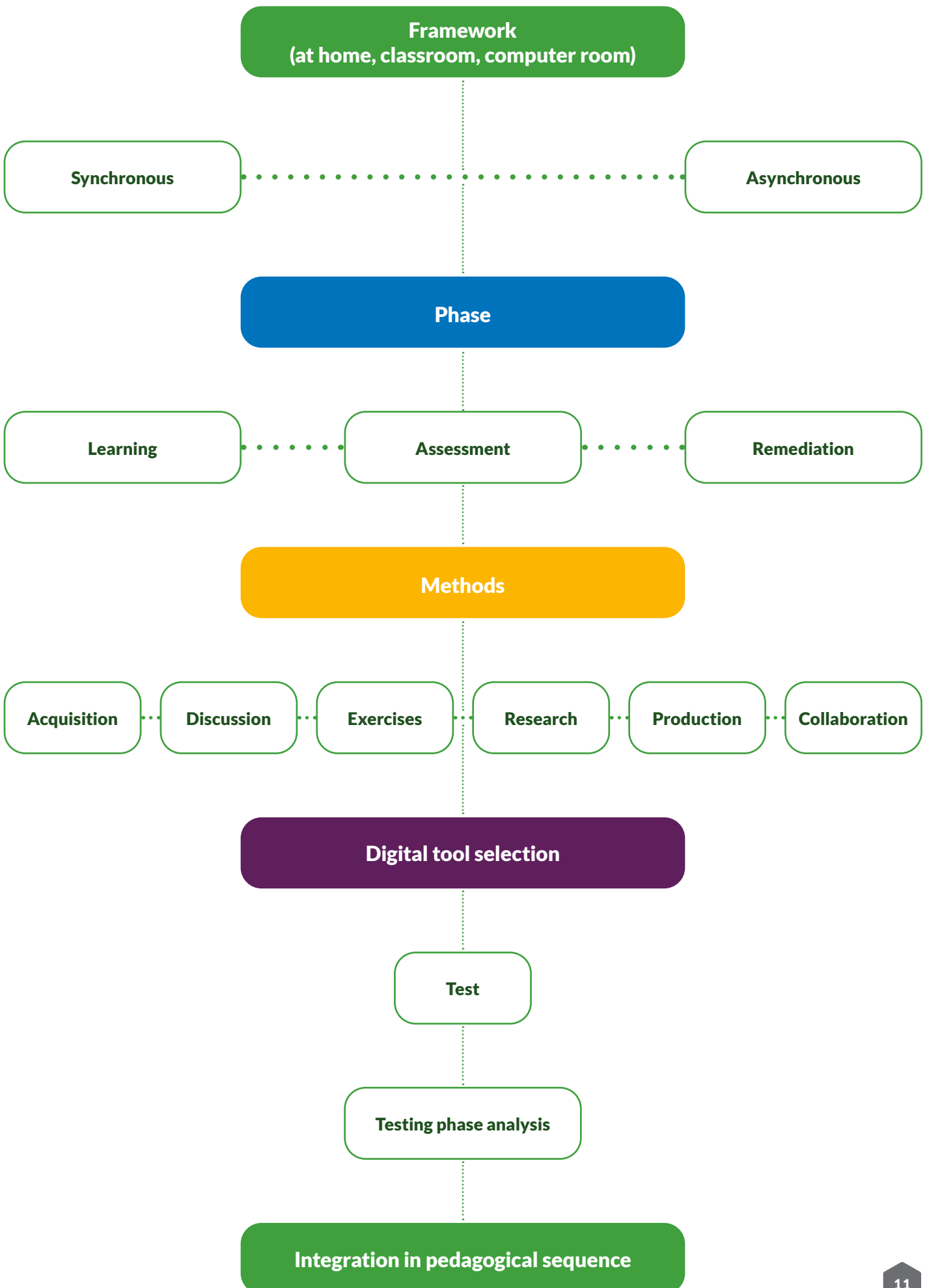
How to form different groups or ensure exchange between the teacher and the students: what digital tool is to be used?

Does it promote exchanges?

What are the modalities of interaction with the chosen digital tools: between yourself and the students, between students themselves, and between the students and people outside the group?

