IMPACTEDTECH

Synthetic presentation	How can we ensure that the measurement of the impact of educational resources is anticipated at the design stage and is not just subject to analysis after the fact? The aim is to develop a standardized method and associated tools in order to better measure the impact and use of the devices made available to the learning public and to ensure interoperability between third-party solutions.

R&D INDICATORS

Collaborations	■ ECE, engineering school, Paris campus ■ Latitudes - Tech For Good ■ Prometheus - DASES Gaia-X ■ LORIA, Lorraine Laboratory for Research in Computer Science and its Applications

1. GENERAL CONTEXT AND PROJECT ISSUES

Problem: The digital educational offer, both public and private, is rich and diversified, as is the demand for digital products and services. The COVID crisis has once again shown the need to capitalize on what already exists, in times of emergency, to make education systems more resilient and to really guarantee pedagogical continuity. Whether they are educational actors (teachers in particular, but also educational managers) or families in the context of their digital parenthood, there is a real expectation of qualification of the offers in terms of educational impact and targeted skills. At the same time, solution publishers are struggling to gather sufficient knowledge about the impact of their products, as they have no visibility into the school-extra-curricular continuum of each student. Any usage data from a specific solution does not allow for an assessment of the impact in terms of learning, without a more holistic view of the learning data and traces that allow for an assessment of how and in what context the resources and services were used (by the student, teachers, etc.).

2. OBJECTIVES, INNOVATION

Solution: Federate student learning data and traces, across all solutions and services used, in a school-extra-curricular continuum, to analyze the impact of each solution and identify areas for improvement.

Pain points

- Lack of infrastructure to facilitate data flow,
- Lack of an interoperability framework, in particular, consensus to be found on the standards allowing to describe the solutions and the skills that can be developed by their use (link with the use case "interoperability, ontology")
- Legal framework (use of learning traces), consent management

Partners/Ecosystem/Synergies

- EdTech actors, schools, local authorities, universities, state operators

Main technology/components

- Establishment of a regulatory and protective framework for the circulation and use of data
- Security and data sovereignty management
- Supra-national framework allowing the standardization of the offer and, in fine, the evolution towards more quality.

Concrete benefits/expected benefits

- To offer the entire educational community greater clarity on the digital educational offer and systems for recommending the most suitable resources and services
- Boost a European offer of digital educational solutions, based on the values supported by Europe, guaranteeing both the enhancement and the protection of data
- Develop the European EdTech offer towards standards of interoperability and educational qualification criteria, which will make it more competitive on the international scene

The question of the panel is essential for two reasons: the impact is not measured on an individual level - evaluation of skills - but on identified populations, for example on a specific age group.

And the idea is to also have the possibility to compare the results of the impact measurement with a neutral panel.

To do this, the first thing to do is to define indicators (definitions of signs of change and their time scales) and a reference ontology (qualitative and quantitative measurement criteria, alignment of semantic reference systems)

Then from an operational point of view, connect APIs to collect and integrate different data sources (LRS, analytics, surveys, etc.)

And finally, to provide representation tools: geographic and semantic mapping and dashboards

3. LOCKS AND ASSOCIATED STATE OF THE ART

3.1. Multifactor impact measurement

Through internal traces, analytics, qualitative questionnaires: how to federate and give a coherent image?
The different resources are recorded on different platforms, which makes it difficult to transfer all the data to a common platform and architecture. In addition, the data itself differs between resources depending on the templates and traces to be recorded, making it difficult to establish a common architecture.
The tools are scattered: LMS, CMS, Analytics (Google + matomo)

Impact measurement methodologies, which are well proven in the health, environmental and social fields, are not well developed in the field of education.

The sources do exist, however:

The OECD publishes a list of key education indicators available at:
https://www.oecd.org/fr/education/scolaire/indicateursclessurleducation.htm
But these are quantitative measures of public policy and social and economic impact

UNESCO, for its part, attempts to identify indicators of quality and learning
https://learningportal.iiep.unesco.org/fr/fiches-pratiques/mesurer-les-apprentissages/indicateurs-de-qualite-and-learning
While some of these can be used in our research, others are again policy implementations.

Specifically, the indicators we can rely on are:

- **Process indicators:** "*They measure how the activities of educational programs were conducted - whether they achieved the desired level of quality. They include the practical implementation of specific educational arrangements, e.g., application of standards, time on task, instructional supervision. Process indicators are concerned with qualitative issues and can be obtained through educational surveys and observations, reports and self-evaluations*.

- **Outcome indicators:** "*They measure the effects of program activities to determine whether their objectives have been met. They reveal the system's performance in terms of subject knowledge, skills, progression and completion, and satisfaction. Outcome indicators can be obtained through international assessments, surveys, and systematic field observations*.

