

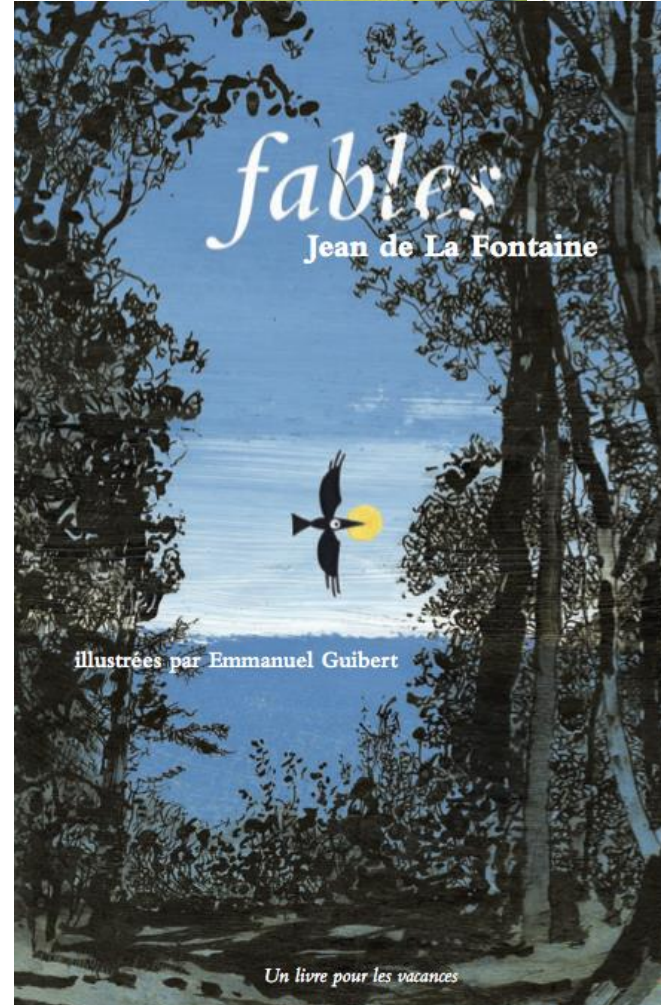


# BIEN JOUE & OISEAUX COMPTEURS:

Can playing card games with mathematical content help first graders progress in math and reading?

Marie Lubineau, Stanislas Dehaene, Marc Gurgand, Adrien Pawlik, Cassandra Potier-Watkins, Caroline Bévalot, Nathan Viltard

# Context of the experiments



Every year since 2018, all 5th graders of France are given a book (operation “a book for the holidays”)

March 2021: suggestion of the DGESCO to give each first grader a card game as a mirror of this operation

With the scientific council, we wondered if we could test such a device before deploying it on a large scale.

Which game(s)? With which protocol? Which skills do we want to work on?

# Examples in the literature

## Board games

Playing Linear Number Board Games–But Not Circular Ones–Improves Low-Income Preschoolers' Numerical Understanding.  
*Siegler & Ramani 2009*



88 children  
in low SES  
kindergarten



5 sessions of  
20 minutes  
during 3  
weeks



board  
game: the  
number  
race



The experimental group is better than the control to **compare numbers** and **place them on a number line**.

## Card games

Benefits of Playing Numerical Card Games on Head Start Children's Mathematical Skills  
*Scalise et al. 2020*



83 children  
in low SES  
kindergarten



4 sessions of  
20 minutes  
during 2  
weeks



card  
game: the  
Battle



The experimental group is better than the control to **recognize and compare numbers**.

# The games

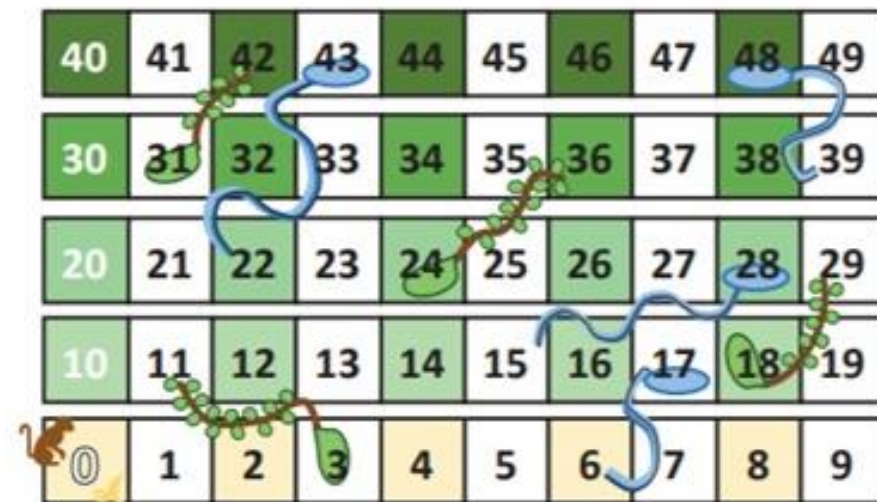
## Bien Joué

*Given to each child*

A **card game** of 40 cards from 1 to 10 in four different colours



A **board game** inspired by snakes and ladders



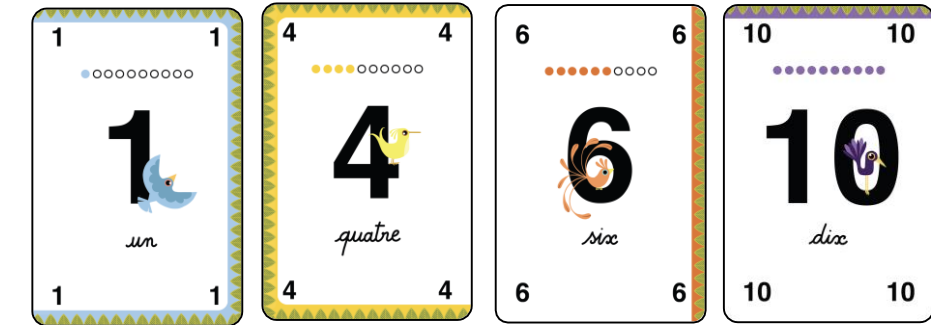
*Available online*

- detailed and illustrated rules of the games
- new game ideas
- puzzles to solve throughout the summer

## Oiseaux Compteurs

*Given to each child*

A **card game** of 40 cards from 1 to 10 in four different colours

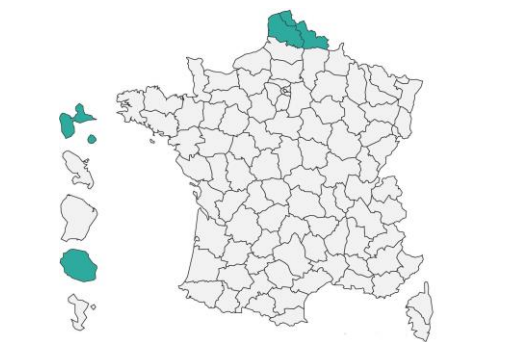


*Available online*

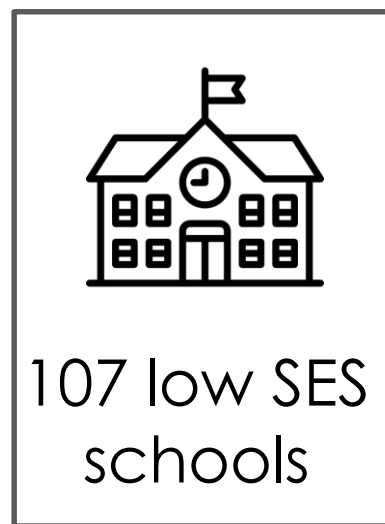
- a board game that could be printed
- detailed and illustrated rules of the games
- other games ideas