What are the ways of connecting to the tools proposed (email, with or without an account)?

Summary table allowing you to check step by step questions necessary to prepare a pedagogical sequence integrating digital tools.



# Six activities to discover and to reappropriate

The proposed digital practises are directly reusable and can be exploited again and again depending on the learning environment in which you work. They will allow you to test tools and to discover new ones. You will also find at the end of this section a summary table bringing together the tools proposed.

# ACTIVITY 1

Catch up on gaps in math learning using the free Khan Academy educational platform

For whom?

Students 1st-12th grade

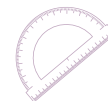
Which subject(s)?

Math



Possible prerequisites

Being able to read



Framework

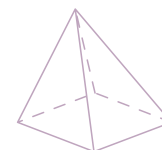
Classroom/At home

Grouping

Whole class/Small group/Individual

Temporality

Asynchronous/Synchronous



## Pedagogical Sequence

**Phase:** Learning/Assessment/Remediation

**Method(s):** Acquisition (Reading/Watching/Listening), Exercises

## Description

At home and in school, students catch up on gaps in their own pace, doing exercises assigned by the teacher using the free online Khan Academy platform.

## Tools

Mobile device/computer for the students, and a computer with projector for the teacher

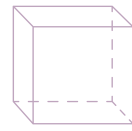
## Workflow

Practice includes using the free platform Khan Academy. The platform is based on the system for full comprehension of the necessary skills, the so-called „Mastery Learning” and stimulates the students to fully master the material before moving on, periodically reviewing skills already learned and catching up on gaps.

For more information on how to create an account and classes, how to assign tasks and use the LearnStorm instrument, check out the [Khan Academy Help Center](#) or the instructional videos on how to use the platform in the [Resources](#) section.

The screenshot shows the LearnStorm interface. At the top, there is a navigation bar with a back arrow, the text "Back to class", a dropdown menu showing "3e année - école Sainte-Marie", and buttons for "Start a new LearnStorm" and "Clear all rings". The main area features a large circular progress indicator with a yellow and white pattern. Inside the circle, it says "LearnStorm BETA" and "Celebrate skill mastery with your class. Level up 8 times to unlock the next ring. Learn More". To the right of the circle is a horizontal row of 10 numbered buttons (1-10). In the bottom right corner, there is a dark blue box with "Ring 1" and "0%" in white, and a "Check for progress" button below it. A small grey box in the top right corner says "Keep going. Keep growing!".

## Planning and workflow



At the beginning of the school year, the teacher performs an entry level ungraded review of the previous school year's material to determine the fields that should be reviewed most thoroughly.

They set up a **class in Khan Academy** and add all students in the class. They show the students the **LearnStorm** instrument used to record the overall skills progress of each class. They tell the students about a competition between them and an adjacent class with a special prize (it can be chosen together with the class, something like, for example, a cake for the class).

The competition runs until the end of the school term, and students are encouraged to use Khan Academy for at least 30 minutes per week and that time may be divided equally for work in class and homework.



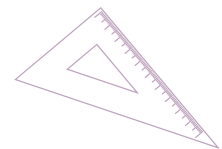
After that, the teacher assigns the students with a **homework**. This means completing the test with no errors, to convince the platform that they have mastered all skills included in this section. When students are struggling with specific problems, the platform directs them to relevant video lessons and shows them the steps to solve the problem.

The teacher reviews the students' scores from their Teacher dashboard and then assigns in class those exercises that have challenged the most children.

Each child receives a notification and solves the exercises in class - using the Khan Academy app on their phone or on a computer/laptop/tablet. The teacher has a real time access to the students' scores in the Teacher Dashboard where they can see if a student makes a mistake or uses a hint.

The teacher groups the students in such a way that the ones who solved the problem can help those who were challenged.

At the end, the teacher summarizes the main gaps and discusses the most challenging problems with the students.



At the end of the teaching class, the teacher uses a computer or a projector and opens the LearnStorm instrument. The progress achieved makes the children happy and motivates them to solve even more problems excellently.

The teacher assigns different problems for homework depending on the level of the students - the same exercises solved in class to reinforce what they have learned, simpler problems to recall the basic mathematical skill they may be lacking in order to solve the current problems successfully, or more complex exercises to try to build on independently.



