Results of our questionnaire on the iGEMINI video game for high school biology teachers

After the first version of the video game storyboard, we coded part of the game. We felt it was essential to seek feedback from teachers in order to know if we were responding fairly to the needs identified during the first interviews. We gave a questionnaire to high school teachers via our acquaintances and a national education inspector. Unfortunately, many teachers were slow to respond because of the extra workload due to COVID-19. Nevertheless, we worked very closely with four high school biology teachers. Here is the overall answer to our main questions and their feedback.

Who are we?
We are an association of students from the INSA of Toulouse and the University Paul Sabatier of Toulouse. We have designed a synthetic biology project in order to compete in the iGEM international competition.

What is iGEM?
iGEM is an international synthetic biology competition that was initiated in 2004 by MIT (Massachusetts Institute of Technology). The competition is annual and is open to graduates, students and high school students from all over the world. Each year, it brings together more than 6,000 people in about 400 teams. The objective is to design a synthetic biology project useful to society in order to train participants in a scientific research approach.

Why this questionnaire?
We have decided to make the popularization of biotechnology techniques.
This questionnaire has been developed for high school SVT teachers in order to help the design of a pedagogical tool. This tool would be in the form of a "point & click" type video game where the player will be guided in the scientific approach of our project. Through this game, we have several objectives:

- To help the understanding of the notions in biotechnology approached in French high school: PCR, cloning, enzymatic digestion...

- To help in the understanding of the PCR practical exercise in French high school.

- To help discover the fields of biotechnology.

- Introduce a scientific and ethical reflection process.

Storyboard of the game

The game is configurable in English or French.

Game mode iGEMINI

● Chapter 1: Coculture

This chapter poses the problem of our project: the need to produce a nutritional supplement for astronauts in a spacecraft. The player will design the co-culture using the resources available on a spacecraft.

The player will discover fermentation and engineering but also the scientific approach of designing a solution to a problem.

● Chapter 2: Synthetic Biology

This chapter discusses how to enrich yeast with provitamin A. The player will discover the world of synthetic biology, learn about cloning and how we can use biological tools in biotechnology.

Steps in this chapter:

- PCR
- Digestion
- Ligation
- Yeast transformation

● Chapter 3: Ethical Thinking

This part could be a short video on the ethics of cloning and the manipulation of living things

● Quiz to recall and test the knowledge learned during the game.

TP PCR game mode

This game mode is based on PCR TP made in general first in SVT. The player will virtually perform the practical exercise to better understand and appropriate the notions associated with the exercise. The different applications of this technique will be presented.

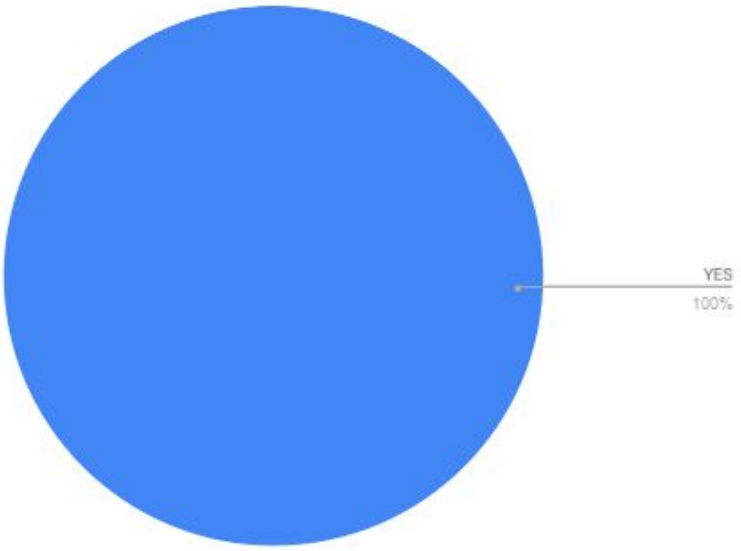
Steps of this chapter:

- DNA extraction
- Preparation of the PCR mixture
- PCR Cycles
- Digestion
- Gel electrophoresis

Take a look at our progress! Beware, it's not all over... But we're working on it!

https://arnobruel.github.io/Jeu-video/

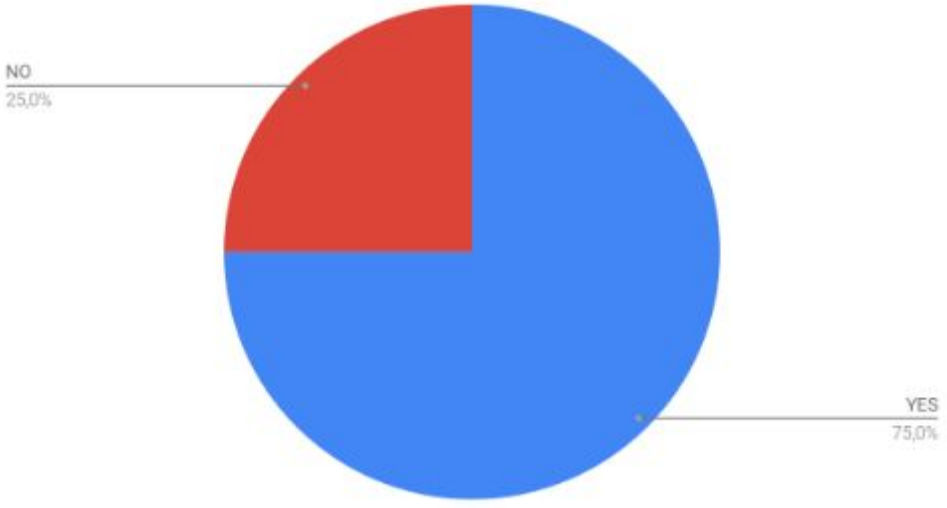
- Do you think you need a visual pedagogical tool in order to approach notions in biotechnology?