# Bien Joué Implementation

## Project's workforce

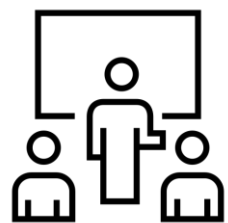


4 départements



50% in the experimental group

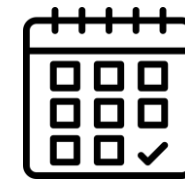
50% in the control group



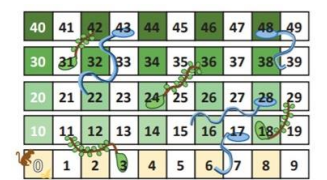
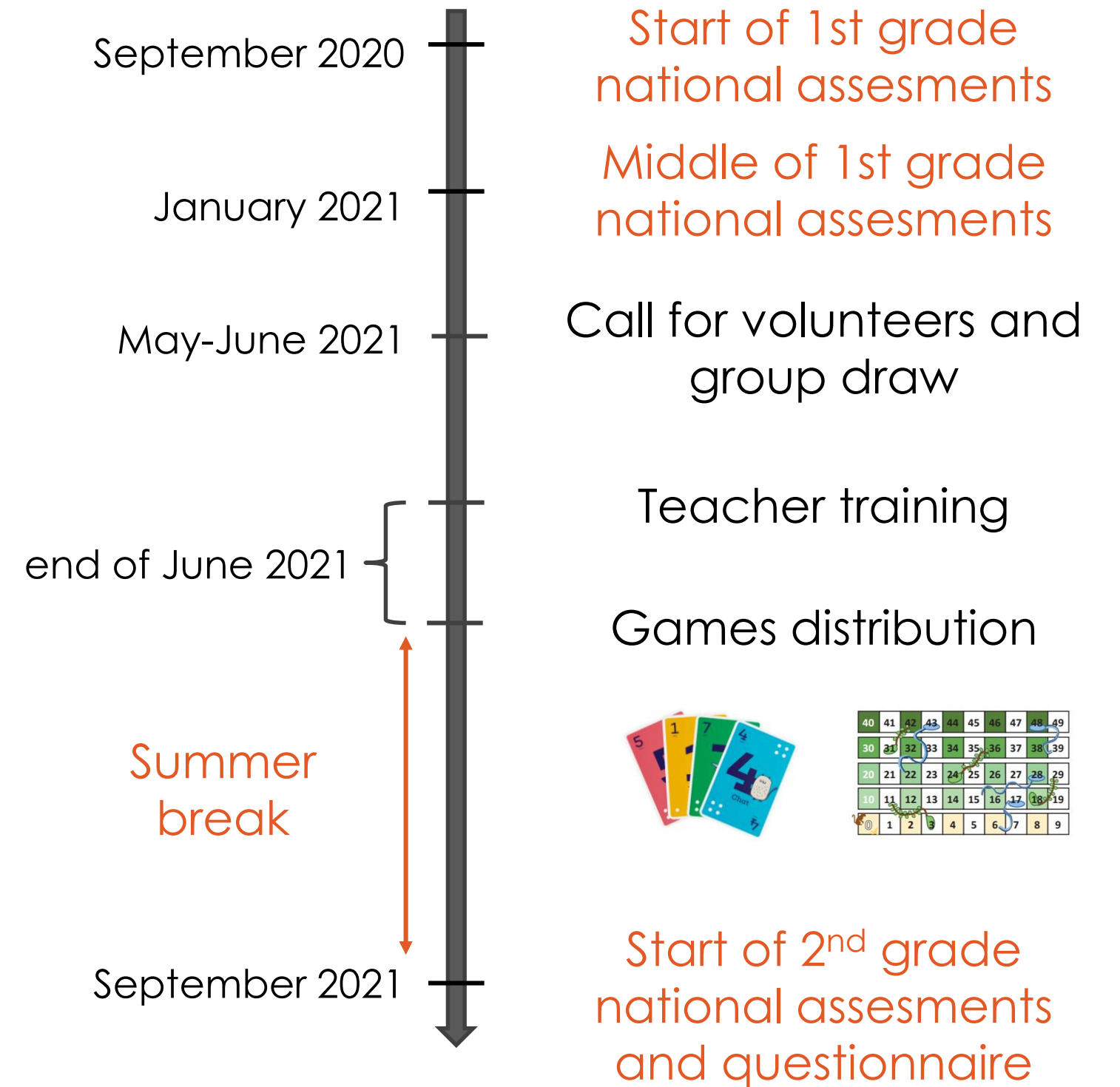
214 first grade classes



2563 children



## Main stages of the project

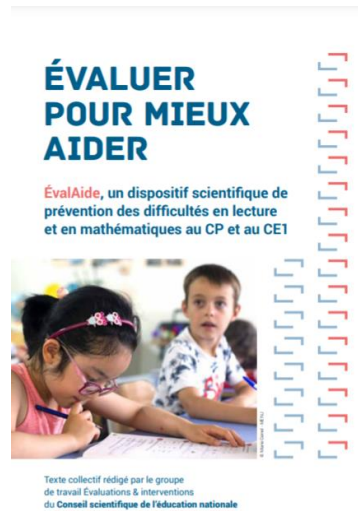


# Bien Joué Results

## Confidence of the child in his abilities



## Results in maths and language



## Motivation and anxiety

I like to go to school.