An example of the introduction of Khan Academy for catching up gaps in the entire 6th grade class, combined with various methods to motivate students, including building the so-called **growth mindset** – anyone can learn anything, as long as they practice enough, is the Math is for Everyone project of Vasil Levski Primary School (Razgrad, Bulgaria). You can find details and sample lesson plans on the project [page](#).

# ACTIVITY 2

Using Edpuzzle and Khan Academy to introduce new concepts and check understanding

For whom?

Students 1st-12th grade

Which subject(s)?

All subjects (videos available in the [Khan Academy](#) platform)

Possible prerequisites

Being able to read



Framework

At home

Grouping

Entire class

Temporality

Asynchronous and synchronous



## Pedagogical Sequence

**Phases:** Learning new material, Assessment and Feedback

**Method(s):** Comprehension (read/watch/listen) and Exercises

## Description

Students learn new concepts by watching teacher-assigned videos through the free [Edpuzzle platform](#), then answering teacher-added questions on the video.

## Tools

Mobile device/computer for the students, and a computer with projector for the teacher.

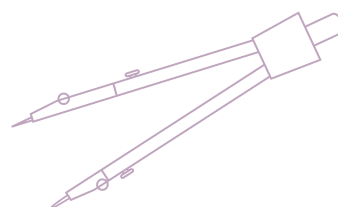
## Workflow

Before you get started, you need to have an Edpuzzle account where you can create classes and add students. For more information on how to create an account and classes, check out [Edpuzzle's help center](#) or the [instructional videos](#). Video tutorial in English on how to work with Edpuzzle and the integration with Google Classroom & MS Teams is available [here](#).

For teaching students new knowledge, for example about a circle, select the Khan Academy video from the lesson on Radius, diameter and length of a circle. Before assigning students to watch the video, use the platform to add questions or even specific small tasks to check understanding. Add multiple choice questions, open-ended questions, or leave comments with additional explanations to the video.

To use the flipped classroom method, assign students the video lesson for homework. Students watch the video at home and answer the questions in the time limit provided through the platform. The teacher reviews the students' scores on the Teacher Dashboard - whether the video was actually watched, which students made mistakes, etc.

In class, the teacher discusses with the class the new concepts from the video, the students' results, and if anything was left unclear, then they solve more complex circle problems together in class.



# ACTIVITY 3

## Group work with Mural using pictures and diagrams

For whom?

**Students of all stages** (The example uses high school material)

Which subject(s)?

**All subjects** (The example uses Biology material)

Possible prerequisites

**Initial knowledge in Anatomy and the digestive system in particular**

Framework

**In the classroom**

Grouping

**In groups and the entire class**

Temporality

**Synchronous**

### Pedagogical Sequence

**Phases:** Learning new material, Assessment

**Method(s):** Discussion, Creation, Collaboration

### Description

Students collaborate in a shared workspace in Mural – an online whiteboard where sticky notes, photos and text can be added – to create a shared model of the digestive system.

### Tools

Mobile device/computer for the students, and a computer with projector for the teacher.

### Workflow

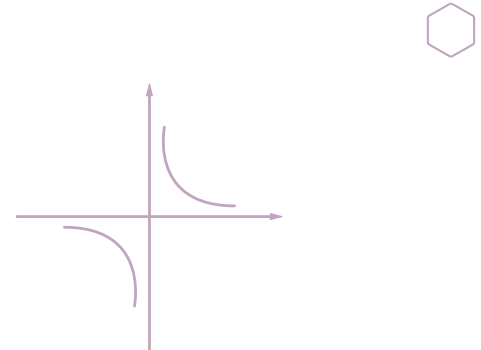
The teacher has pre-registered on **Mural**, where they create a workboard. They generate a link to this common workspace - with different areas for the different steps of the activity - and share it with students through the usual channels of communication with them, e.g. **Google Classroom/Microsoft Teams**.

The teacher creates a workboard in Mural, an online space with different areas for the different steps to create a model of the digestive system. The class can work together or be divided into small groups. A chat or online meeting can be used if students are at home, or instructions can be given directly in the classroom.