However, we cannot influence the other types of indicators:

- **Context indicators**: "provide information about contextual factors that affect learning, such as student characteristics, socioeconomic conditions, cultural aspects, and local population issues. "
- **Input indicators:** *"They primarily measure the deployment and use of resources to facilitate learning. They indicate whether the planned financial, material and human resources are delivered in the planned quantities, at all levels of the system. One of the problems that can arise is that even if resources have been provided, it does not necessarily mean that they will ultimately be available. "*

ERASMUS has developed a number of tools dedicated to institutions engaged in international exchanges that we can take advantage of:

- indicator tables
- practical exercises to measure its impact
- templates and mapping examples

However, all this methodology, which is very rich, has not been the subject of the development of digital tools to facilitate its implementation.
The same is true for business schools such as ESSEC

Public policies are attentive and vigilant on impact issues, as evidenced by recurrent reports:

National Assembly Reports (IMPACT STUDY for a School of Trust) :
https://www.assemblee-nationale.fr/dyn/15/textes/l15b1481_etude-impact#
Longitudinal Evaluation of ActIvities Related to Digital Education (ELAINE) 2015 digital plan:
https://www.education.gouv.fr/presentation-de-l-etude-elaine-303264
Findings from the impact study of the My College Success program:
https://impact-tank.org/wp-content/uploads/2021/07/Synthese-resultats-etude-dimpact-20210323-1.pdf

Internationally, many initiatives to measure the impact of lessons have been initiated in very different geographical areas (Mali, Belgium, Jamaica).
Example: https://www.kinderpostzegels.nl/Uploaded_files/Zelf/mali-issuu.ea9394.pdf

3.2 Learning Traces

Measuring impact at the level of target populations cannot be conceived without going through the trace at the individual level.

By "traces", we mean all the data related to a learning interaction and which are backed up by a collection of appropriate events.
Even if standards exist (xApi), this is massive data by nature and scalability can be problematic because everything depends on the granularity and the context.

The tools themselves influence scalability: for example, **Trax** is recommended over **Learning Locker**.

It is necessary to rely on CMI5, a set of rules that offer all the functionalities of SCORM and xAPI.

Finally, the question arises as to whether it is the traces themselves or their interpretation that should be traced for impact measurement purposes.

3.3 Visualization tools

During the prototype of the dashboard that we realized (cf. paragraph 5), we were led to explore the existing solutions on the visualization such as :

We chose to develop the prototype from opensource and not paying solutions (unlike PowerBI) in order to keep the sovereignty of the data we handle.

3.4. Personal data and consent

RGPD compliance is central to the collection of personal data.
Apart from the email address, the other data recorded are disparate. For example, only some of the resources identify whether the users are parents, students or teachers; the age or class of the participants; the number of participants (if the material is projected in class in particular). Obtaining a unitary user profile that is cross-platform is therefore an important barrier to overcome, both technically and in terms of the consent required.
In this respect, there are solutions such as Visions. member of PrometheusX

4. RESEARCH WORK UNDERTAKEN DURING THE YEAR

We have initiated a two-pronged program:

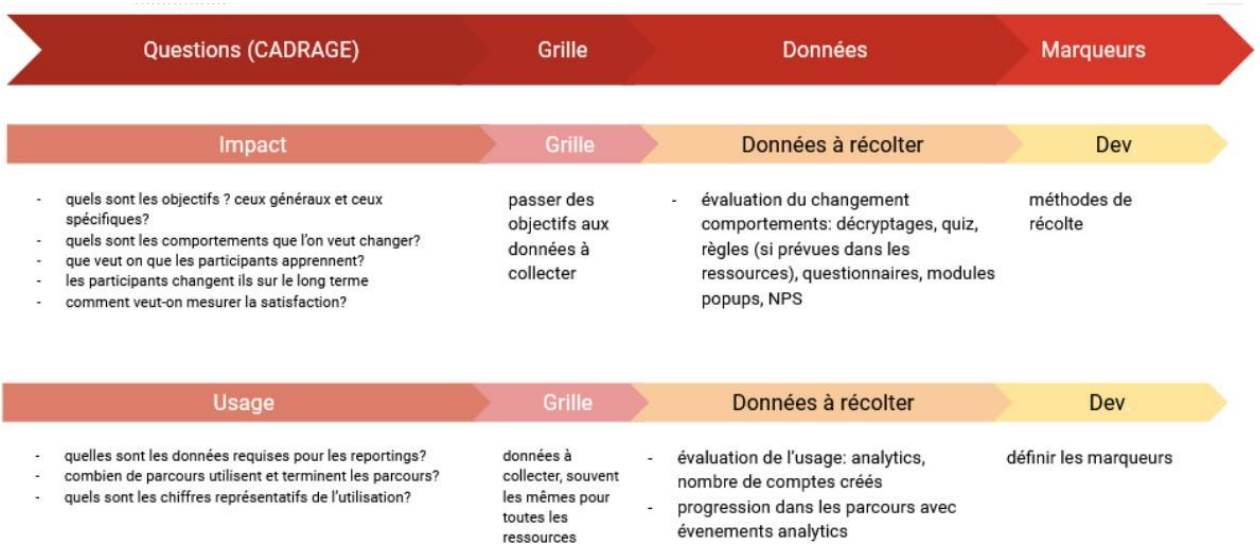
- the methodology
- the tools

4.1. Methodology

4.1.1. Scoping document

A grid has been developed to record upstream data feedback needs within a project. This document is made available to program managers and stakeholders on all aspects of data outsourcing (communication, LRS, partner reporting, etc.)

The diagram below shows the process used:



To move from the scoping document to a set of implementable data, we relied on our previous work on "impact stories".

4.1.2. Impact stories

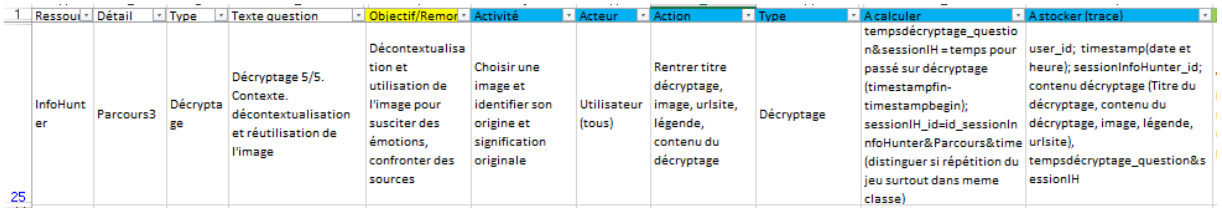
It is a matter of organizing the traces thanks to a "template" of purpose, which we call "impact stories": the expected returns regarding the digital skills to be developed: what we expect the users to learn through the decoding / the question / the video / the course.

- the actor: the individual who visualizes the course and/or participates in the activities, whether he or she is an adult or a child, a teacher or a student, etc.
- the activity: what activity the actor is confronted with, e.g. choosing an image/response, checking information, etc.
- action: type of action carried out by the actor and which gives rise to recorded data.
- the type of feedback: what is the purpose of the activity carried out, practice, conclusive evaluation, deciphering, etc.
- information to be calculated: this is mainly the time spent on the different activities and decoding as well as the definition of scores for the games and tests proposed in the different resources. The definition of scores allows the standardization of the evaluation of behaviors so that the answers and scores are comparable between the resources and between the themes.

- information to be recorded: this is all the traces that we want to keep and that are considered important for the impact analysis.

This information is listed in the form of standardized tables:

Figure below: Impact stories of content. Example of an InfoHunter journey.



	Ressou	Détail	Type	Texte question	Objectif/Remor	Activité	Acteur	Action	Type	A calculer	A stocker (trace)
25	InfoHunter	Parcours3	Décryptage	Décryptage 5/5. Contexte. décontextualisation et réutilisation de l'image	Décontextualisation et utilisation de l'image pour susciter des émotions, confronter des sources	Choisir une image et identifier son origine et signification originale	Utilisateur (tous)	Rentrer titre décryptage, image, urlsite, légende, contenu du décryptage	Décryptage	tempsdécryptage_question&sessionIH = temps pour passé sur décryptage (timestampfin-timestampbegin); sessionIH_id=id_sessionInfoHunter&Parcours&time (distinguer si répétition du jeu surtout dans meme classe)	user_id; timestamp(date et heure); sessionInfoHunter_id; contenu décryptage (Titre du décryptage, contenu du décryptage, image, légende, urlsite), tempsdécryptage_question&sessionIH

For each activity, question, video, we get a complete overview of what data is recorded, what issues it addresses and what theme it focuses on.

Figure below: A line from the complete content overview.