strongly disagree



disagree



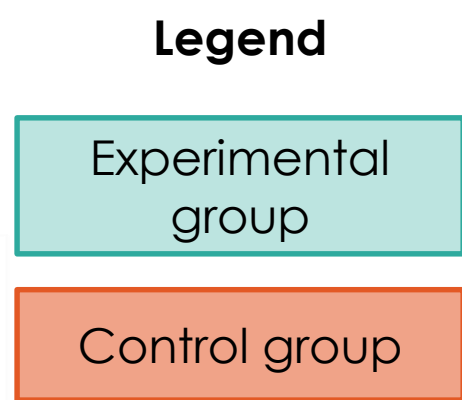
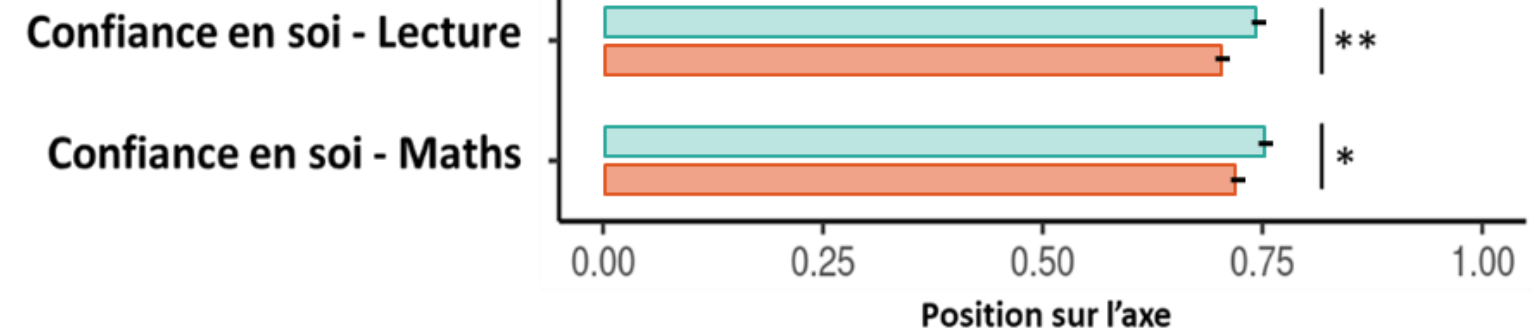
agree



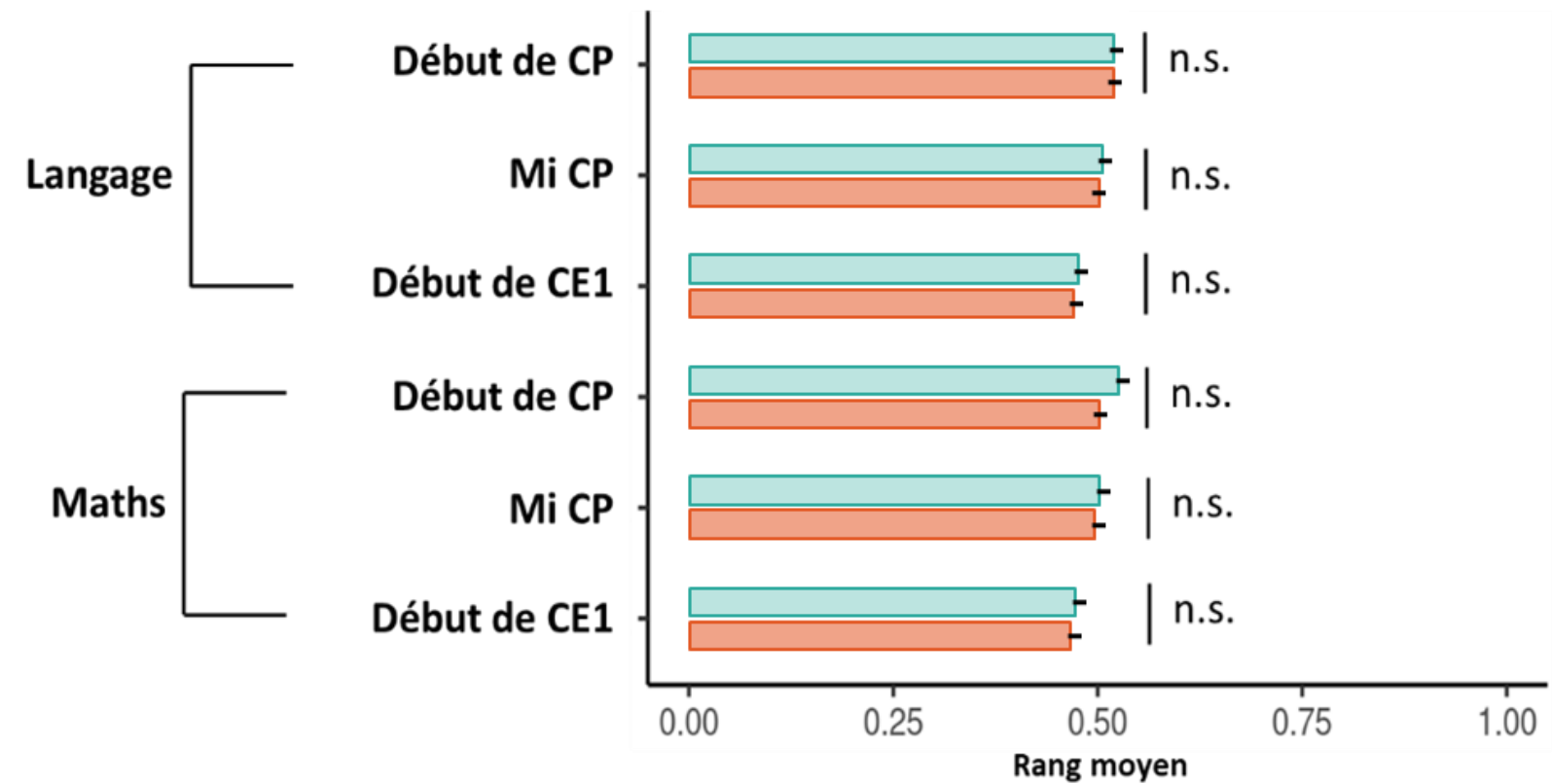
strongly agree



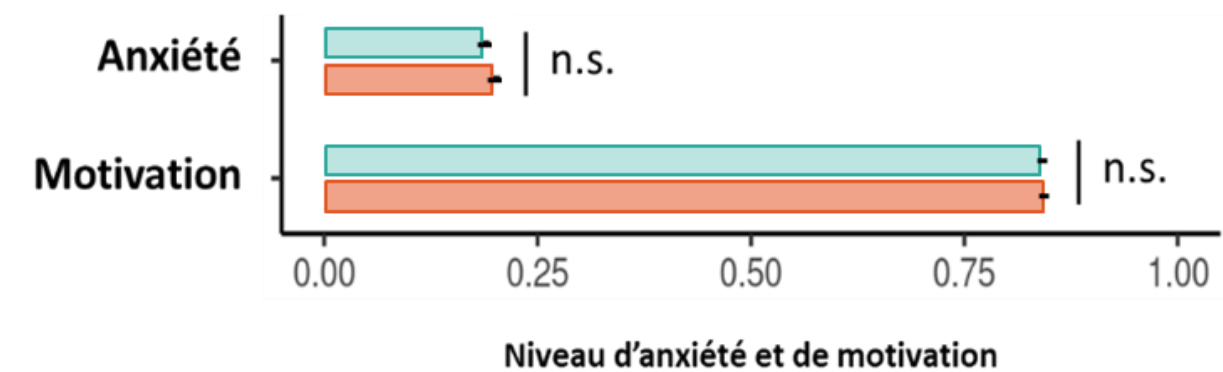
## Confidence of the child in his abilities



## Results in maths and language



## Motivation and anxiety



# Bien Joué

## Results

As our data have a hierarchical structure, scores for children in the same class are likely correlated → we should take this correlation into account in our analysis.