The teacher can use ready-made templates from Mural or create their own. They can leave the instructions for the board activities, links, shapes, assign different areas to different students. The software automatically saves the students' progress. All students can work simultaneously and see their work.

### Other work options:

- Create a mind map of the digestive system. The teacher can add a mind map example, add a shape, leave instructions, a video or other reference to a lesson about the digestive system. After reading/listening – students can create a mind map.
- Completing a chart: Students can complete the uploaded diagram with a missing part.
- Assessment of work: The teacher can create a survey that can be started and paused at any time. Students can also assess their work by clicking on the board and rating it according to predefined criteria.
- Reflection on the work process: at the end of the activity, the teacher can put questions on the virtual board for students to discuss and reflect on their work process. This can be separated into a separate rectangle on the board, students can respond with pictures, text, or sticky notes.
- If the digestive system model is part of a longer project: the teacher can add an activity to plan the project steps and distribution of work, materials, timelines, etc.





# ACTIVITY 4

## Reactivation & review

For whom?

**4th year general upper secondary** (science option)

Which subject(s)?

**Biology** (the carbon cycle)

Possible prerequisites

**None**

Framework

**At home and in the classroom**

Grouping

**Entire class, groups and individually**

Temporality

**Asynchronous and synchronous**



## Pedagogical Sequence

**Phases:** Learning new material, Assessment and Feedback

**Method(s):** Discussion, Creation, Collaboration

## Description

Reactivation of educational material studied before school holidays using Wooclap, an interactive tool that allows to create quizzes and tests. The Wooclap questions are transformed into Wooflash sheets which will be used to review them for the assessment that will take place in a few days.

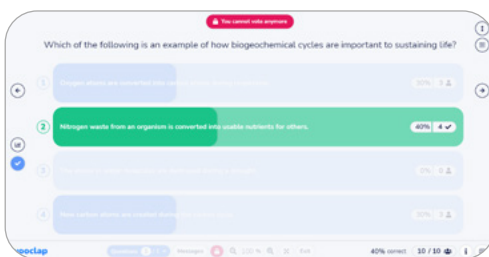
## Tools

Mobile device/computer for the students, and a computer with projector for the teacher.

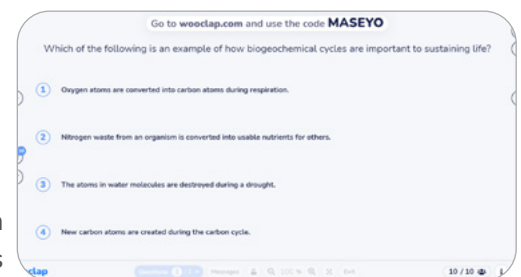
## Workflow - Phase 1: In the classroom

 (about 60 min)

First lesson after a two-week school holiday: the teacher proposes that the students reactivate the material studied before holidays through a series of interactive questions in Wooclap.



Answers to questions are hidden by default. When all the students have answered a question using a computer or smartphone, the teacher unveils the results generated by Wooclap using the projector. These results allow him to see the students' level of knowledge acquired and each question gives rise to a discussion with the students around the topic.



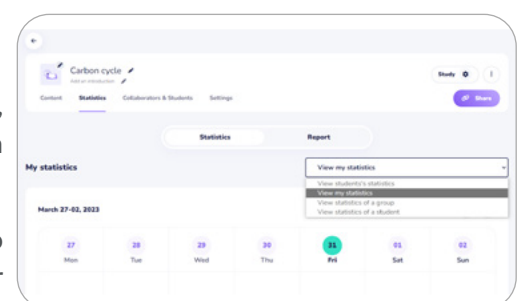
## Workflow - Phase 2: At home

 (Questions are shared via a link or QR code).

Previously, the teacher has imported the Wooclap questions into Wooflash, which are compatible tools, and added new ones so that the Wooflash flashcards covered all the material to be studied.

The students are then invited to revise at home using the Wooflash course to prepare for the next assessment, which will take place in class. The teacher suggests several short sessions (15-20 minutes). Using the Wooflash platform,

the teacher can track students' progress during these sessions of studies and check their coverage rate. He will thus be able to check that all the students achieve a sufficient success for the on-going assessment. Thanks to this system, he will be able to see whether any problems arise about different questions and remedy them before the assessment.



