mixap

WHAT IS MIXAP?

The objective of the **MIXAP research project** is to develop a simple tool to **enable teachers to create their own educational applications,** for smartphones and tablets, using **Augmented Reality** (Mixed Reality to be more precise).

MIXAP offers several types of activities that use Augmented Reality to enhance pedagogy. The tool was co-designed with twenty pilot teachers. It is currently used in pre-schools, middle schools and vocational high schools for all types of disciplines and activities (vocabulary acquisition, reading, independent exercises, review of technical procedures, etc.).

More information on the website: https://mixap-lium.univ-lemans.fr/

A MULTIDISCIPLINARY TEAM

The MIXAP project is led by the Computer Science Laboratory of Le Mans University (LIUM) in collaboration with the Nantes Educational Research Center (CREN), both in France. The project is funded by the Pays de la Loire region and the University of Le Mans as part of the Rising Star program (January 2022 to April 2024). What's more, MIXAP is produced in partnership with Réseau Canopé, an operator of the French Ministry of Education, whose mission is lifelong training and professional development for teachers. 4 Canopé trainers and **more than 20 teachers** took part in the co-design of MIXAP and the in-class experimentation of the activities created.

After very positive initial results, the research project is continuing, thanks to our partnership with INOD Solutions. This company is currently developing an improved version of MIXAP and ensuring its sustainability. This new version will also be available on the La Digitale website in 2024. It is one of the most widely used digital platforms for teachers in France. The MIXAP project is promoted by SATT Ouest Valorisation and was awarded the Encouragement Prize by the Grand Ouest Foundation in 2023.

► Iza MARFISI - LIUM
► Mohamed EZ-ZAOUIA - LIUM
► Cendrine MERCIER - CREN
► Benoit CHALLEMEL-DU-ROZIER - CANOPE

4 TYPES OF AUGMENTED REALITY ACTIVITIES FOR TEACHING PURPOSES

Image Augmentation

Add media ressources (text, video, links, images, audio ...) on an image-marker.

Image Validation

Add feedback that indicates if the right image-marker has been found or not.

Associating 2 Images

Add feedback (animation, sound...) if two image-markers are shown simultaniously.

Image Overlay

Overlay several transparent images of the same size as the image-marker.

Activity Group

The leaners choose the order in which they want to complete the

Activity Path

The leaners complete the activities in a specific order.

Thanks to several co-design sessions with pilot teachers, we were able to identify four pedagogical activity models that use Augmented Reality.

Image augmentation: This activity allows multimodal resources (text, image, video, audio, 3D model and supplementary information sheets) to appear on an image marker (e.g., poster, book and exercise sheet). For example, a pre-school teacher wanted to add pictures of animals and audio recordings of important vocabulary (e.g., "a reindeer has four hooves and two antlers") to the pages of a book. Another high school teacher wanted to display 3D models created by his students in the class yearbook.

Image validation: This activity allows for the creation of autonomous activities in which Augmented Reality automatically validates whether the chosen image is correct. For example, a high-school technology teacher wanted students to identify a specific part of a machine (e.g., the engine).

Associating two images: This activity also allows teachers to create autonomous activities as it provides feedback so that students know if they have correctly matched two associated images. For example, a pre-school teacher said that she wanted the children to practice recognizing the same letter written in upper and lower case.

Image overlay: This activity allows students to see transparent layers on top of an image. For example, a university geology professor wanted students to be able to turn on and off layers showing different types of rock on a picture of a mountain. Other teachers wanted to use this type of activity to show the answer to an exercise.

These four types of activities can be combined into **groups of activities**, used, for example, by teachers who offer several augmentations on the same book, or **ordered activity paths**, used, for example, to create guides for turning on a machine with several steps to be completed in a predefined order.

WHO ARE THE USERS?

MIXAP is initially targeted **at teachers** who want to create educational activities that are fun, engaging or simply encourage autonomy. However, the application can also be used by:

- **Cultural mediators in museums**, tourist offices or heritage departments who wish to create interactive exhibitions.
- **Artists** wishing to create interactive works of art
- **Companies** wishing to preview the potential of Augmented Reality before having a custom application developed.

As the teacher testimonials below shows, MIXAP works just as well for 3-year-olds as it does for adults, and for all kinds of disciplines. More examples of feedback are provided at the end of this document.