$$dv \sim \beta_i X_i + (1 | \text{school/class})$$

Parameters that have been found to have an impact on maths and reading scores and that we need to take into account are:

- Age
- Sex
- Department
- ips (only for Oiseaux Compteurs)
- pre-test scores in maths and language
- familiarity with games in general

Langage\_start\_2nd\_grade ~ Age + sex + department +  
 Langage\_start\_1st\_grade + Langage\_mid\_1st\_grade +  
 Maths\_start\_1st\_grade + Maths\_mid\_1st\_grade +  
 familiarity with games +  
 group + (1 | school\_id/class\_id)

	Estimate	Std. Error	df	t value	Pr(> t )
(Intercept)	8.727e-02	6.251e-02	1.781e+03	1.396	0.162845
Age_CP	-1.112e-03	8.070e-04	1.747e+03	-1.377	0.168575
sexe	1.107e-02	6.613e-03	1.726e+03	1.674	0.094366 .
departement1	-3.105e-02	1.149e-02	7.943e+01	-2.703	0.008403 **
departement2	1.387e-02	1.077e-02	5.836e+01	1.288	0.202897
departement3	-4.315e-04	9.935e-03	5.824e+01	-0.043	0.965503
T1_Math_Rank	4.749e-02	2.079e-02	1.816e+03	2.284	0.022462 *
T2_Math_Rank	7.129e-02	2.142e-02	1.817e+03	3.328	0.000893 ***
T1_Lang_Rank	1.620e-01	2.206e-02	1.829e+03	7.342	3.16e-13 ***
T2_Lang_CuRank	6.254e-01	2.172e-02	1.821e+03	28.791	< 2e-16 ***
group	3.642e-03	1.216e-02	7.013e+01	0.300	0.765368
nb_games_known	3.243e-03	1.808e-03	1.782e+03	1.793	0.073067 .
freq_play	-5.869e-03	3.548e-03	1.791e+03	-1.654	0.098246 .

Maths\_start\_2nd\_grade ~ Age + sex + department +  
 Langage\_start\_1st\_grade + Langage\_mid\_1st\_grade +  
 Maths\_start\_1st\_grade + Maths\_mid\_1st\_grade +  
 familiarity with games +  
 group + (1 | school\_id/class\_id)

	Estimate	Std. Error	df	t value	Pr(> t )
(Intercept)	1.456e-01	6.341e-02	1.777e+03	2.296	0.0218 *
Age_CP	-1.709e-03	8.145e-04	1.726e+03	-2.098	0.0361 *
sexe	-4.273e-02	6.670e-03	1.709e+03	-6.407	1.92e-10 ***
departement1	-2.363e-02	1.405e-02	9.385e+01	-1.682	0.0959 .
departement2	-4.050e-05	1.335e-02	7.179e+01	-0.003	0.9976
departement3	8.021e-03	1.231e-02	7.671e+01	0.651	0.5167
T1_Math_Rank	1.871e-01	2.108e-02	1.792e+03	8.877	< 2e-16 ***
T2_Math_Rank	4.368e-01	2.186e-02	1.834e+03	19.979	< 2e-16 ***
T1_Lang_Rank	1.078e-01	2.246e-02	1.822e+03	4.797	1.74e-06 ***
T2_Lang_CuRank	1.945e-01	2.214e-02	1.824e+03	8.783	< 2e-16 ***
group	1.045e-02	1.496e-02	8.667e+01	0.699	0.4866
nb_games_known	-3.705e-04	1.829e-03	1.756e+03	-0.203	0.8395
freq_play	1.393e-03	3.590e-03	1.765e+03	0.388	0.6981

# Bien Joué

## Results

A large proportion of children say they used our games during the summer

		Group	
		Experimental	Control
Frequency of use of our games during the summer	Every day	<b>209</b> 22,5%	<b>56</b> 6,0%
	Every week	<b>144</b> 15,6%	<b>34</b> 3,7%
	Sometimes	<b>333</b> 36,0%	<b>195</b> 21,0%
	Never	<b>157</b> 17,0%	<b>112</b> 12,1%
	Do not recognize the games	<b>82</b> 8,9%	<b>531</b> 57,2%

Overall, the vast majority of children are familiar with games in general.

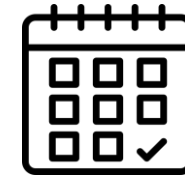
Game	% of children who recognizes the game	Game	% of children who recognizes the game
Mille bornes	18,8	Petit chevaux	69,5
Lynx	25,1	Qui est-ce	71,1
Jeu de l'Oie	45,3	Monopoly	77,6
7 familles	49,4	Cartes	80,5
Dobble	64,2	UNO	85,5

The lack of benefit from the intervention could be explained by an **overly traditional use of the cards** during the summer, not very different from that of the children in the control group.

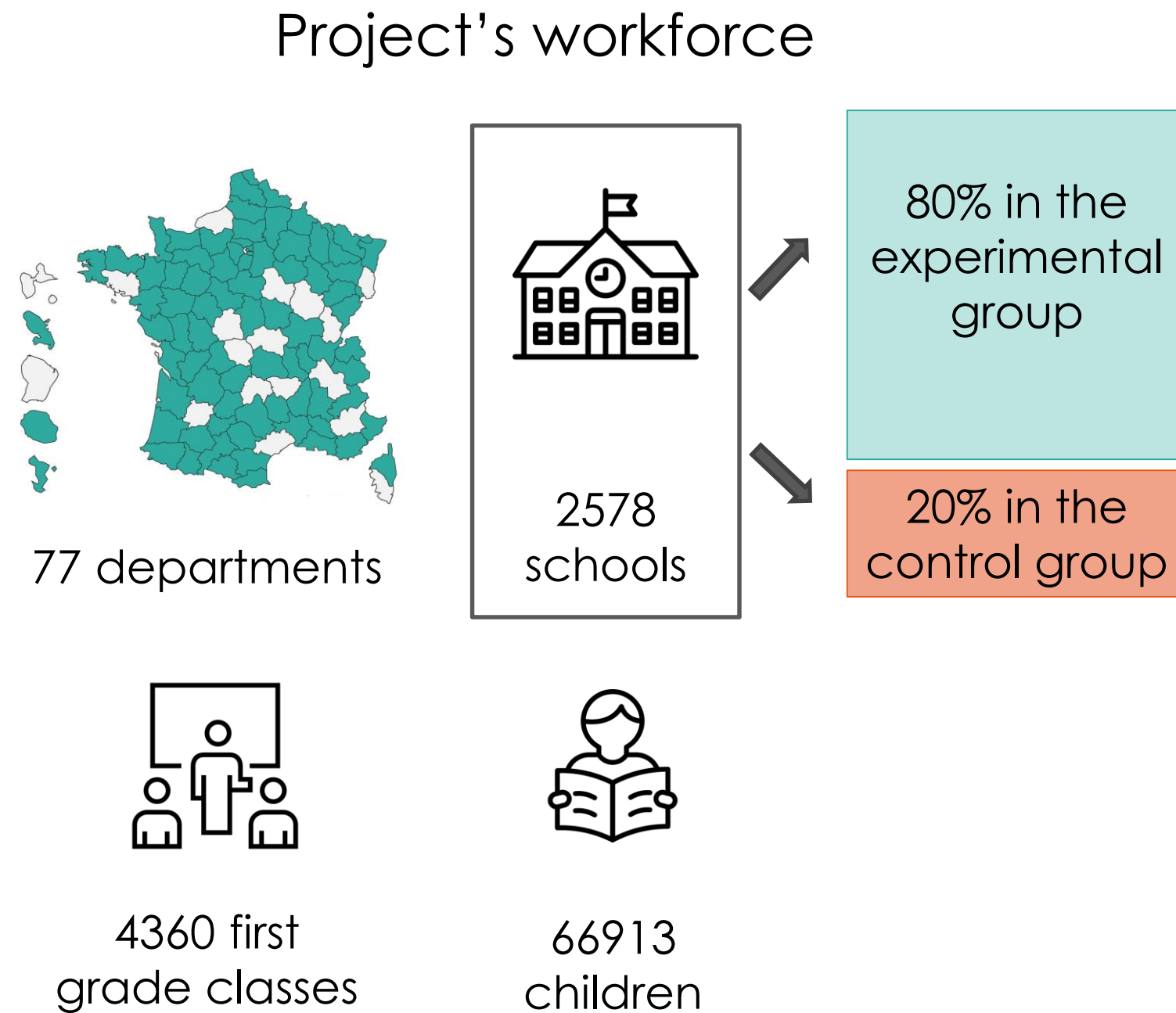
**Distribution at the beginning of the year** might be more effective, as the practice of the games could be integrated into the **classroom pedagogy**.