# ACTIVITY 5

## Reactivation & review

For whom?

**4th year general upper secondary** (science option)

Which subject(s)?

**The scientific method**

Possible prerequisites

**None**

Framework

**At home and in the classroom**

Grouping

**Individually or in pairs**

Temporality

**Asynchronous or/and synchronous**



## Pedagogical Sequence

**Phases:** Learning new material and Assessment

**Method(s):** Acquisition (Reading/Watching/Listening) and Exercises

## Description

Reminders on the scientific method thanks to Khan Academy, which offers a learning path dedicated to that subject and using the Learning apps tool. This is an online resource where you can find a number of models (exercises, multiple choice patterns, etc.) that can be integrated into learning scenarios. Registration is required for the following activity, but it is free.

## Tools

Mobile device/computer for the students, and a computer with projector for the teacher. Khan Academy and Learning apps

## Workflow - Phase 1 (about 30 min.)

In the classroom or at home, students follow the Khan Academy course on the experimental method. They watch the videos, read the articles and answer the exercises you have selected for them.

*You can share the course with them through a clickable link or QR code.*

## Workflow - Phase 2 (about 50 min.)

The teacher offers a collection of Learning apps on the experimental approach. To use a collection, there are different possibilities:

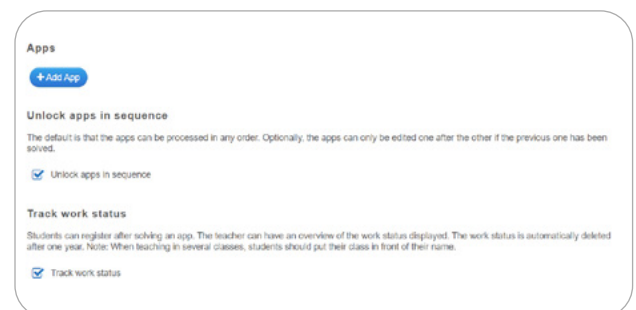
- create a collection using the apps available on the website;
- take an existing collection as it is;
- duplicate an existing collection and adapt it to your needs.

*You can then share it through a clickable link or QR code.*

If you are creating your own collection, we recommend you checking the following options:



Students will need to identify themselves (without creating an account). The best is to require the first name and surname. To move on to the next app (or in other words, next exercise), they must have passed successfully the previous one.

In this way, the teacher will be able to „directly“ follow the progress of each and every student. They will be able to see whether students are experiencing difficulties. If this is the case, they will be able to take care of those students on a priority basis and, if necessary, propose a remediation.



# ACTIVITY 6

## Reactivation & review

For whom?	4th year general upper secondary
Which subject(s)?	Data Processing
Possible prerequisites	Percentages 
Framework	Classroom
Grouping	Entire class
Temporality	Synchronous 

## Pedagogical Sequence

**Phases:** Learning and evaluation

**Method(s):** Discussion, collaboration, investigation/research

## Description

Interpreting and constructing a table of numbers, a graph and a diagram relating to a set of statistical data using collaborative digital tools.

## Tools

Mobile device/computer for the students, and a computer with projector for the teacher.

Collaborative Table: Google Jamboard

Survey to retrieve data: Google Forms

Online assessment: Plickers

Spreadsheet software such as Excel or Google Sheets are required.

**Workflow** (All digital tools can be shared using a clickable link or QR code.)

● Analysis of a mobilising situation to determine the graph data on the basis of a collaborative document. The teacher shares a document containing the data to analyse (example here).

- Collective analysis of the graphs proposed using Google Jam board. The questions relate directly to the statistical data presented.
- Collaborative research about information on the graphs using a computer or a smartphone.
- Group work on the differences and similarities on the graphs.
- Creation of a common synthesis via Jamboard that can be downloaded in PDF or accessible through a link.
- Searching for graph data through a form using Google Forms.

*The results obtained through the form can be used in two ways: a) to assess students' understanding of the data analysed together; b) to use the students' answers to study data again – in the form of a graph, or otherwise. Warning: at the end of the activity, access to document must be changed to read only format so that it is no longer modified.*

● Construction of a bar chart, step diagram and/or pie chart using a spreadsheet software.