DELPHINE DESHAYES

With MIXAP, I created an activity with a children's album that we already use in class to reinforce the acquisition of the lexicon, work on writing these words and to compare illustrations and real objects. The students were very enthusiastic about this new activity proposal which required helping each other.

CAMILLE POQUET

Thanks to MIXAP, students were able to check their work as they went along, progressing at their own pace. When their answer was not validated by augmented reality, the students were able to find the source of their error on their own and correct it by returning to their research work in complete autonomy.


NICOLAS GAUDIN

The MIXAP project allowed me to develop activities on the workshop's production systems. The students managed to start industrial systems without knowing them, and this in complete autonomy. This is technology that they will definitely use in their professional lives.

HOW DOES IT WORK?

Phase 1. Activity creation

By following the tutorial on the MIXAP website (**https://mixap-lium.univ-lemans.fr/mixap-objet/**), teachers can create their own educational activities on their smartphones, tablets or even computers. Simply choose the type of activity you want to use, from the 4 types listed above, then let yourself be guided by intuitive, highly visual interactions, similar to *PowerPoint*. Here are the 4 steps for creating an « Image augmentation » activity, for example.
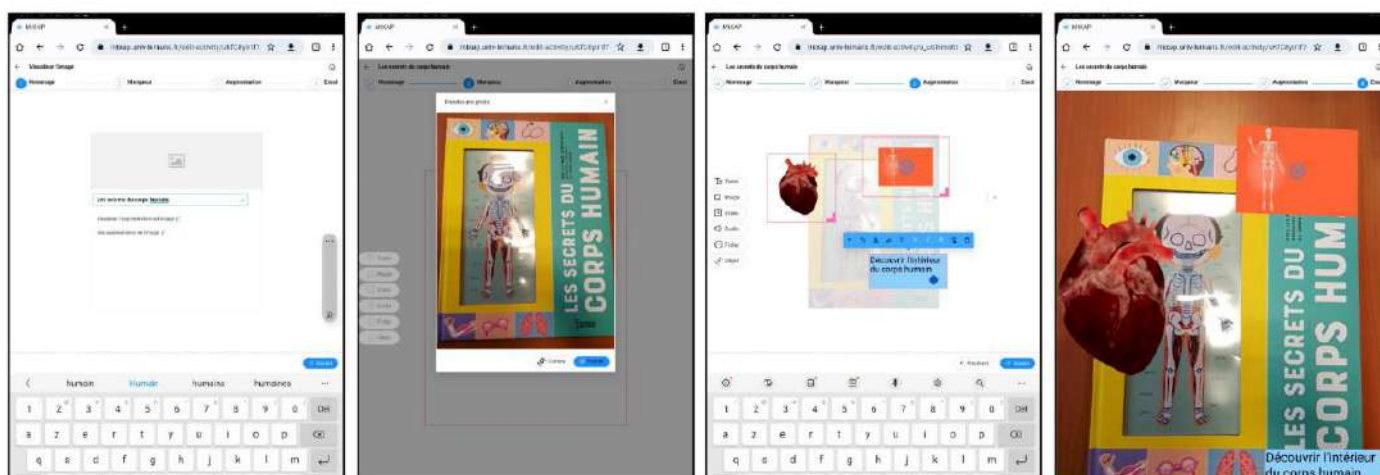
1) Name
Provide a title and a discription for the activity to be able to find it later. Add instructions that will be displayed for the leaners.

2) Marker
Take a photo of the objet or image that will serve as the augmented image-marker or import an existing image.

3) Augmentation
Add augmentations (text, audio, video, 3D model, buttons...), personalize the content and style.

4) Test
Test the activity the way it will be presented to learners. The camera detects the image-marker and displays the augmentations.

Phase 2. Sharing activities

When they are satisfied with the activities they have created, teachers can share them, in read-only mode, on the tablets or smartphones that the learners will be using. They can also share the activities in edit mode, with other teachers, so that they can reuse the activities or modify them to suit their own context.