# Oiseaux Compteurs Implementation



## Main stages of the project

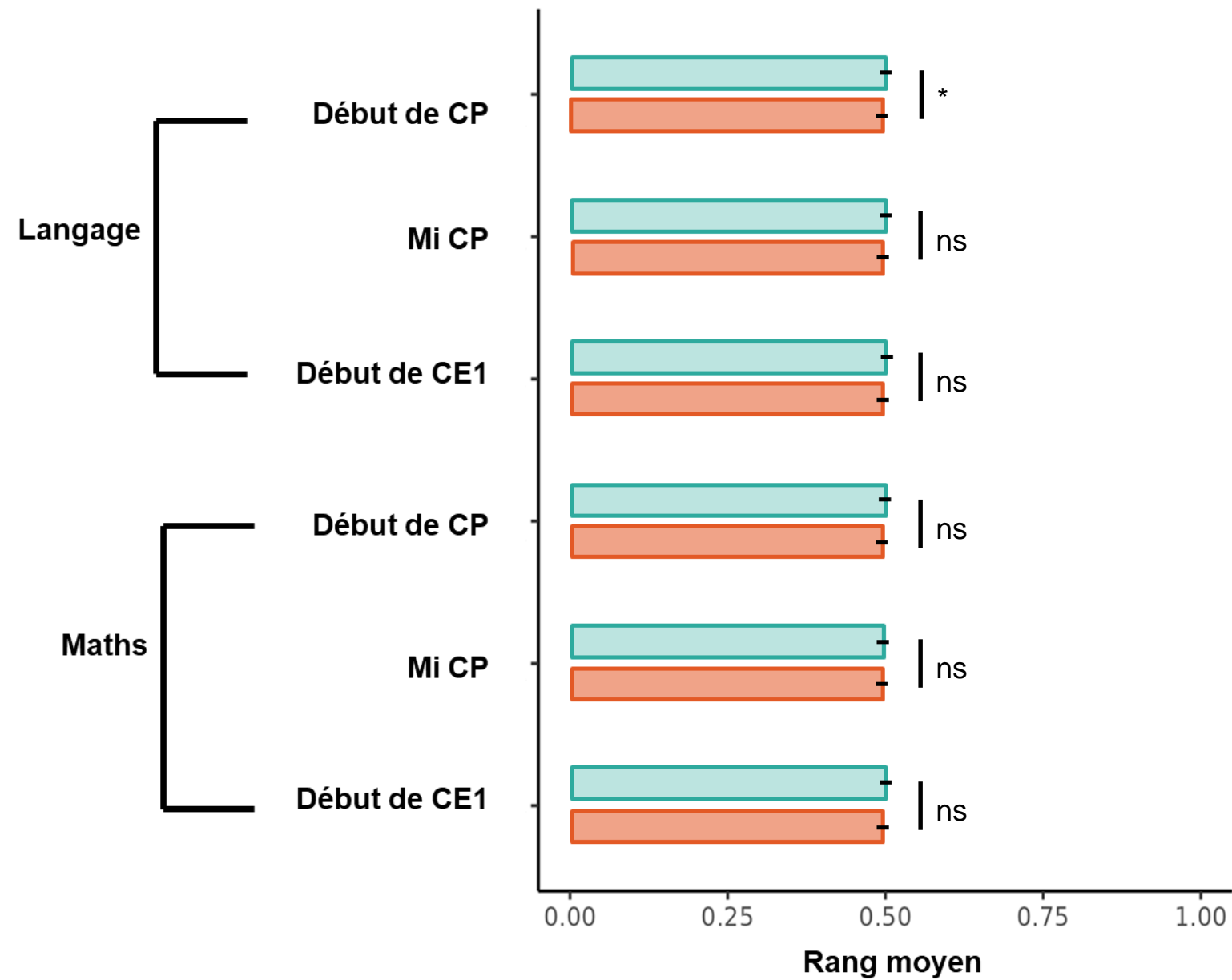


Use of the games in the classroom

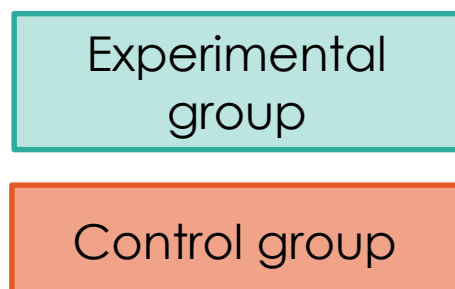
# Oiseaux Compteurs

## Results

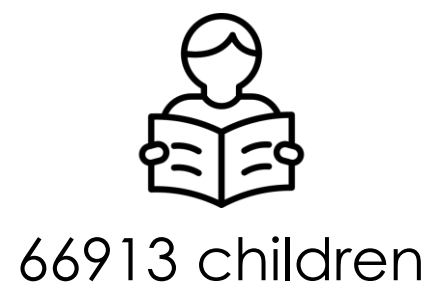
Performance in maths and langage



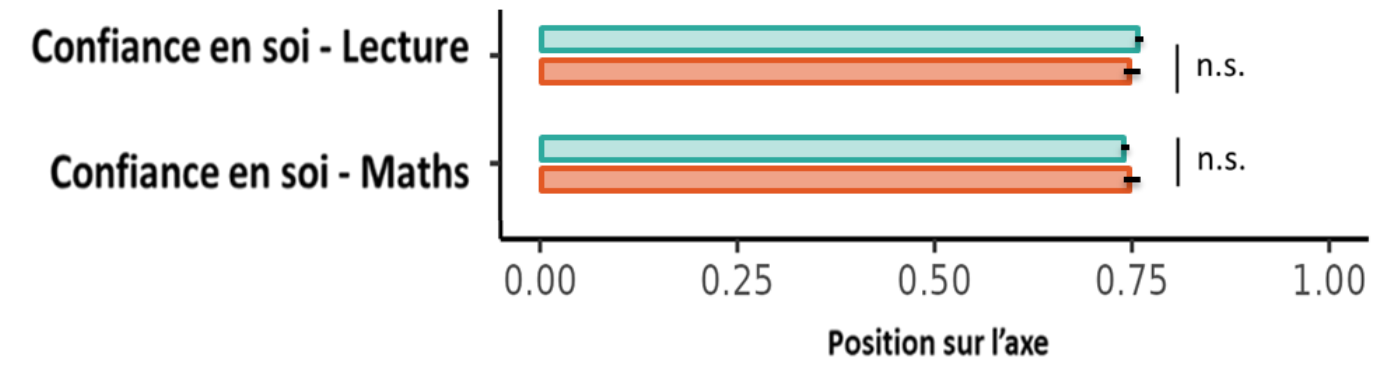
**Legend**



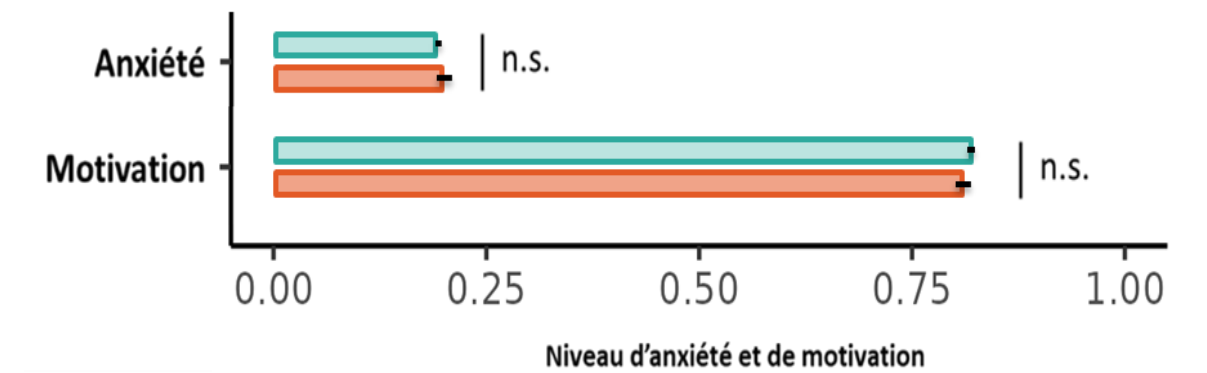
**Workforce**



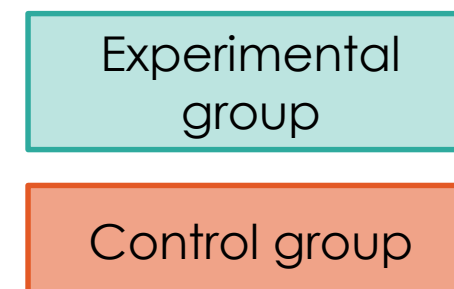
Confidence of the child in his abilities



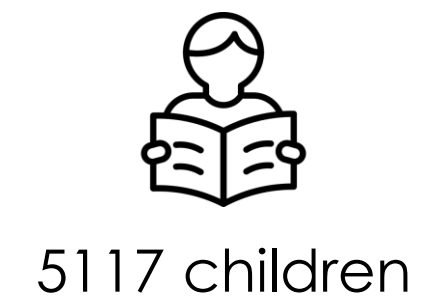
Motivation and anxiety



**Legend**



**Workforce**



# Oiseaux Compteurs

## Results

We run the same kind of models as for Bien Joué and we had a look at the results at the **middle of first garde** and at the **start of second garde**.

Langage\_mid\_1st\_grade ~ Age + sex + ips +  
 Langage\_start\_1st\_grade +  
 Maths\_start\_1st\_grade +  
 group + (1 | school\_id/class\_id)

	Estimate	Std. Error	df	t value	Pr(> t )
(Intercept)	5.003e-01	1.853e-03	2.135e+03	270.009	<2e-16 ***