● Integration of generated graphics in a shared document and creation of a collaborative synthesis.

● Formative assessment on the basis of a Plickers in order to be able to instantly see students' results and thus give directions to them for an adequate remediation (example here)

● Differentiation in exercises depending on the level of understanding of each student.

Become an  
ambassador



## WHAT DOES A “GOOD DIGITAL AMBASSADOR” MEAN? HOW CAN YOU BECOME ONE?

An European Commission study shows that student success and the quality of the education process are influenced by teachers' confidence in using **digital tools**. Not all teachers are experts or adept at manoeuvring between different software products, but most are required to use them increasingly in their work. And if given the right advice, any teacher could integrate useful tools and related working practices into their teaching. In this part of the guide, we want to explore good examples and practices for introducing digital tools. Use the examples and practices not as a recipe, but as a starting point for inspiration to explore your own way of implementing digital tools in your school or community.



*The Digital Ambassador is an inspiration and support for their fellow teachers in the process of introducing digital tools in teaching. We will explore what it means to be a Good Digital Ambassador through **3 main aspects** – attitudes, skills and specific best practices.*

# ATTITUDES

The first step in promoting digital tools among fellow teachers is your attitude towards the process of introducing them.

## ► Teachers are in the role of students

The messages to your fellow teachers and to students are similar. Encouragement of progress and support are key in all steps in learning and implementing digital tools.

No one is born all-knowing, small steps are necessary and mistakes are no reason to give up on development. The concept of a **growth mindset** can help your colleagues in the learning process.

Example of an inspirational video: **Everyone can learn everything!**

When trying out new tools, it is good for teachers to have opportunities to explore and show curiosity in a safe environment. The Ambassador can offer colleagues short meetings to test new tools.

## ► Be patient

Implementing digital practices is a long process, requiring time and extra effort. A good ambassador has patience and follows the speed of their colleagues. Ivan Dragomirov, **EU Learning Corner** Ambassador and a Teacher for Bulgaria alumnus, on his experience in implementing and promoting digital practices among colleagues in his school:

*"I was aware that there was no way I could upload all of my colleagues' school assignments to Google Classroom at once, so for a few weeks I used a hybrid model. Teachers had the choice of using a device or paper. Over time, the paper worksheets were reduced as students increasingly chose the devices, and eventually their homework became entirely digital."*

"Gradual introduction to the world of technology is important and should be done at the pace of students and teachers."

# SKILLS

According to education expert **Steven Farr**, there are four key teacher skills that can make a difference in the **workflow**:

### 1. The skill of being able to identify one's own strengths and weaknesses, and the environment

Being able to understand themselves helps the ambassador to identify their own strengths and weaknesses and to build strategies to overcome or build upon, in order to better support their colleagues. Knowing the community and developing a critical perspective on beliefs, especially those that reinforce low expectations and self-doubt can be key to encouraging colleagues not to give up developing.

### 2. The skill to use digital instruments

The ambassador uses digital tools in their practice – they are familiar with different tools, make connections between them and apply them directly. They are always on the look up for new digital solutions.

### 3. The skill to build trust and relationships

A good ambassador acts with empathy, social intelligence, intercultural competence and appreciation for their colleagues. It is important to show respect for the learning process of everyone in the school.

### 4. The skill to act with a vision and a goal at the benefit of others

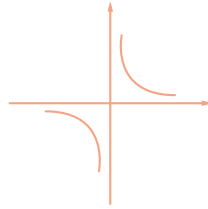
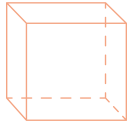
The ambassador understands the value of technology for their colleagues and acts with that understanding to support them. They consistently show examples of how collective action leads to meaningful change throughout the school community. All teachers possess these skills at diverse levels. Perhaps the most important skill of all is maintaining a **growth mindset** – it helps the ambassador learn and improve their skills.

The digital ambassador may be fearful or uncomfortable in unfamiliar situations but knows that there are usually opportunities to facilitate teaching with digital tools and any mistakes are a normal part of the learning process. Calmness, patience, and a consistent search for solutions are needed.

# BEST PRACTICES

As part of the project, we explored the question “How can I support my colleagues so that they want to introduce digital technologies into their teaching?”