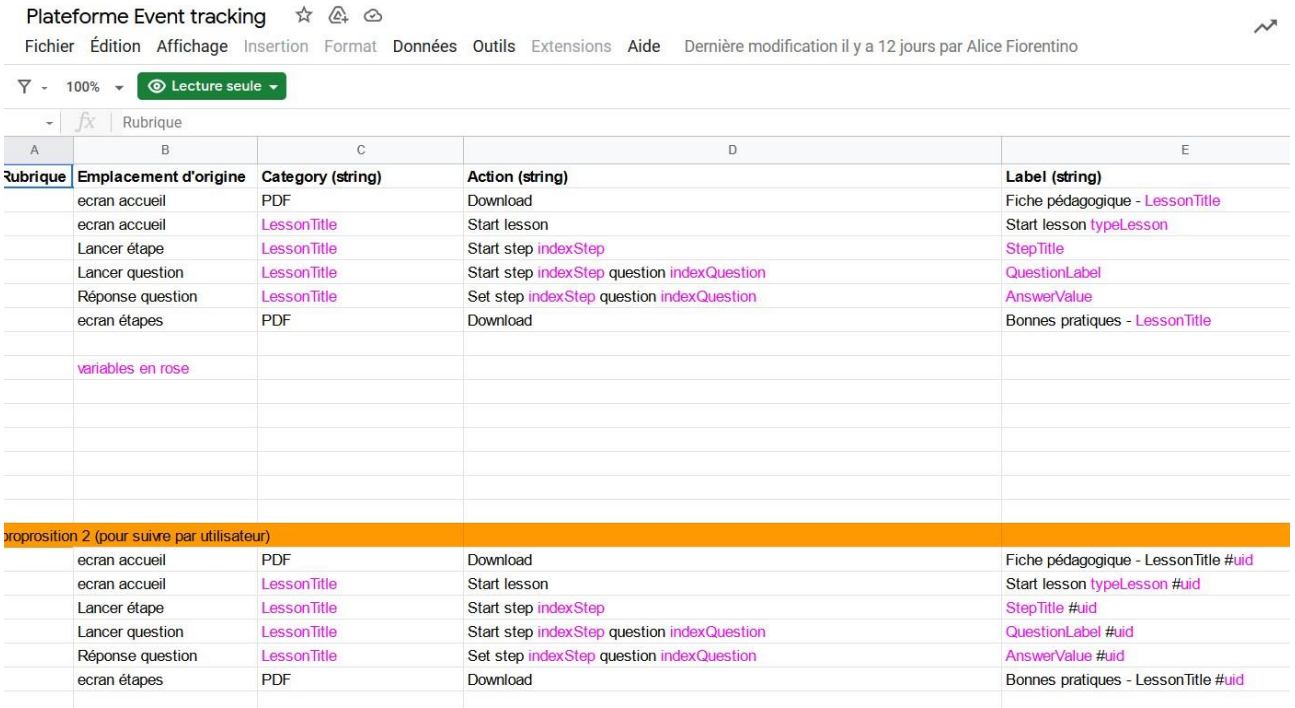
	Ressou	Détail	Type	Texte question	Thème	Apport/Objecti	Compétence-	Réponses possibles	Objectif/Remor	Activité	Acteur	Action	Type	A calculer	A stocker (trace)
25	InfoHunter	Parcours3	Décryptage	Décryptage 5/5. Contexte. décontextualisation et réutilisation de l'image	La fabrique de l'informati on	Décrypter l'information, reconnaitre les fake news	Questionner la fiabilité et la pertinence des sources. Évaluer la fiabilité et la pertinence de diverses sources	Titre du décryptage, contenu du décryptage, image, légende, urlsite	Décontextualisation et utilisation de l'image pour susciter des émotions, confronter des sources	Choisir une image et identifier son origine et signification originale	Utilisateur (tous)	Rentrer titre décryptage, image, urlsite, légende, contenu du décryptage	Décryptage	tempsdécryptage_question&sessionIH = temps pour passé sur décryptage (timestampfin-timestampbegin); sessionIH_id=id_sessionInfoHunter&Parcours&time (distinguer si répétition du jeu surtout dans meme classe)	user_id; timestamp(date et heure); sessionInfoHunter_ contenu décryptage (Titre d décryptage, contenu du décryptage, image, légende urlsite), tempsdécryptage_question essionIH

These impact-stories are managed by a data-analyst, in collaboration with the stakeholders identified in the scoping document.

4.1.3. Implementation

The last step before development is to translate the impact stories into traceable events.

To do this, the data analyst transfers the information to a member of the development team, who must then complete a final grid: "event tracking".