groupe	-5.546e-04	4.607e-03	2.091e+03	-0.120	0.904
Age_CP	-1.283e-02	7.904e-04	5.696e+04	-16.231	<2e-16 ***
sexe	-3.711e-04	1.566e-03	5.612e+04	-0.237	0.813
ips_cp	-1.782e-03	1.925e-03	1.949e+03	-0.926	0.355
T1_Math_Rank	4.009e-02	1.170e-03	5.844e+04	34.265	<2e-16 ***
T1_Lang_Rank	1.734e-01	1.199e-03	5.868e+04	144.666	<2e-16 ***

Maths\_mid\_1st\_grade ~ Age + sex + ips +  
 Langage\_start\_1st\_grade +  
 Maths\_start\_1st\_grade +  
 group + (1 | school\_id/class\_id)

	Estimate	Std. Error	df	t value	Pr(> t )
(Intercept)	4.999e-01	1.649e-03	2.042e+03	303.190	< 2e-16 ***
groupe	-2.883e-03	4.090e-03	1.977e+03	-0.705	0.48100
Age_CP	-2.583e-03	7.906e-04	5.707e+04	-3.267	0.00109 **
sexe	-4.531e-02	1.566e-03	5.626e+04	-28.939	< 2e-16 ***
ips_cp	-8.348e-03	1.698e-03	1.822e+03	-4.917	9.6e-07 ***
T1_Math_Rank	1.248e-01	1.169e-03	5.860e+04	106.774	< 2e-16 ***
T1_Lang_Rank	9.845e-02	1.198e-03	5.882e+04	82.206	< 2e-16 ***

Langage\_start\_2nd\_grade ~ Age + sex + ips +  
 Langage\_start\_1st\_grade +  
 Maths\_start\_1st\_grade +  
 group + (1 | school\_id/class\_id)