We present specific steps and strategies that teachers shared and implemented in their work to encourage colleagues to use digital tools:



“I digitized my coursework with the start of the school year. Initially, students only used laptops in my classes. A month later, my colleagues tried using them in theirs because they saw how at ease the students were with them. After a few days of working this way, my fellow teachers saw how it facilitated and improved the learning process. My colleagues are now actively using their devices.”



## 1. Organise short meetings and discuss the issues with fellow teachers:

- What are the problems that teachers face?
- What are the solutions they have already used and how can they build on them?
- Where can the whole team organise their learning resources and how can they support each other?

## 2. Promote good examples of using digital tools with the students.

- Holding a competition between students using a digital platform and sharing the results with other teachers in the school.
- Presentation by a student or a teacher about a student who has had difficulties with the subject but has made progress after using an online platform (for example with Khan Academy).

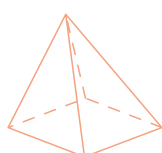
## 3. Present statistics, research and data to colleagues proving that the tool is useful. Examples:

- Students who have the opportunity to master digital skills do better on the **functional literacy test**.
- **Students who use Khan Academy for math** at least 30 minutes per week have higher grades and scores, regardless of ethnicity, gender, native language, etc.

## 4. Share instructions on different tools with the other teachers in the school

The digital tools have resources, FAQ pages and ready-made videos that can help any teacher become familiar with the relevant platform. It is good practice to spend time at the beginning of the year training fellow teachers and students so that they feel comfortable using devices and (new) digital tools.

Create a shared space for digital resources for all teachers in the school (Google Drive or OneDrive, for example) so that they are easily and quickly accessible to all colleagues.



# BEST PRACTICES

## 5. Be proactive and make a demonstration.

Show your fellow teachers the new digital tool, no matter how easy it seems to you because for them it may not be, and because by taking the time to explain an idea, you begin your partnership with your colleagues.

## 6. Create a community.

The ambassador can create opportunities for communication, exchange and learning between teachers in a school or even between schools:

- Teachers in a school team can set regular meetings (e.g. monthly or bi-monthly) to share practices and discuss what they have learned.
- Similarly, inter-school meetings can be arranged where a different colleague prepares a topic/practice using a digital tool.

## 7. Create a position within the school's organisational structure

For example: Digital School Leader or Assistant Principal for Digitisation and Digital Practices (If/when no such position exists within the school system). This will ensure that there is a designated member of staff/colleague in the school who is formally accountable and is given a time budget and other resources to organise the 'ambassador work' and deliver the above points. A prerequisite for this is that the school leadership realizes the value of the position, even if it is not full time.

This is more of a list of ideas than exact recipes that can serve any teacher to think and experiment with an approach in their school.

Anyone can be a digital ambassador if they want to work towards digitalising their school community while improving their teaching practice.

Digitalisation is a process that is entering classrooms and will depend on the attitude and expertise of teachers to support student learning. It is not important to use many tools, techniques or tricks, but to choose those tools and practices that will facilitate teachers' work and students' progress.

*Be patient! Be brave and experiment!*

*Take small steps, celebrate progress, and share what you learn with your fellow teachers.*

Encourage your colleagues to participate in different platforms and communities for learning and sharing best practices, for example:

[comunidadatenea.org](https://comunidadatenea.org)

– a free social support network for teachers.

[teach2030.com](https://teach2030.com)

– short online professional development modules.

[education.ec.europa.eu](https://education.ec.europa.eu)

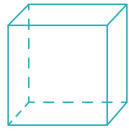
– the latest digital education resources from the European Commission.

[hundred.org](https://hundred.org)

– HundrED is a global network sharing educational innovation, including digital.

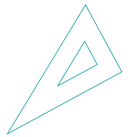






## CONCLUSION

From Brussels to Sofia, technological tools are now an integral part of our daily life and somehow interfere in our teaching practices. This is a multi-purpose guide, but above all its mission is to present how the wide range of digital tools that we have available can be useful to you in the creation of your lesson sequences, both in science and in mathematics.