- If so, what notions in particular?

CRISPR CAS9
Differences between GMO and hybridization phenomenon
PCR
Enzymatic digestion
Electrophoresis
I might have thought that it is not necessary, but seeing your tool, I think it is very relevant.

- Do you think the storyboard of our game meets these needs?



- If not, why not and what would be missing?

A part to understand bioinformatics

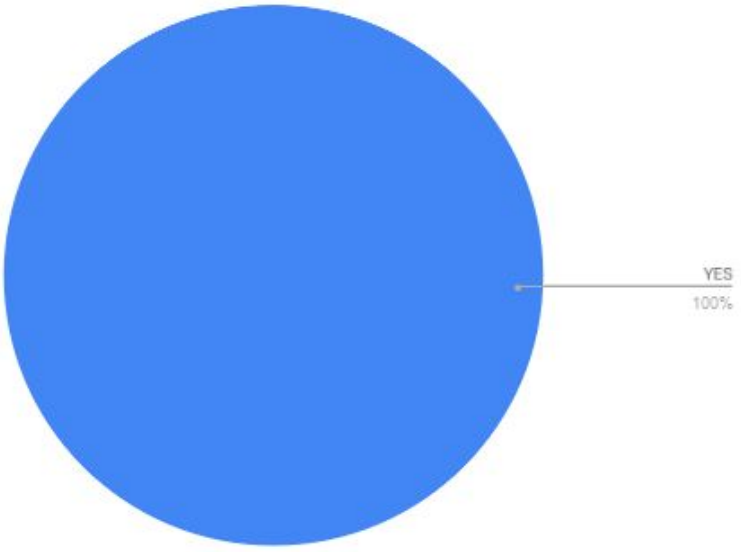
- Do your students have to do the PCR lab? Why?

The cost of this practical work is too high...

- What does the TP PCR bring to students?

Making more abstract notions concrete

- Would you be interested in addressing the ethical issues related to synthetic biology?



- If so, in what form (quiz, list of topics for individual and group reflection, anecdotes on history and related laws, etc.)?

Role-playing game

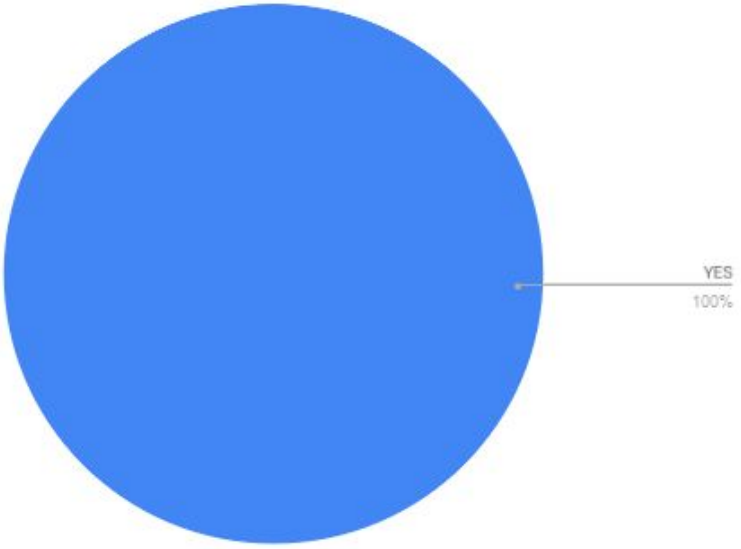
quiz

The aspect of law and history are very important to address

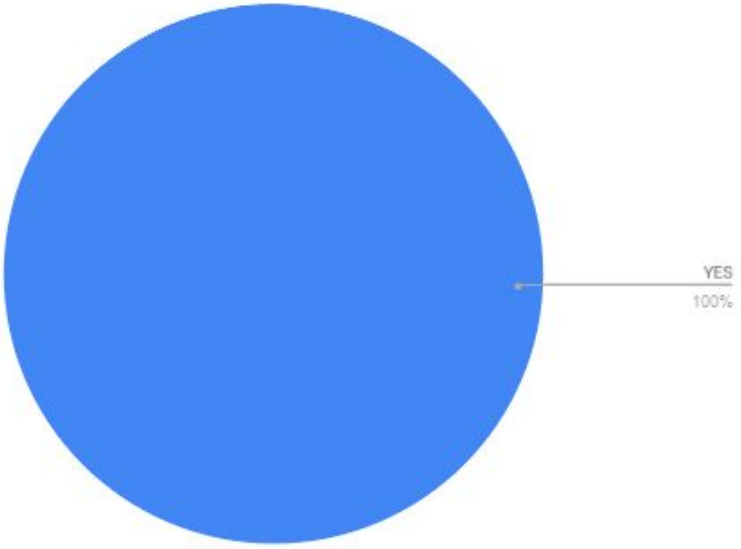
- In what way do you think the high school reform has impacted the concepts addressed in biotechnology?

There is little room for biotechnology
This reform has brought teaching closer to the applied sciences.

- Could you test our game with your students between the start of the school year and November 27th?



- Do you think it makes sense to briefly explain some of the areas of biotechnology that are addressed in our project (microbiology, molecular biology and their markets)?



- Other feedback:

“It is necessary to promote the graduate studies in biology and the studies for technical courses.”

“The game is really fun to play, but it takes time. It seems to me that a mini presentation of the team and the research project you are conducting would have spiced things up a bit at the beginning. Maybe in the form of a short introductory video before you get into their game.”

“This game is very interesting and would be perfect for second year high school students and those in their final years.”