Phase 3. Doing the activities

Learners complete the activities, or groups of activities, created by their teachers on the school's tablets or directly on their smartphones. Access to the activity is immediate: MIXAP does not require the creation of an account. Each activity is represented by a small thumbnail with the image to be augmented.
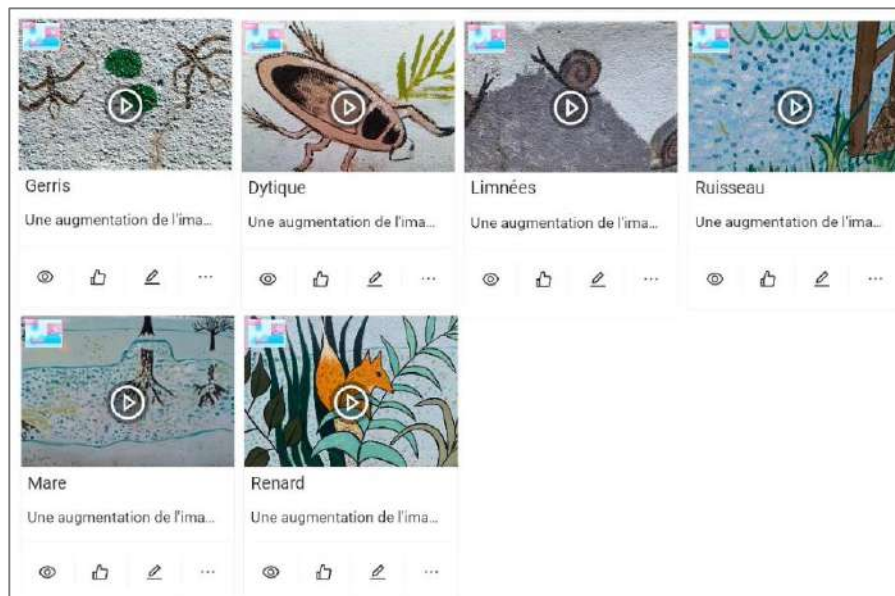
WHY USE MIXAP?

- MIXAP is **free, open-source and RGPD compliant.**
- MIXAP enables teachers to **create customized educational activities**.
- MIXAP **does not require the purchase of additional material or equipment**.
- MIXAP can be used to augment a **wide variety of existing educational material**, such as worksheets, maps, drawings, posters, objects, sculptures, buildings or even outdoor murals.
- MIXAP was **co-designed with pilot teachers and the Canopé network**, and offers a number of original ways of using Augmented Reality to support learning and teaching.
- MIXAP is a **web application**, so it doesn't need to be installed via an app store.
- MIXAP works **without an Internet connection** (except for the synchronization of activities on several tablets).
- The design process is so simple with MIXAP that the **Augmented Reality activities can be created by the students themselves**, from 10 years old and up.
- MIXAP has **already been tested in over 10 classes**, from pre-school to technical high school, and has demonstrated several pedagogical benefits thanks to a scientific experimental protocol (encouraging collaboration, increasing autonomy, integrating learners with difficulties or that are not native speakers, active learning...). All the scientific papers on the project, published in international journals and conferences, are available on the project website.

The goal of my activity is to listen to the songs learned in class this year: to make them their own, remember them, or simply enjoy them.

All of my students experienced the MIXAP activity, and I continued this work in class. I noticed that they became faster and more skilled over time.

MIXAP

Annabel
LE GOFF
Huisserie public school

The use of augmented reality requires various skills: the children are no longer just "consumers of songs," they truly become active participants in their learning.

PLEASURE

"

With MIXAP, I offered them an augmented reality "Seek and find" activity based on a painting discovered at the museum. Once they found the detail (an animal), a real object appeared, and by clicking, they could hear its name.

"

This way, my students were able to reinforce the vocabulary they learned in class and enhance their observational skills.

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Vanessa
FROC
Huisserie public school

"

In the traditional format, the "seek and find" activity is done independently. With MIXAP, the students were encouraged to cooperate and help each other to succeed.

RESEARCH

"The MIXAP project allowed me to develop activities related to workshop production systems.

"With the help of the tablet, the students were able to start industrial systems even without prior knowledge, and they did so independently.

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Nicolas
GAUDIN

Raoul Vadepied high school - Evron

"In the industrial world, the use of augmented reality is becoming increasingly frequent. The MIXAP project enables students to use a "technology" that they will likely use in their future professional lives.