Plateforme Event tracking

Fichier Édition Affichage Insertion Format Données Outils Extensions Aide Dernière modification il y a 12 jours par Alice Fiorentino

100% Lecture seule

fx Rubrique

A	B	C	D	E
Rubrique	**Emplacement d'origine**	**Category (string)**	**Action (string)**	**Label (string)**
	ecran accueil	PDF	Download	Fiche pédagogique - LessonTitle
	ecran accueil	LessonTitle	Start lesson	Start lesson typeLesson
	Lancer étape	LessonTitle	Start step indexStep	StepTitle
	Lancer question	LessonTitle	Start step indexStep question indexQuestion	QuestionLabel
	Réponse question	LessonTitle	Set step indexStep question indexQuestion	AnswerValue
	ecran étapes	PDF	Download	Bonnes pratiques - LessonTitle
	variables en rose			
proprosition 2 (pour suivre par utilisateur)				
	ecran accueil	PDF	Download	Fiche pédagogique - LessonTitle #uid
	ecran accueil	LessonTitle	Start lesson	Start lesson typeLesson #uid
	Lancer étape	LessonTitle	Start step indexStep	StepTitle #uid
	Lancer question	LessonTitle	Start step indexStep question indexQuestion	QuestionLabel #uid
	Réponse question	LessonTitle	Set step indexStep question indexQuestion	AnswerValue #uid
	ecran étapes	PDF	Download	Bonnes pratiques - LessonTitle #uid

4.2. Tools

We have focused our approach on the development of "connectors" between existing tools

- Merge Google and Matomo analytics into a single document
- Automation of data retrieval tasks
- Data filtering according to stakeholder profiles

The result takes the form of a data table, the preliminary form of a real dashboard:

Données pour reporting partenaires

DEPUIS LE LANCEMENT DE FAMINUM (01/12/2021)

Rappel: Les informations Matomo se mettent à jour automatiquement. Les Google Analytics en jaune se mettent à jour une fois par semaine, ou peuvent etre mises à jour sur le moment en faisant fonctionner le rapport (extensions > Google Analytics > run report). Les cellules en rose sont celles dont la mise à jour est manuelle

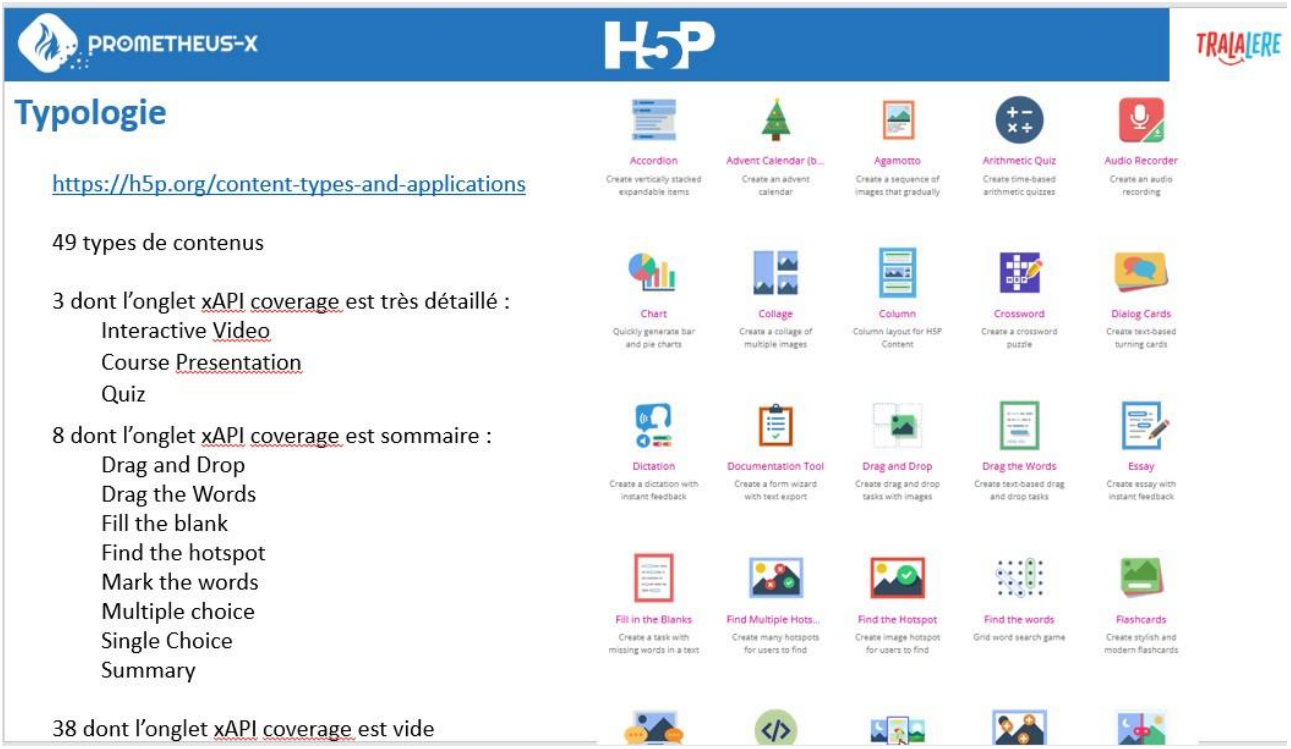
UTILISATEURS

Nombre d'utilisateurs	
Nombre de personnes déclarées dans le	3503
Nombre d'utilisateurs - Matomo	5555
Nombre de compte créés	1012
Utilisateurs par âge déclaré dans les profils famillle, sur total	
- de 6 ans	0,1049928673
6-9 ans	0,1506419401
10-12 ans	0,1440798859
13 ans et +	0,1523537803
Adulte	0,4479315264
Temps moyen passé sur le site	0:06:44
Nombre d'inscriptions à la newsletter:	0,3211462451