We wanted to demonstrate, through three different axes, that digital tools can support your teaching method and that they are flexible resources which can be adjusted and adapted according to your needs and your knowledge in the field. They are intended not to replace teachers, but to support them and allow them to enrich their teaching practices.

The inequalities in access to digital technologies and devices, the complexity of using certain tools, the availability or non-availability of free resources, or simply the difficulty of having a stable Internet connection are all obstacles that we must be able to overcome or bypass in order to take advantage of all opportunities that digital technologies can really offer. This guide is there to help you, to give you some clues. At the beginning, we wanted to highlight two theoretical models, namely TPACK and SAMR, and discuss teacher's posture. The activities referred to in Part Two have been designed in such a way that they can be shaped as desired, according to the objectives and skills of those who decide to use them.

Through the discussions initiated by teachers within the framework of this project, it became obvious that asking questions about the place of everyone, teachers and students, in the context of learning, is necessary, should be possible and must accompany the reflexion on the path of digital tools integration. The contribution of digital technologies will undoubtedly push you to review your posture, perhaps you will then become a co-learner or position yourself as a supporter. In addition, throughout the different parts of this guide, thanks to lessons and activities proposed, we wanted to offer some points for consideration and concrete approaches so that teachers can understand, appropriate and use the resources available today.



Finally, if you want to find out more and continue the adventure beyond these pages, the ideas suggested in the third part will help you to take the problem on board in order to become yourself an ambassador of pedagogical practices involving digital technologies, both in science and in mathematics. Do not hesitate to share this guide with your colleagues, management, your professional communities and to take advantage of international feedback which, we hope, will continue to enrich teaching practices for as many teachers as possible.

# NON-EXHAUSTIVE LIST OF DIGITAL TOOLS

TOOL	TYPE	GDPR	COST	LANGUAGES	ACCOUNT CREATION
<b>Google Classroom</b>	Classroom management – Digital workspace	<b>yes</b>	Free for Education and Workspace accounts for NGOs.	EN, FR & 28+	Yes
<b>Microsoft Teams</b>	Video Conferencing Platform – Digital workspace	<b>yes</b>	Depending on size and type of enterprise	EN, FR & 46+	Yes
<b>Khan Academy</b>	Learning Platform	<b>yes</b>	100% free	EN, FR, BG & 41+	No
<b>EdPuzzle</b>	Interactive video lessons	<b>yes</b>	Yes, in basic version (2 videos max)	EN, ES, PT, CA, ID	Yes
<b>Mural</b>	Collaborative wall	<b>yes</b>	Free for Education accounts	EN	Yes
<b>Zoom Whiteboard</b>	Whiteboard	<b>yes</b>	Free limited version. Must be combined with a Zoom subscription.	EN, FR & 13+	Yes
<b>Wooclap</b>	Quiz tool	<b>yes</b>	Free limited version, free education version	EN, DE, FR, IT & ES	Yes
<b>Wooflash</b>	Tool for assessment and remediation and review courses	<b>yes</b>	Limited number of learners and collaborators	EN, FR	Yes
<b>Learning apps</b>	Platform for practitioners	<b>yes</b>	100% free	DE, EN, ES, FR, IT & RU	No
<b>Google Jamboard</b>	Whiteboard	<b>yes</b>	Basic limited version	EN, FR & 28+	Yes
<b>Google Forms</b>	Forms and questionnaires	<b>yes</b>	Basic limited version	EN, FR & 28+	Yes
<b>Plickers</b>	Quiz Tool	<b>yes</b>	Basic limited version	EN	Yes

# ACTIVITY SHEET TEMPLATE



For whom?

Which subject(s)?

Possible prerequisites

Framework

Grouping

Temporality

.....

.....

.....

Classroom    At home    In the computer room    In the laboratory

Individual    In pairs    Small group    Whole class

Synchronous    Asynchronous

## Pedagogical sequence

- Learning
- Assessment
- Remediation



## Method(s)

- Acquisition (Reading/Watching/Listening)
- Discussion
- Exercises
- Investigation/Research
- Production
- Collaboration

## Description of the activity in a few sentences

## Tools

## Workflow



Bibliothèques Sans  
Frontières Belgique:  
khanacademy@  
bibliosansfrontieres.org

Education Without Backpack:  
hi@obr.education

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