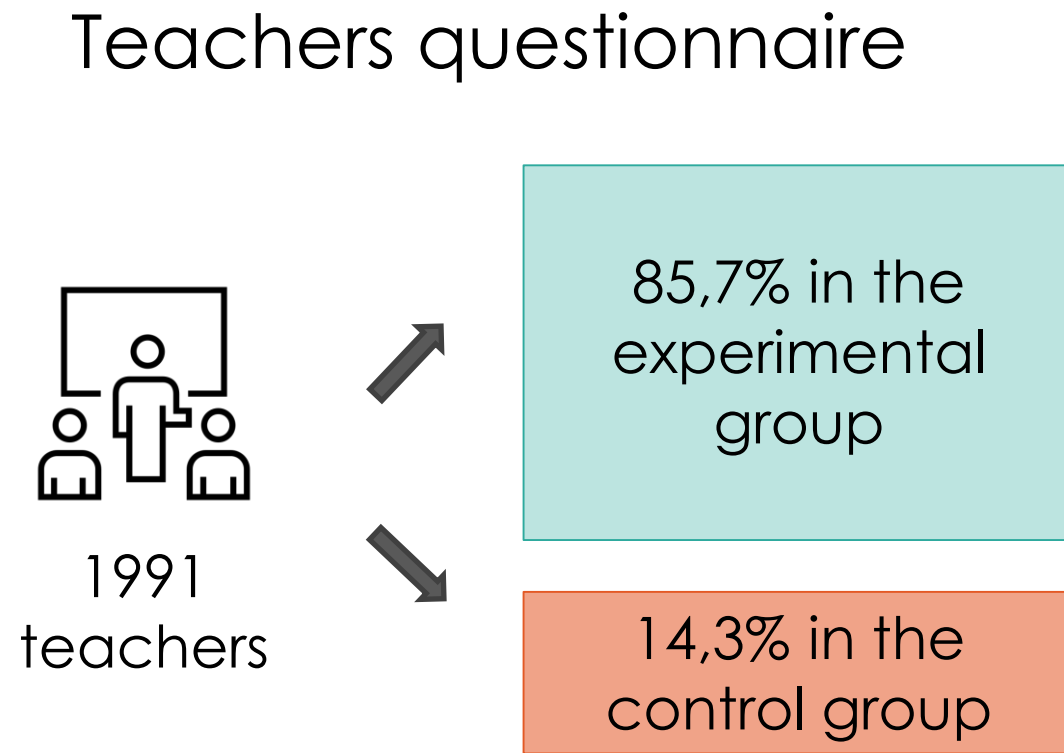
	Estimate	Std. Error	df	t value	Pr(> t )
(Intercept)	5.007e-01	1.705e-03	2.075e+03	293.573	<2e-16 ***
groupe	-9.134e-04	4.242e-03	2.035e+03	-0.215	0.8295
Age_CP	-9.643e-03	8.249e-04	5.740e+04	-11.691	<2e-16 ***
sexe	3.436e-03	1.636e-03	5.645e+04	2.100	0.0357 *
ips_cp	1.773e-02	1.775e-03	1.914e+03	9.991	<2e-16 ***
T1_Math_Rank	4.148e-02	1.217e-03	5.886e+04	34.089	<2e-16 ***
T1_Lang_Rank	1.657e-01	1.246e-03	5.900e+04	132.955	<2e-16 ***

Maths\_start\_2nd\_grade ~ Age + sex + ips +  
 Langage\_start\_1st\_grade +  
 Maths\_start\_1st\_grade +  
 group + (1 | school\_id/class\_id)

	Estimate	Std. Error	df	t value	Pr(> t )
(Intercept)	4.989e-01	1.738e-03	1.943e+03	287.102	< 2e-16 ***
groupe	5.038e-04	4.321e-03	1.899e+03	0.117	0.907
Age_CP	-4.139e-03	7.944e-04	5.715e+04	-5.210	1.89e-07 ***
sexe	-8.147e-02	1.574e-03	5.625e+04	-51.748	< 2e-16 ***
ips_cp	4.410e-04	1.806e-03	1.768e+03	0.244	0.807
T1_Math_Rank	1.140e-01	1.174e-03	5.867e+04	97.123	< 2e-16 ***
T1_Lang_Rank	1.121e-01	1.203e-03	5.887e+04	93.187	< 2e-16 ***

# Oiseaux Compteurs

## Results



Only 36% of the teachers in the experimental group used the game in the last period of the year

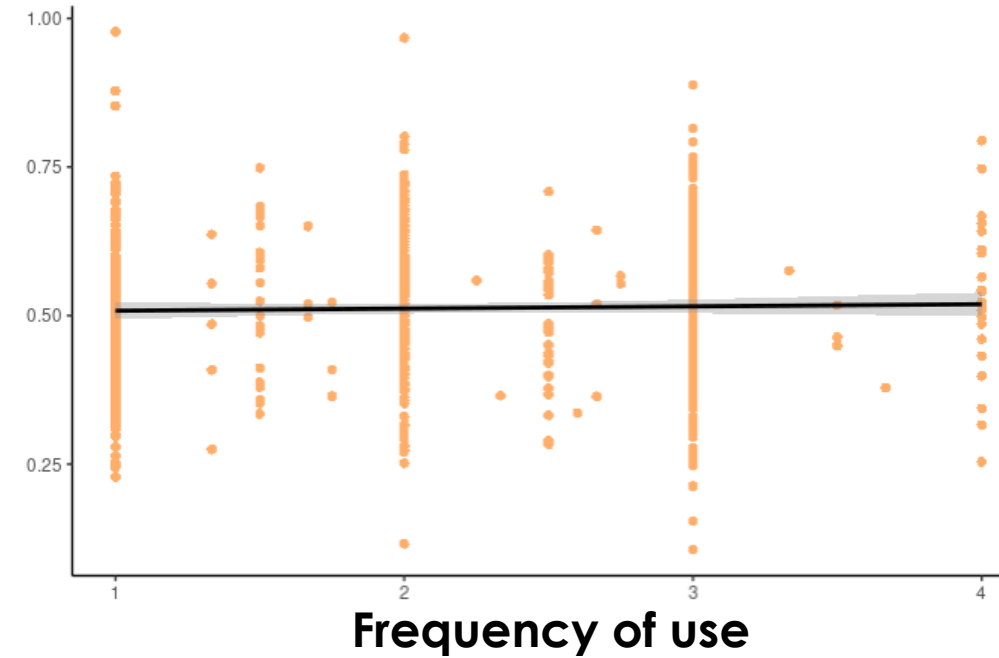
The most used games:

- the battle
- the number race

These are **really easy and classic games** that could have been used as well in the **control group**.