Progression	événements uniques (comptabilisés une seule fois par visite)/utilisateurs ayant créé un compte	événements uniques (comptabilisés une seule fois par visite)/utilisateurs total	
1. Création d'un compte et d'un profil	1	0,1821782178	(est mis à jour tous les mois, peut conduire à des erreurs)
2. Questionnaire	0,7826086957	0,1425742574	(nombre de réponses à la question qui a eu le plus de réponses entre toutes), est un minimum
3. Mise en préféré de règles	0,3171936759	0,05778577858	(nombre de fois où la règle la plus préférée a été selectionnée), est un minimum
4. Impression de charte	0,3250988142	0,05922592259	

Concerning trace tools, our participation in the Prometheus-X working group has led us to analyze devices such as H5p and to identify the trace feedback mechanisms that will allow us to anticipate the integration of our platforms in other systems (via APIs).

Example:



5. RESULTS

5.1. Prototype dashboard

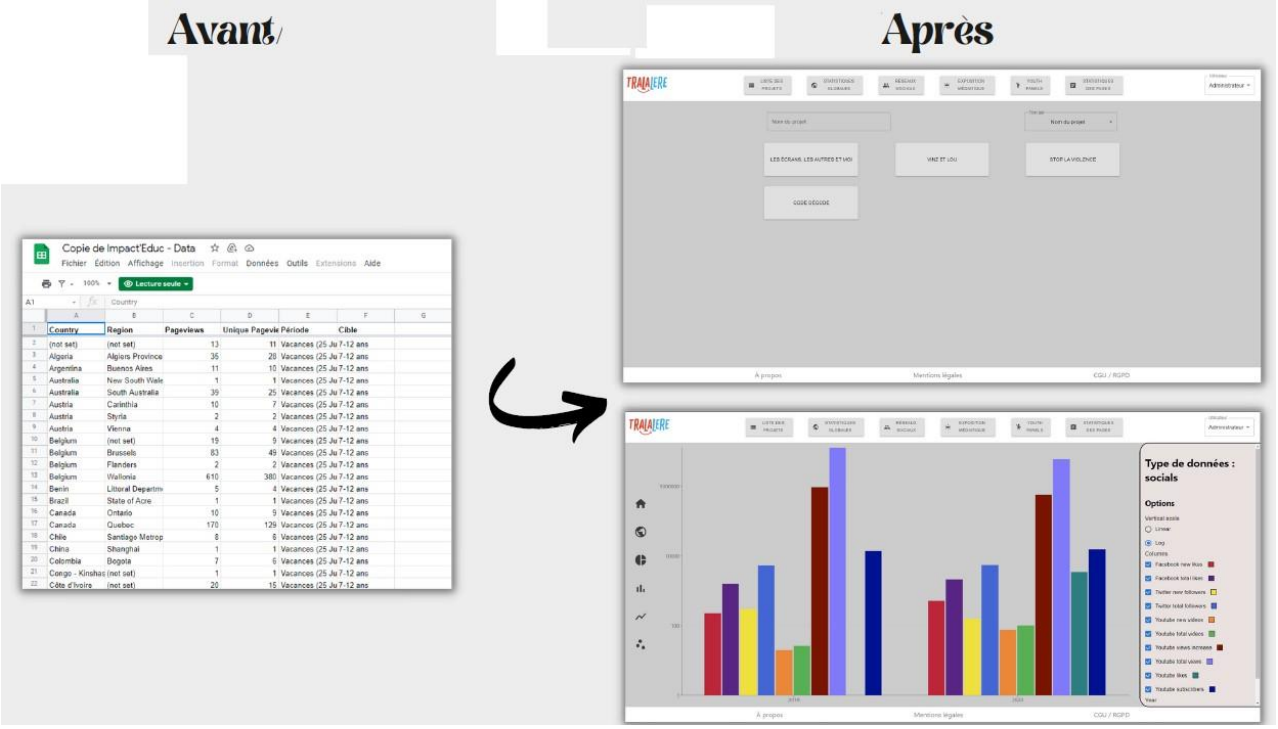
In addition to the methodology we have developed and the tools we have federated, we have also developed a prototype to validate our assumptions:

How can we differentiate between what is reporting and what is a real tool for managing our impacts?