Maintenance 4.0

"

Thanks to the video , audio and textual help provided by MIXAP , the students were able to use their headphones to answer the initial session problem at their own pace. After proposing an answer, a distributed marker allowed them to self-assess. Everyone completed the task.

"

The students were initially independent, immediately engaged in research, then they developed collaboration in using the tool. They appreciated the distribution of assistance based on their needs and the appearance of videos from the paper activity. They were comfortable using MIXAP.

MIXAP

Tony

NEVEU

La Foresterie middle school
Bonnetable

"

The pedagogy of the session was based on the possibilities offered by the application to allow student autonomy and self-assessment; MIXAP supports my pedagogy.

DIFFERENTIATE

"

I created two activities to work on phonology in a different way with MIXAP. The students have to find the letter corresponding to the first sound of a word represented by a drawing (choose from 3 letters), then a word represented by a photo (choose from the 26 letters of the alphabet).

"

With MIXAP, pedagogical progression is possible. MIXAP promote learning, autonomy and self-validation. The students also need to fill out a record sheet to keep track of the activity.

MIXAP

Elisabeth
PLANTE

Jules VERNE public school, Laval

"

All the students are intrigued by this new way of approaching phonology. The use of a tablet made the activity more engaging. All of them quickly became familiar with the MIXAP application.

MOTIVATION

The MIXAP project allowed me to develop activities related to workshop production systems.

With the help of the tablet, the students were able to start industrial systems even without prior knowledge, and they did so independently.

MIXAP

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GAUDIN
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In the industrial world, the use of augmented reality is becoming increasingly frequent. The MIXAP project enables students to use a "technology" that they will likely use in their future professional lives.

Maintenance 4.0

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With MIXAP, I created an activity using a children's book that we had already use in class to reinforce vocabulary acquisition, work on writing these words, and compare illustrations with real objects.
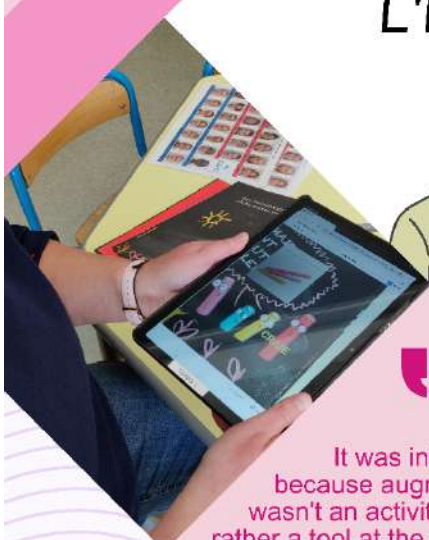
"

The students were very enthusiastic about this new activity proposal that required teamwork. They had a lot of fun and all experienced a sense of accomplishment while feeling like they were having fun.

MIXAP

**Delphine
DESHAYES**
L'Huisserie public school

"

It was interesting because augmented reality wasn't an activity on its own but rather a tool at the service of learning: they still had to manipulate sheets, images, glue, and pencils... MIXAP became a tool to do the work differently!

PLAYFUL

" I used MIXAP as a complement to a traditional activity, allowing students to self-correct. Beforehand, in pairs, they had to do research involving spatial and temporal identification, as well as information extraction using traditional tools.

" Thanks to MIXAP, students could verify their work progressively at their own pace : no fear of judgment or feelings of failure. When their answer wasn't confirmed by augmented reality, the students could search for the source of their error and correct it by going back to their research work.

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Camille
POQUET

Ambroise Paré middle school , Le Mans

" The students enjoyed being active in correcting their work rather than just receiving corrections in the traditional way. The ability to move around, participate without being under the scrutiny of others, and discover a new digital use appealed to them.

AUTONOMY

> The use of MIXAP created a new learning and cooperation situation, bringing together students from all levels of the school: Kindergarten and first grade, across different learning areas.

> MIXAP dynamically and interactively synthesizes various projects previously undertaken with the students at the school.

MIXAP

Adeline JAN
Damien DUMOUSSET

Brûlatte public school, La Gravelle

> Thanks to augmented reality (sounds, images, texts), the students were able to discover their school courtyard mural in a different way. This new pedagogical approach allows us to diversify and enrich our future teaching methods.

INTERDISCIPLINARITY