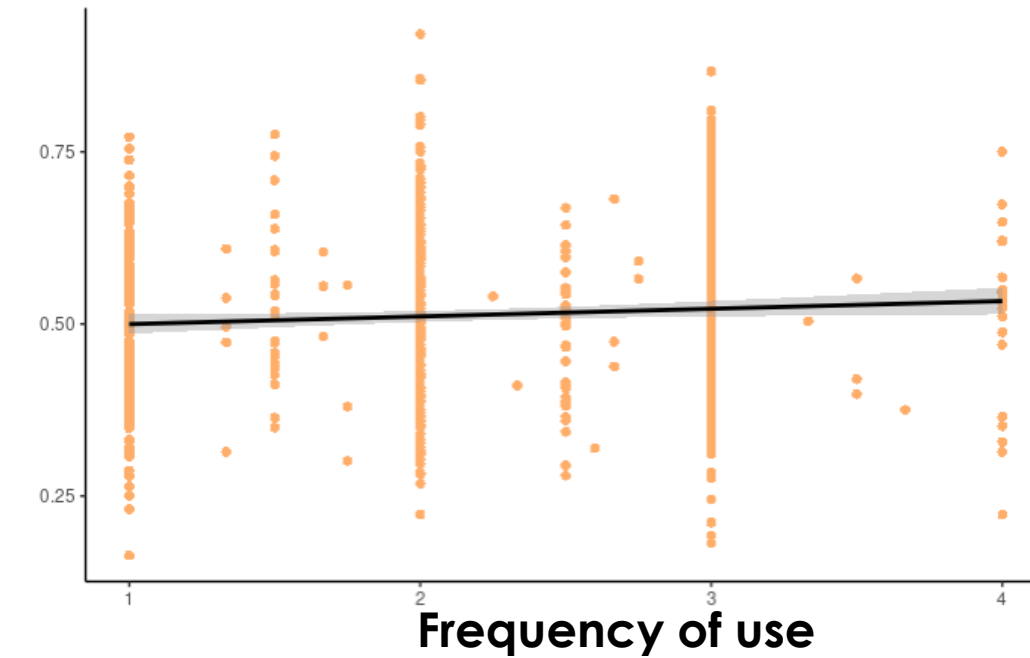
At the school level, we were able to **correlate the frequency of playing and the results in maths and language**.

Middle of 1<sup>st</sup> grade Language



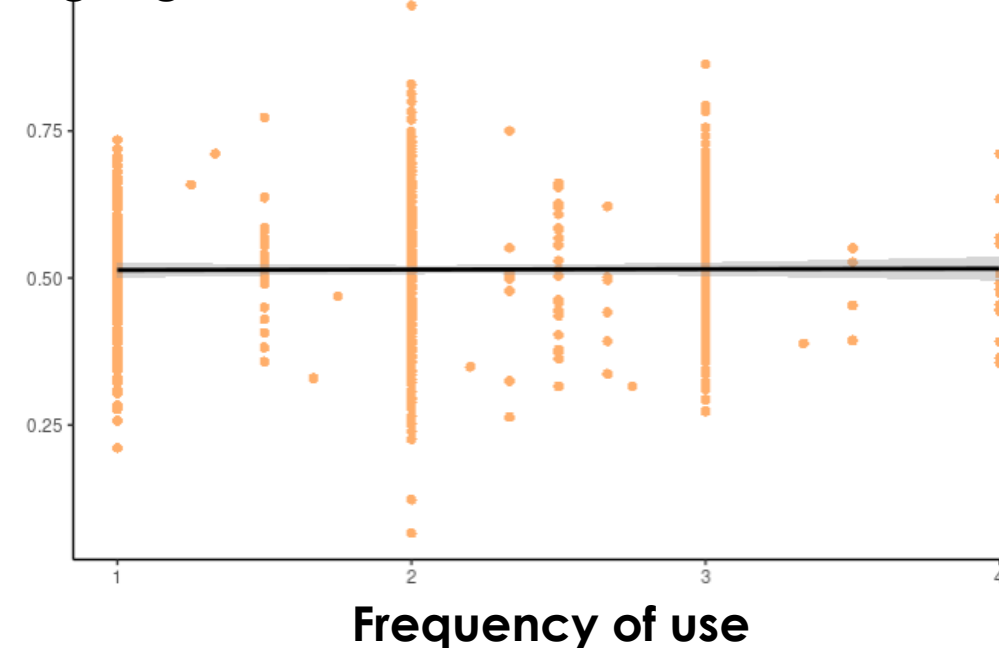
correlation: 0.025 - p: 0.4731

Middle of 1<sup>st</sup> grade Maths



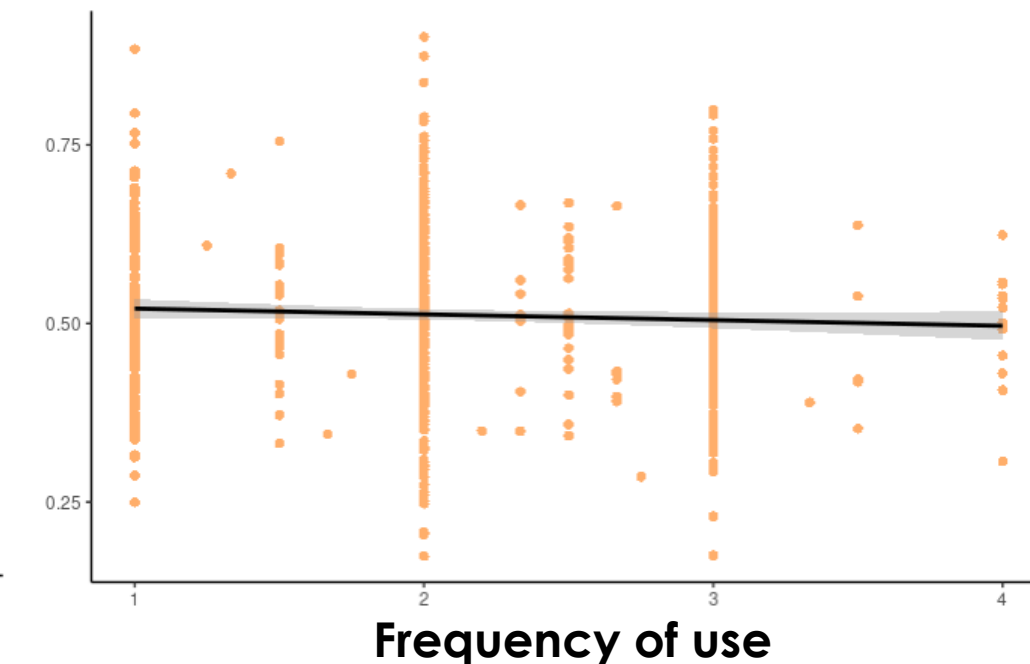
correlation: 0.078 - p: 0.02433

Start of 2<sup>nd</sup> grade Language



correlation: 0.0057 - p: 0.8705

Start of 2<sup>nd</sup> grade Maths



correlation: -0.056 - p: 0.1054

# Conclusions and perspectives

- Experimentation in education allows **rigorous conclusions** to be drawn about the effects of a system.
- Experimentation is **always useful**, even if the result is zero.
- Distributing games before the summer has an **effect on subjective confidence, but not on objective short-term results**.
- When the games are used throughout the year, there is **no increase in children's confidence anymore, and no progress in maths or reading** a few months later.
- One reason why there is no visible progress in math could be that the **games are used in a very basic way**, not involving complex mathematical skills.
- An Oiseaux Compteurs II project **using more adapted games** is already planned for the beginning of the school year 2023.

# Acknowledgments

## Research team



Stanislas Dehaene  
Marc Gurgand  
Adrien Pawlik  
Cassandra Potier-Watkins  
Caroline Bévalot  
Nathan Viltard

## Data collection



## Bien Joué



## Oiseaux Compteurs



Direction générale  
de l'enseignement  
scolaire