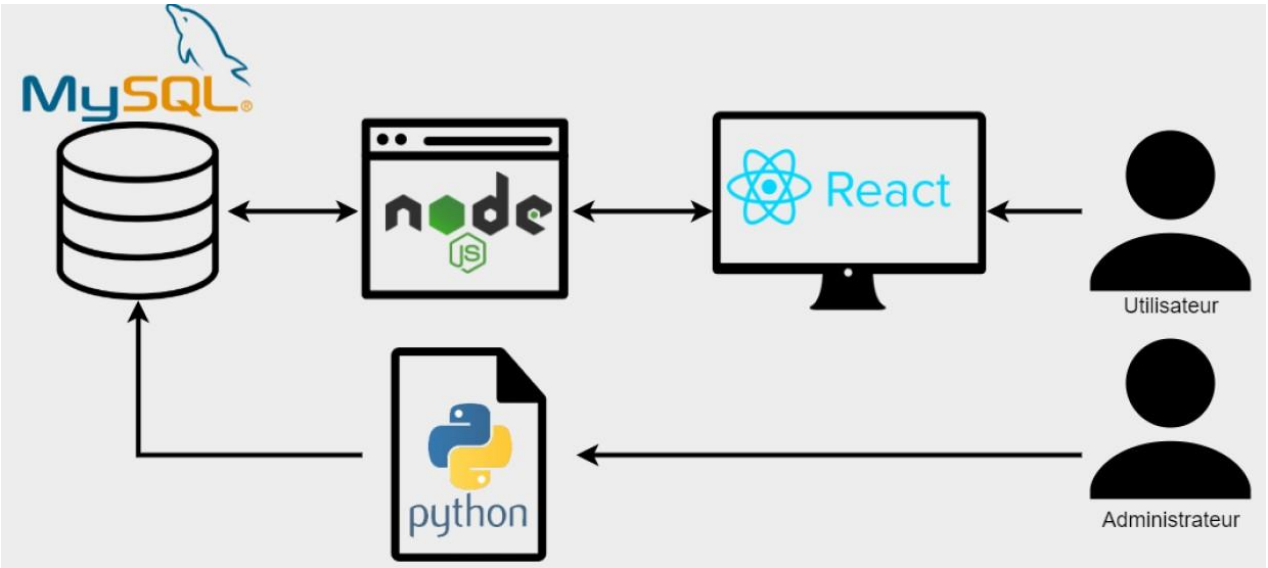
We collaborated with 7 students from ECE, an engineering school in Paris, and gave them a set of specifications specifying their mission:

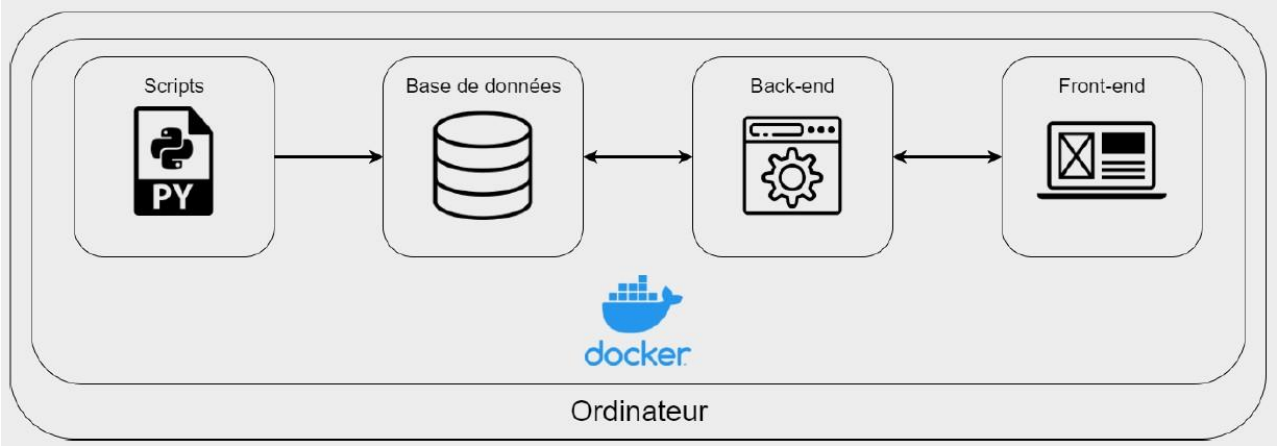
Create a dashboard tool for impact measurement with a simplified and dynamic interface.

The principle adopted in the absence of APIs - which have yet to be developed - was to export the data produced by our centralization tables (cf. paragraph 4.2), then to run a script that would subsequently allow the interface to be controlled.

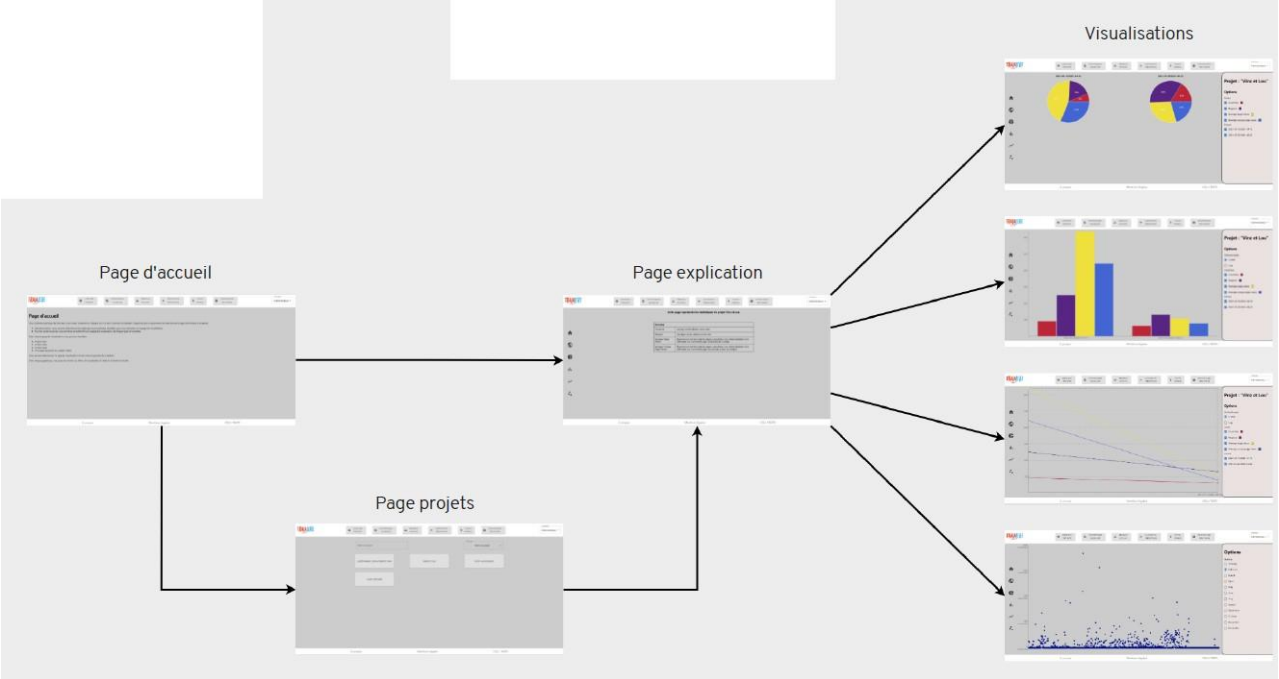


The software architecture is as follows:





The sequence of screens in the prototype:



The important thing to remember about this work is that it is impossible to include this component in a static document:

- **the ability to animate the graphs according to the selected data, in order to make certain correlations explicit**

For example, see dynamically how the distribution between girls and boys evolves according to the topics covered, the periods considered, the region, etc.

5.2. Data Protection Impact Assessment

We have been conducting applied research on impact measurement, and those related to the compliance of our processing with the RGPD.
This has allowed us to set up a template of documents and processes that guarantee the production on demand of the AIPD: https://www.cnil.fr/fr/RGPD-analyse-impact-protection-des-donnees-aipd

- AIPD itself

- Process maps and support
- Table of treatments
- Table of subcontractors
- Terms to be included in the privacy policy

6. CONCLUSIONS

Our approach to exploring the issue of impact measurement led to the following results:

- Resumption of previous work on impact-stories, in order to insert them into a more global methodology ranging from the expression of needs to technical implementation
- development of tools to cross-reference and federate analytics and learning traces tools into a single data silo
- development of a dynamic control prototype, the decision on the data to be crossed being left to the user, which allows him to bring out - or not - correlations

We have also highlighted issues to be addressed in future developments:

- systematize export formats, or even create a mill to have always the same format as input to the future dashboard
- introduce a notion of mapping and geolocation, for example to easily find the ambassadors likely to intervene in its region.
- Develop paradigms and connectors that do not yet exist, especially with qualitative impact measurement tools such as our LimeSurvey questionnaires